

Overview and Summary of Recent Initiatives

A **Pennsylvania Biosciences Continuum** strategy was released in 2005 by the state Department of Community and Economic Development. This strategy emphasizes creating connectivity among the state's research institutions, its mature pharmaceutical and bioscience companies, and emerging companies. The strategy is being implemented through several intermediary programs such as three regional **Life Sciences Greenhouses**, several statewide venture-capital initiatives, and various programs operated by the **Ben Franklin Technology Development Authority (BFTDA)**.

The three Greenhouses were established with a \$100 million commitment from the state Tobacco Settlement Investment Board, matched by local communities. The Greenhouses are conceived as comprehensive centers for commercialization of bioscience research. The **BioAdvance** Greenhouse in Philadelphia targets bioinformatics, biopharmaceuticals, medical devices, and clinical trials. The **Pittsburgh Life Sciences Greenhouse** focuses on drug discovery tools and targets, tissue and organ engineering, medical devices, and therapeutic strategies for neuropsychiatric disorders. The **Life Sciences Greenhouse of Central Pennsylvania** targets rational drug design/delivery, biomedical devices, and bionanotechnology. In the most recent fiscal year, 69 companies and 22 university-based projects were funded for a total of \$20 million, leveraging an estimated total of \$130 million in private follow-on investment.

Since the last BIO report, the Tobacco Settlement Investment Board completed its related commitment of \$60 million to four venture capital funds that operate in Pennsylvania. Also, the economic stimulus proposed in 2004 was largely approved, giving the Commonwealth Financing Authority (CFA) \$60 million in new capacity for loans to in-state venture partnerships and \$250 million in capacity to guarantee in-state investments. The **BFTDA** also rolled out the **Keystone Innovation Zone (KIZ) Program**. KIZs are intended to help regions surrounding colleges and universities better link their economic-development strategies to these institutions. Each KIZ receives \$250,000 in planning funds, and participating institutions are eligible for \$250,000 grants to develop infrastructure for technology transfer. Companies locating in KIZs qualify for \$25 million in tax credits targeted at very early-stage businesses with rapid revenue growth. These credits can be sold, along the model of the state's R&D tax credit for which the statewide pool was expanded from \$15 million to \$30 million.

In his 2006 budget address, Governor Edward Rendell proposed that part of the 19 percent of the tobacco settlement currently used to fund a research initiative operated by the Department of Health be diverted to back \$500 million in bonding capacity for a **Jonas Salk Legacy Fund** that would support bioscience faculty recruitment and facilities construction (see below under "Pending Proposals").

Building Bioscience R&D Capacity

Recent state investments in facilities

The University of Pittsburgh opened **Biomedical Science Tower 3**, a new 331,000-square-foot, 10-story, \$205 million structure that will house a regional biocontainment laboratory and university programs in bioengineering, computational biology, neurobiology, structural biology, drug discovery, neuro-degenerative disease, and core facilities in proteomics. Financing came from the state capital budget, the Pittsburgh Life Sciences Greenhouse, and other sources. Since the last BIO report, the state has made commitments to the following additional capacity:

- **Cancer Research Pavilion**, a five-story, 300,000-square-foot structure at Fox Chase Cancer Center (\$10 million state commitment)
- **Research/Clinical** expansion at University of Pennsylvania (\$10 million toward a 2-million-square-foot. new Riverview Campus at the old convention center
- **Research/Clinical** expansion at Children's Hospital of Philadelphia (\$10 million state commitment toward a \$1 billion expansion project)
- **Materials Science Research Building** at The Pennsylvania State University (Penn State), \$40 million state commitment toward 192,000-square-foot, \$84 million building aimed at convergent applications such as biomaterials
- **Research Building** at Penn State Cancer Institute in Hershey (\$10 million state commitment)
- **Life Sciences Building** at Franklin and Marshall College, a focal point for the Lancaster KIZ (\$10 million state commitment toward a \$40 million building).

Penn State is also planning a **Life Sciences II** building for neuroscience, complementing the **Huck Life Sciences Institute** biotechnology building opened in 2004. In the private sector, Penn was fund-raising through its life science initiative for a new, 217,000-square-foot life research building.

Research programs

Under Act 77 of 2001, 19 percent of tobacco settlement funding is allocated to the **Commonwealth Universal Research Enhancement Fund (CURE)**, administered by the state Department of Health. In the 2004/2005 annual round, CURE made 44 grants totaling \$72 million to universities, research institutes, and hospitals statewide. The CURE pool is part formula and part competitive, with a different priority stressed each year in the competitive program. The most recent competitive priority was neurodegenerative disease, and the next is obesity. See "Pending Proposals" below for more information.

Since 2001, the BFTDA has had the ability to make grants for large-scale university research programs or consortia. For example, in the southeastern region, Ben Franklin supported creation of the **Nanotechnology Initiative**, a collaborative of Penn, Drexel, other universities in the Philadelphia region and Ben Franklin Technology Partners of Southeastern Pennsylvania that focuses specifically on biomedical applications of nanotechnology and includes resources for commercialization. BFTDA university funds have also supported capital projects.

Faculty development programs

The BFTDA recently announced **Keystone Innovation Starter Kits** to be used in conjunction with KIZ grants to attract faculty across multiple fields. These awards will average about \$200,000 per institution and may be enhanced if the proposed Jonas Salk Legacy Fund is enacted.

The Pittsburgh Life Sciences Greenhouse offers an **Opportunity Fund** to help universities attract faculty members in the four areas it has targeted.

Encouraging Academic/Industrial Interaction

A portion of the BFTDA's Technology Development Grant Fund has been set aside for the **Keystone Innovation Zone** program, which is recognizing geographically designated zones where collaboration is fostered among universities, economic-development agencies, financial institutions, and businesses. KIZs are eligible for planning grants that start at \$250,000 and decline 25 percent a year until they reach self-sufficiency. To date, \$3.7 million in operational grants have been committed to 16 KIZs involving 30 institutions of higher education, including two zones in Philadelphia and one in Pittsburgh. There are 10 zones in which a campus of the Penn State system has some participation, including its large Medical Center at Hershey. Each participating institution is also eligible to compete for a \$10 million pool of **Keystone Innovation Grants**, which provide up to \$250,000 to build infrastructure for collaboration and technology transfer. To date, 13 institutions have received these grants.

The Pittsburgh Life Sciences Greenhouse offers a **Collaborative Research Fund** that finances projects matched by in-state companies. The matching requirement scales from 0.5:1 for the smallest companies to 1:1 for companies with more than 100 employees.

Moving Technology into the Marketplace

Commercializing university technology

BioAdvance will provide up to \$200,000 for precommercialization research on university-owned intellectual property with commercial promise. Also in Philadelphia, the **Science Center** research park has also created a commercialization division that sources technology from all its shareholding institutions and creates start-up vehicles that can attract capital.

In Southwestern Pennsylvania, the University of Pittsburgh (Pitt) operates a **Technology Commercialization Alliance**. MPC Corp., a collaborative of Pitt and Carnegie Mellon that operates the KIZ in Pittsburgh, received \$500,000 from the BFTDA to match \$400,000 from the Heinz Endowments for a **Gap Fund** accessible to both institutions. Pitt operates an **Office of Technology Development** that educates faculty on entrepreneurial possibilities stemming from bioscience and other research.

Life Sciences Greenhouse of Central Pennsylvania will make grants for commercialization research up to \$250,000 through its **Technology Development Fund**.

Supporting bioscience entrepreneurs and emerging companies

Innovation Philadelphia is a multisector commercialization assistance center supported by city and state funds and linked to a pre-seed investment fund (see below). The **BioAdvance** Greenhouse also offers up to \$50,000 to assist entrepreneurs in the commercialization process, not necessarily in collaboration with

universities. Both Pitt and Penn State maintain industrial liaison offices to assist entrepreneurs in accessing university resources.

Pennsylvania's 10 percent R&D tax credit may be transferred by application to the Department of Community and Economic Development. The overall pool of "tradable" tax credits is capped at \$30 million annually (up from \$15 million). As of the first year, 11 tradable assignments were approved, generating \$564,000 for six sellers.

Making Capital Available

Pre-seed and seed capital

The **Innovation Partnership**, a collaborative of 13 organizations statewide, will support half the cost of SBIR proposal preparation up to a total grant of \$3,000.

Innovation Philadelphia, a city-supported accelerator, can make pre-seed investments directly and has also raised \$4 million from 80 investors for **Mid-Atlantic Angels**, a formal pre-seed investment fund. **Pennsylvania Angel Network** plans statewide outreach to potential bioscience angel investors.

The four regional centers of the statewide Ben Franklin Technology Partners program make direct investments in start-ups from all sectors including the biosciences. The size of the investment varies from region to region but usually ranges from \$100,000 up to \$500,000. Above that level, some of the centers may co-invest with other parties. Several of the centers such as the one in Philadelphia maintain a separate **Technology Commercialization** fund that invests up to \$350,000, but only in companies formed around a discovery licensed from a university in the region.

Pre-seed and seed-stage investments targeted at the bioscience sector are also available from each of the three Greenhouses:

- In Philadelphia, the BioAdvance **Greenhouse Fund** can invest up to \$500,000.
- In Pittsburgh, the Life Sciences Greenhouse **Pre-Seed Fund** invests up to \$100,000.
- In Central Pennsylvania, the Life Sciences Greenhouse **Gap Fund** invests up to \$500,000.

Venture capital

The Health Venture Account of the Tobacco Settlement Investment Board has invested more than \$50 million to date in four Pennsylvania-based venture capital funds. In each case, the board required that its investment be levered at least 3:1 by outside investments, and the actual leverage has been double that goal. All have at least some interest in bioscience and a commitment to source deals in-state in partnership with the three Greenhouses:

- **PA Early Stage Partners** of Wayne (\$20 million investment from the Health Venture Account), an \$86 million, multisector fund that also includes participation from city and state pension funds. PA Early Stage also manages an allocation from the Pittsburgh Life Sciences Greenhouse and has opened a Pittsburgh office.
- **Quaker BioVentures** of Philadelphia (\$20 million investment), a \$280 million bioscience fund with broad mid-Atlantic scope. Quaker BioVentures also manages additional funding from the

BioAdvance Greenhouse in Philadelphia and has a similar investment from the New Jersey Economic Development Authority.

- **Birchmere Ventures III** of Pittsburgh (\$10.8 million), a \$44 million multisector fund.
- **Commerce Health Ventures** of King of Prussia (\$9.2 million), a bioscience fund with special focus on the western region of the state.

The **Science Center** of Philadelphia has created its own internal \$10 million venture fund to support its commercialization division, capitalized by refinancing of certain properties in the research park.

Pittsburgh Life Sciences Greenhouse is also attempting to raise its own \$150 million venture fund specifically targeted at the biosciences in southwestern Pennsylvania.

The BFTDA also has the capacity to make direct investments in venture capital funds, and the **Commonwealth Financing Authority** has two venture capital initiatives:

- CFA has completed the first round of what will be a \$60 million program called the **New PA Venture Investment Program**. Under this program, CFA will loan funds to Pennsylvania-focused venture firms that agree to match its commitments 3:1 with investments in Pennsylvania companies. Loans in the range of \$3 million to \$7 million have been made to various firms, among which Draper Triangle Ventures II of Pittsburgh will consider deals in medical devices.
- The \$250 million **New PA Venture Guarantee Program**, set to roll out this spring, will guarantee portfolio investments in Pennsylvania companies by top-quartile venture firms that agree to commit at least \$15 million to Pennsylvania.

Providing Space for Bioscience Companies

Incubators

Bioscience incubators include the following:

- The **Science Center Incubator** occupies a 25,000-square-foot floor in a larger, privately developed multitenant building.
- The **Pittsburgh Life Sciences Greenhouse Incubator** occupies 17,000 square feet in a building at Pittsburgh Technology Center developed for Cellomics and also housing research operations of the McGowan Center at Pitt.
- The **Ben Franklin Business Incubator** occupies 10,400 square feet on the campus of Lehigh University in Bethlehem.
- **Zetachron Center for Science and Technology Business Development** at Penn State's Innovation Park has three bioscience tenants in 4,000 square feet of wet-lab space, and Innovation Park's own **Technology Center Incubator** has an additional four wet labs totaling 2,000 square feet.

Penn State's separate Hershey Medical Center is planning incubation space within an 80,000-square-foot **Center for Applied Research** due to open in 2007.

Bioscience research parks

The research park with the strongest bioscience orientation is the **Science Center**, a 40-year-old, 17-acre park in Philadelphia. The Science Center is now targeting buildout to 2 million square feet, with substantial additional wet-lab multitenant space.

The **University of Pittsburgh Applied Research Center** is a large facility with multitenant wet-lab space operated on the site of a former Gulf Oil R&D campus 14 miles upriver from Pittsburgh. The **Pittsburgh Technology Center**, an industrial park developed by the city on the site of a 48-acre former steel mill, houses bioscience operations of Pitt, Carnegie Mellon, and the Pittsburgh Life Sciences Greenhouse. A consortium of Pittsburgh area foundations is also developing another brownfield site for possible science park use on 138 acres of a former coke works.

Addressing Talent Needs

Recruiting management talent

Both Innovation Philadelphia and the Pittsburgh Life Sciences Greenhouse maintain CEO-in-residence programs to assist in the start-up process.

Specialized postsecondary programs

Penn has launched the **Vagelos Program in Life Sciences and Management** through which undergraduates receive special exposure to life science research and may receive either a BA from the School of Arts and Sciences or a BS from the Wharton School.

Innovation Philadelphia coordinates **Career Philly**, an internship program designed to link college graduates to opportunities across multiple sectors. The goal is to develop 5,000 internship slots.

K-12 outreach programs

A consortium of employers and institutions in Eastern Pennsylvania has created a **Life Sciences Career Alliance**, which tracks educational training and internship opportunities across the health professions. For example, the Career Alliance will manage a \$400,000 state grant for biotech worker training at four area firms, financed by the state's Manufacturing Sector Incumbent Worker Fund.

Several institutions also collaborate on **Career Philly**, which is aiming to create 5,000 regional internship opportunities across all sectors.

Pending Proposals

Governor Rendell's Jonas Salk Legacy Fund proposal suggests that half the 19 percent of the tobacco settlement funds currently used to fund the CURE health research program be used to back a \$500 million bond issue. Of this, \$100 million would be used to enhance the **Keystone Innovation Starter Kit** program begun last year and \$400 million would be available as a matching fund for research or incubation facilities.

Contacts

Rebecca Bagley

Deputy Secretary for Technology Investment, Pennsylvania Department of Community and Economic Development

400 North Street

Commonwealth Keystone Building, 4th floor

Harrisburg, PA 17120-0225

(717) 214-5325

rbagley@state.pa.us

Pennsylvania Bio's mission is to be a catalyst to ensure that Pennsylvania is a global leader in the biosciences by developing a cohesive community that unites the region's biotechnology, pharmaceutical, research, and financial strengths.

Dennis M. "Mickey" Flynn

President, Pennsylvania Bio

20 Valley Stream Parkway, Suite 110

Malvern, PA 19355-1457

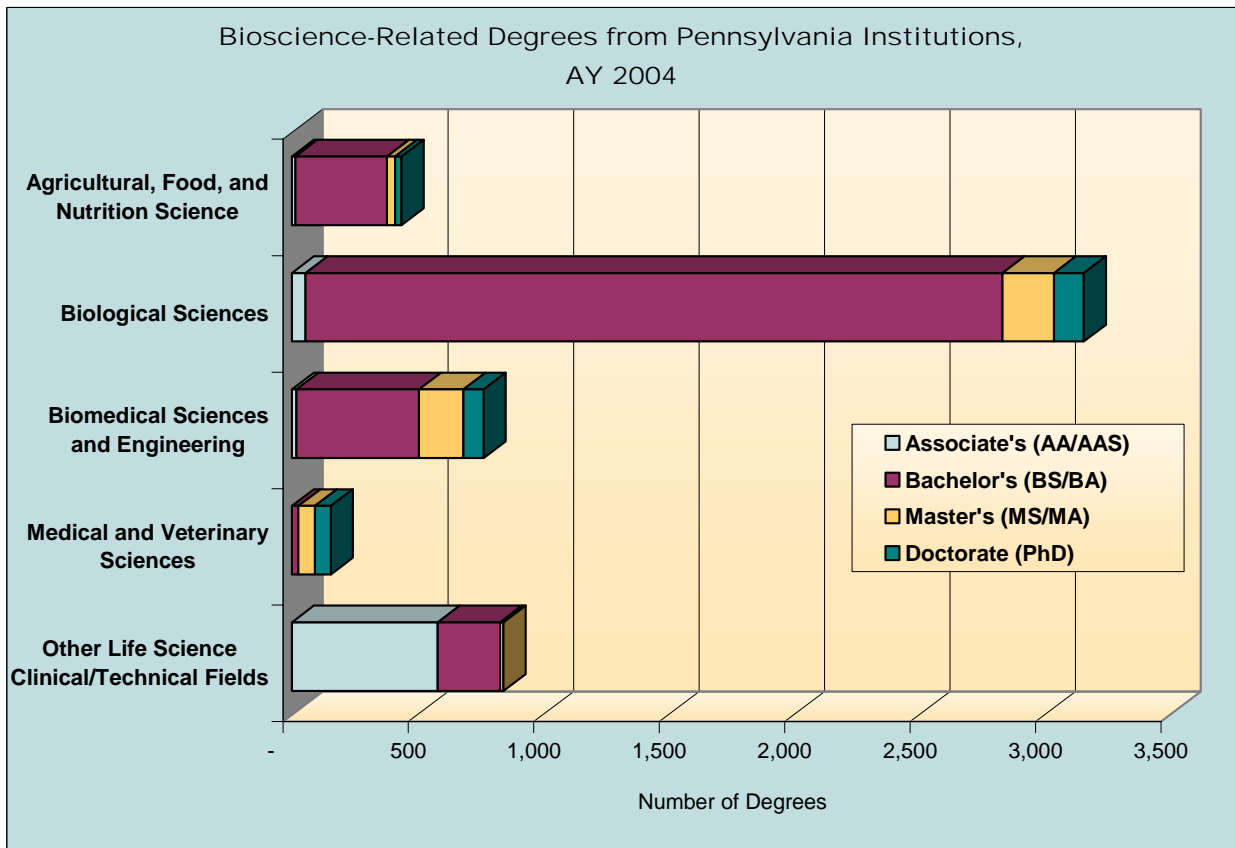
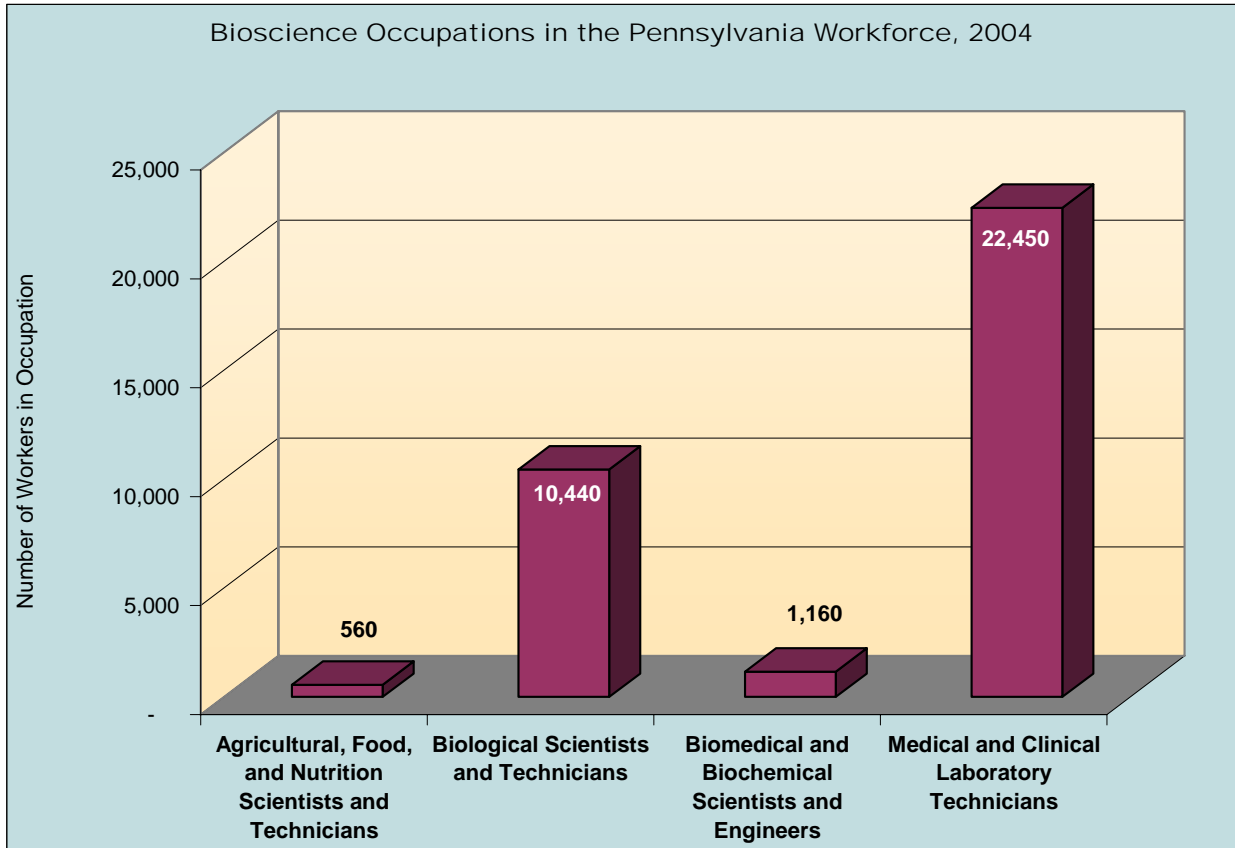
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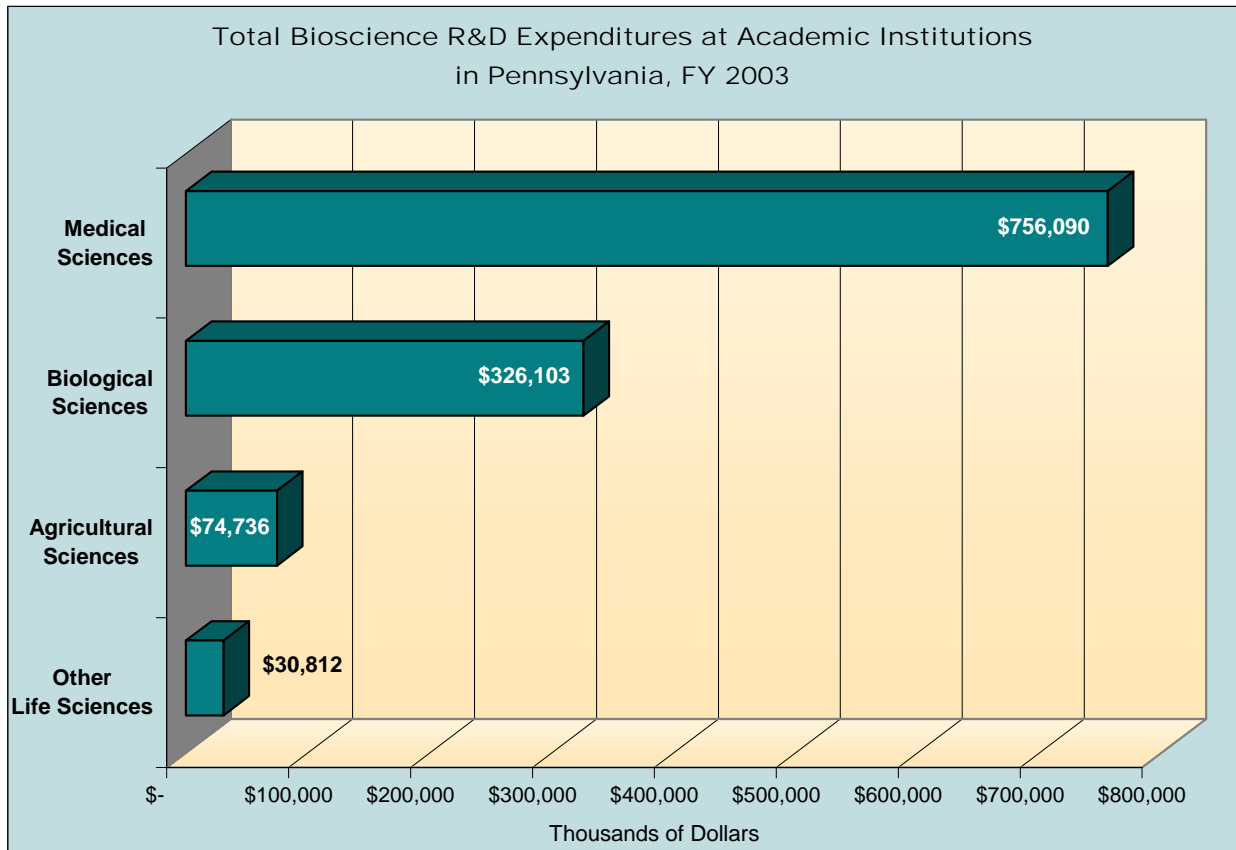
president@pennsylvaniabio.org

Industry Subsector	Pennsylvania	United States
Agricultural Feedstock & Chemicals		
Establishments 2004	69	2,111
2001-2004 Establishment % Change	-10.3%	0.4%
Employment 2004	2,164	104,893
2001-2004 Employment % Change	-25.6%	-6.9%
Share of U.S. Employment	2.1%	100.0%
Location Quotient	0.47	n.a.
Average Annual Wage 2004	\$61,576	\$63,383
Direct-Effect Employment Multiplier	6.77	10.91
Total Employment Impact	14,649	1,212,094
Drugs & Pharmaceuticals		
Establishments 2004	112	2,589
2001-2004 Establishment % Change	-9.7%	-0.6%
Employment 2004	23,307	313,207
2001-2004 Employment % Change	-9.6%	2.7%
Share of U.S. Employment	7.4%	100.0%
Location Quotient	1.70	n.a.
Average Annual Wage 2004	\$88,754	\$79,303
Direct-Effect Employment Multiplier	7.49	9.51
Total Employment Impact	174,639	2,731,321
Medical Devices & Equipment		
Establishments 2004	625	15,190
2001-2004 Establishment % Change	-3.8%	0.2%
Employment 2004	19,876	411,460
2001-2004 Employment % Change	-6.3%	-3.6%
Share of U.S. Employment	4.8%	100.0%
Location Quotient	1.10	n.a.
Average Annual Wage 2004	\$50,590	\$56,449
Direct-Effect Employment Multiplier	3.50	4.56
Total Employment Impact	69,631	1,817,705
Research, Testing, & Medical Laboratories		
Establishments 2004	945	20,565
2001-2004 Establishment % Change	9.8%	19.4%
Employment 2004	27,488	413,550
2001-2004 Employment % Change	19.0%	8.2%
Share of U.S. Employment	6.6%	100.0%
Location Quotient	1.52	n.a.
Average Annual Wage 2004	\$67,405	\$65,414
Direct-Effect Employment Multiplier	2.45	3.15
Total Employment Impact	67,307	1,272,936
TOTAL PRIVATE SECTOR		
Establishments 2004	315,168	8,156,137
2001-2004 Establishment % Change	-2.0%	4.8%
Employment 2004	4,781,008	109,249,195
2001-2004 Employment % Change	-1.4%	-0.7%
Share of U.S. Employment	4.4%	100.0%
Location Quotient	n.a.	n.a.
Average Annual Wage 2004	\$38,055	\$39,003

Source: Battelle calculations -- based on Bureau of Labor Statistics QCEW data from the Minnesota Implan Group, RIMS II Employment Multipliers from the Bureau of Economic Analysis, and the Census Bureau's Economic Census.

Note: n.a. = metric is not applicable.





	Pennsylvania	United States	Rank
University R&D Expenditures, FY 2003			
Total (\$ thousands)	\$2,013,453	\$40,104,621	5
Life Science R&D (\$ thousands)	\$1,210,524	\$24,062,088	4
Percent of Total R&D	60.1%	60.0%	
Life Sciences Per Capita	\$97.90	\$82.74	
Change in Life Sciences FY 1999–2003	52.8%	52.7%	
NIH Support to Institutions, FY 2004			
Total (\$ thousands)	\$1,394,475	\$22,556,459	5
Per Capita Expenditures	\$112.77	\$77.56	
Change in Expenditures FY 2000–2004	47.4%	53.2%	
Higher Education Degrees in Bioscience Fields, AY 2004			
	5,360	111,329	4
Bioscience Occupations in the Workforce, 2004			
	34,610	616,140	4