Greater Philadelphia Region Life Sciences Report

Trends and Highlights, January 2011 to June 2016

Report developed by IHS Markit

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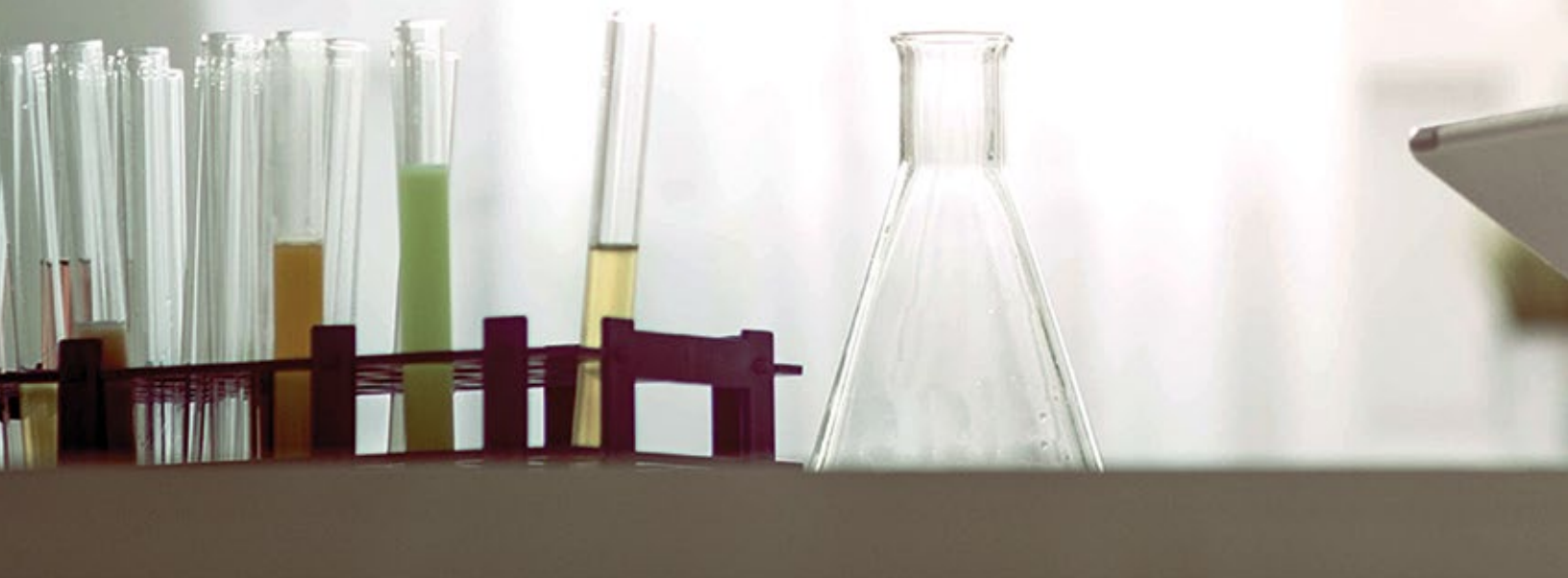


Executive Summary

Amid national and global changes in the Life Sciences sector, the Greater Philadelphia Region (GPR) is primed to be a national leader in the development of the Life Science breakthroughs leading to the next generation of health care solutions.

From groundbreaking research that illuminates new biological mechanisms to advanced technologies that are solving global health issues, the GPR's unique concentration of diverse resources positions the region to emerge as leader in life science innovation. Born from the region's world renowned academic research institutions, top biomedical programs, and the presence of both small and large enterprises, these innovations can improve human well-being while providing significant economic returns. In order to successfully translate this intellectual property to commercial viability, a highly supportive and specialized regional network is required. Successful execution will create a stronger and more integrated regional ecosystem that induces innovations and innovators from across the globe into our region to become part of the solution, resulting in economic growth and increased regional competitiveness.

The delivery of health care services is now entering its next stage of disruption. This transformation requires the convergence of technology development and technology delivery with the goal of expanding knowledge, making outcomes clinically relevant and valuable, becoming more responsive to consumers' needs and preferences, being more convenient for patients to access, and becoming more efficient for providers to deliver. The new focus on connecting patients and stakeholders to

1,200
establishments in the Life Sciences

>$1B
in NIH funding

$6.3B
in investment in regional companies

Here are just a few of the numbers:

>5,400
life science-related patents since 2010

$24.6B
in real output (in constant 2010 dollars), 4% of the GPR's total

6 medical schools
4 NCI-designated Cancer Centers
10 Medical centers

48,900
direct jobs

13
university-industry partnerships focused on Life Sciences

improve the quality efficacy, and efficiency of care and to cut costs requires new solutions that are just beginning to emerge: full digitization of the entire health care enterprise; advanced analytics; outcomes-based medicine that informs drug discovery; next-generation diagnostics and devices; improved security of information; and streamlined infrastructure. These advances are rapidly happening with changes in health care policy and technologies. Leveraging the implementation and early experience under the Affordable Care Act is but one driver to the development of the new health care industry, one that itself may be facing fundamental change. We are at the beginning of this revolution and chaos rules: present solutions are fragmented, narrowly focused and time constrained, and the impact on overall health care delivery has yet to be determined.

In the report, we quantify and characterize the region's evolving Life Sciences sector. The GPR is home to a large community of innovative, diverse, and growing Life Sciences companies encompassing technology start-ups to long-established corporations reinventing themselves. We have identified 526 investment deals in Life Sciences companies, both public and private, totaling almost $6.3 billion since 2011.

The report details investments in Life Sciences companies from 2011 through the first half of 2016 and discusses how the payoffs from those investments have been woven into the economic fabric of the GPR. It speaks to how the long-standing and continued importance of Life Sciences in the region is producing a broad range of sustainable employment opportunities and is increasing the importance of this sector to our export profile.

The goal of the report is to provide information about what is already here and that can help identify actions that business, government, and non-profit organizations can take to propel this forward momentum!

Why Here, Why Now?

The GPR, consisting of Philadelphia and the 10 surrounding counties in southeastern Pennsylvania, southern New Jersey, and northern Delaware, is home to one of the largest and most concentrated Life Sciences asset bases and one of the most vibrant Life Sciences communities in the country. Collectively, these assets represent an opportunity for partnerships, collaborations, and investments leveraging the unique culture of the innovation ecosystem in the region that includes multiple partners representing multiple disciplines and the commitment of regional stakeholders to work in an integrated way that accelerates commercialization of groundbreaking technologies.

The region's strength also lies in its resilience — its ability to adapt to and evolve with changes in technology, markets, policy, and opportunity, all of which defines the future of the Life Sciences industry and the future of health care. The region as a national leader in pharma and biotech has been challenged by retrenchment, acquisitions and mergers. This challenge is also an opportunity and our vibrant community has adapted to become a national leader in digital health, med tech and medical devices to complement our biotech and pharma assets: the very definition of innovation!

Equally important is the benefit of working and living in the GPR. The region sits within a major market that comprises 14.9% of the total US population, and has easy access to the New York financial hub, NIH and NSF, and Washington DC legislative and regulatory center. In 2014, approximately 47.4 million people lived within a 200 mile radius of Greater Philadelphia, comprising 14.9% of the total US population. In 2014, the total gross regional product made within the 200-mile radius was $3 trillion, or 17.3% of total US gross domestic product.

The GPR is primed to fill the gap between opportunity and impact. The region will be successful when we:

- **Expand** commercialization expertise at many research institutions where innovative technology is born;
- **Create** systematic innovation-focused partnerships between universities and industry;
- **Increase** the supply of seed-stage and early-stage venture capital; and
- **Build and attract** management talent and industry-specific talent to create and grow local companies; strengthen our local workforce.

We hope that readers will come to understand that innovation is in our DNA from the formation of a nation to the development of new health care solutions.

Building on Our Strengths

The Greater Philadelphia Region is home to one of the most concentrated Life Sciences asset bases and one of the most vibrant Life Sciences communities in the country.

The origins of the Life Sciences industry in the GPR can be traced to the establishment of the University of Pennsylvania in 1740 and its Medical School in 1765, E. I. du Pont de Nemours and Company in 1802, the Philadelphia College of Pharmacy and Science (now University of the Sciences in Philadelphia) in 1821, and The Wistar Institute in 1892. The growth of the chemical industry in the 1800s amassed new resources and talent that provided a foundation for the new pharmaceutical industry, with William H. Rorer in 1910, and Merck Sharpe & Dohme in 1953; then onward to the creation of the region's first biotechnology company, Centocor, in 1979.

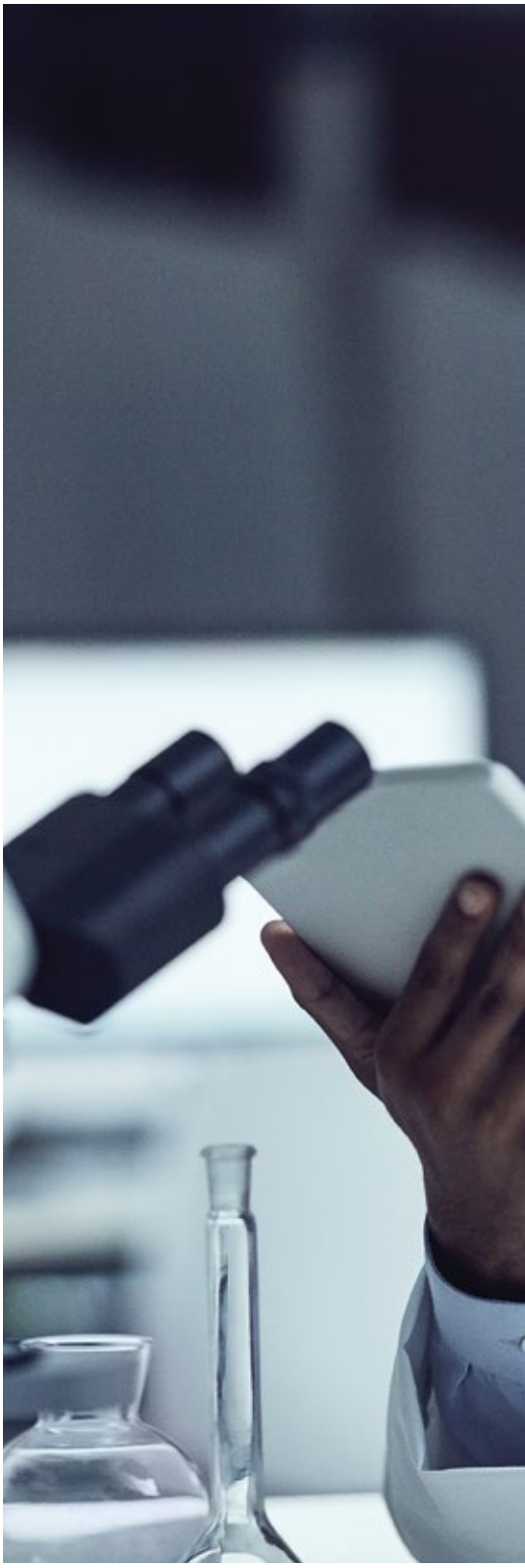
Today, in addition to well-establish large companies such as AmerisourceBergen, FMC Corporation, GSK, Merck, Johnson & Johnson and Teva Pharmaceuticals USA, Inc., the region includes a diverse array of innovative and growing companies such as:

- Aclaris Therapeutics (ACRS) – a dermatologist-led specialty pharmaceutical company focused on defining new standards of care in medical and aesthetic dermatology.
- Adaptimmune (ADAP) – a multinational, clinical-stage biopharmaceutical company focused on developing novel immunotherapies using its proprietary T-cell receptor platform that has the potential to transform the treatment of cancer.
- Agile Therapeutics (AGRX) - a women's health specialty pharmaceutical company focused on the development and commercialization of new prescription contraceptive products.
- Aspire Bariatrics - a privately-held company founded in 2005, whose initial product concept was developed as a collaboration between three physicians to provide an effective, low-risk method of weight loss for obese people.
- Avid Radiopharmaceuticals – a subsidiary of Eli Lilly & Co., which is developing new molecular imaging agents to assist in the diagnosis and management of significant, chronic diseases such as Alzheimer's disease.
- Cagent Vascular - a medical device company dedicated to improving the treatment of Peripheral Artery Disease (PAD).

- Immunome – a startup that is developing a unique platform to discover native human antibodies as well as novel targets.
- Intact Vascular – a medical device company that provides efficacious and easy-to-use products for patients with vascular disease and the physicians who treat them.
- Liquid Biotech USA – a biotechnology company with a unique and powerful approach to diagnosing cancer, using technology that can detect cancer at early stages of the disease.
- Mebias Discovery – company with a novel platform to identify biased GPCR ligands to reduce side effects and improve the therapeutic index of this major class of therapeutic agents.
- Neuronetics – a privately held medical device company focused on developing non-invasive therapies for psychiatric and neurological disorders using MRI-strength magnetic field pulses.
- Ossianix – a privately held pre-clinical company that develops biotherapeutic products using the highly versatile single domain VNAR antibody from sharks.
- PhotoSonix Medical – a company focused on developing treatments for moderate to severe acne.
- Spark Therapeutics (ONCE) – a leader in the field of gene therapy seeking to transform the lives of patients suffering from debilitating genetic diseases by developing potential one-time, life-altering treatments.
- Trice Medical – a company focused on eliminating the false reads associated with current indirect modalities and significantly reduce the overall cost to the health care system.
- UE LifeSciences – a startup focused on breast cancer detection with innovative technologies, whose mission is to make the hope of early detection a reality.
- VenatoRx – a company that is discovering and developing novel anti-infective agents to address the threat of antibiotic resistance.
- Zynerba Pharmaceuticals (ZYNE) - a clinical-stage pharmaceutical company dedicated to the development of innovative transdermal synthetic cannabinoid treatments for patients with high unmet medical needs.

Through our universities, health care systems and innovative companies, the GPR is a leader in cellular, gene therapy and gene vaccines. Examples include WuXi AppTec (WX), a leading open-access R&D capability and technology platform company serving the pharmaceutical, biotechnology, and medical device industries, which in 2016 opened a150,000-square-foot biomanufacturing facility designed for cell therapy products such as those based on chimeric antigen receptor T-cell (CAR-T cell) therapies; Spark Therapeutics (ONCE), a spinout from The Children's Hospital of Philadelphia utizing its groundbreaking AAV technology to address a range of debilitating genetic diseases including inherited retinal diseases, hematologic disorders and neurodegenerative diseases; Adaptimmune (ADAP), a clinical-stage biopharmaceutical company focused on developing novel immunotherapies using its proprietary T-cell receptor platform that has the potential to transform the treatment of cancer; Inovio (INO), a DNA-based immunotherapy company targeting cancer and infectious diseases; and the numerous viral-based gene therapy technologies emerging from the University of Pennsylvania's Gene Therapy Program.

Over the past five and a half years, the GPR has experienced significant innovation in the Life Sciences sector. According to the U.S. Patent and Trade Office, between 2010 and 2015 2,642 patents were issued in the region in the drug technology class. The Life Sciences sector's resiliency both has contributed to and benefited from the region's strengths, with nearly 1,200 Life Sciences companies calling Greater Philadelphia home. Added to this is the region's venture capital community, pre-seed and seed stage public/private investment resources such as Ben Franklin Technology Partners of Southeastern PA, BioAdvance, Militia Hill Ventures and Domain Ventures; private angel investor



funds; and the University City Science Center's QED and Phase 1 Ventures early-stage technology commercialization programs. Vibrant networking and educational opportunities such as those sponsored by PACT, Philly BioBreak, Life Sciences Pennsylvania, Quorum at the Science Center, and the Pennsylvania Biotechnology Center in Bucks County offer opportunities to learn, connect and imagine new ideas. Regional incubators and accelerators including the Science Center's Port Business Incubator and Digital Health Accelerator, the Innovation Center@3401 (a partnership among the Science Center,Drexel, Ben Franklin Technology Partners of Southeastern PA, and Safeguard Scientifics), Plexus at One Drexel Plaza, the new Pennovation Center at the University of Pennsylvania, and the Pennsylvania Biotechnology Center in Bucks County, offer companies the right environment to start and grow, with the Navy Yard now a new home to major Life Science company expansions.

Along with a wide range of existing programs that offer support and resources to Life Sciences companies, new programs, including the Advanced Manufacturing for the Medical Device Industry (AMMDI) and the emerging Greater Philadelphia MedTech Collaboration help to grow and support Life Sciences companies. Most recently, the region's key stakeholders in the delivery of next generation health care coalesced around digital health to create the Health Care Innovation Collaborative—a partnership among the region's medical centers, hospital systems, investors, insurance companies, and Comcast that was launched in 2015 with the vision of Greater Philadelphia claiming its deserved recognition as a global leader in health care innovation.

Report Sponsors

This study was sponsored by the following organizations that have a collective interest in promoting the continuing development of the GPR's Life Sciences sector:

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President & CEO
Ben Franklin Technology Partners
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President & CEO
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Managing Director and
Chief Executive Officer
BioAdvance

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Phil Hopkins
Director, Economics and Country Risk
IHS Markit

Stephen S. Tang, Ph.D., MBA
President & CEO
University City Science Center

Context

In recent years, the Life Sciences sector, both nationally and in the major metropolitan areas in the U.S. including Greater Philadelphia, has undergone a number of dramatic changes, especially in the consolidations of companies as many major biochemical and pharmaceutical manufacturers have merged or been acquired. Life Sciences firms are facing increasing pressure to control costs while maintaining profitability, driven by global competition and domestic pressure to slow the escalation of heath care costs. According to IHS-Markit (Markit), between 2006 and 2016 U.S. employment in the Life Sciences sector, as defined in the section below, rose at an average annual rate of 1%, while real output also rose 1% annually over the same period. Within the Life Sciences sector, employment performance varied. The Testing and Medical Laboratories, Biotechnology, and Life Sciences R&D classes defined on the following page each had annual employment growth rates above 1%. By contrast, employment in the Pharmaceutical class declined 1.3% annually, while real output fell even faster at -3.1% per year. As discussed below, the U.S. trends were also reflected in the performance of the GPR's Life Sciences sector.

Life Sciences Definition

The Life Sciences definition used in this report is comprised of detailed economic sectors presented in the table below. A total of 20 detailed 6-digit NAICS codes were identified by the report's sponsors as comprising the Life Sciences, based primarily on definitions that had been included in other comparable studies. The detailed codes were then grouped into the six functional Life Science groups as shown in the table below based on the similarities of goods and services they produce.

This report does not include digital health, a sector that plays a key role in the region and was reported in the 2014 report, "GPR Digital Health: Building on Our Strengths" (accessed at http://tinyurl.com/l8xdkrl). As noted in that report, the GPR had over 100 digital health companies and over $900 million in investments existing over a five-and-a-half year period.

Definition of the Life Sciences Sector

NAICS code (2012)	Description
Life-Science Supporting Goods	
325180	All Other Basic Inorganic Chemical Mfg.
325199	All Other Basic Organic Chemical Mfg.
333314	Optical Instrument and Lens Mfg.
Biotechnology Industries	
325411	Medicinal and Botanical Mfg.
325413	In-Vitro Diagnostic Substance Mfg.
325414	Biological Product (except Diagnostic) Mfg.
Pharmaceutical Industry	
325412	Pharmaceutical Preparation Mfg.
Medical Device Industries	
334510	Electromedical and Electrotherapeutic Apparatus Mfg.
334516	Analytical Laboratory Instrument Mfg.
334517	Irradiation Apparatus Mfg.
339112	Surgical and Medical Instrument Mfg.
339113	Surgical Appliance and Supplies Mfg.
339114	Dental Equipment and Supplies Mfg.
339115	Ophthalmic Goods Mfg.
339116	Dental Laboratories
Life Sciences R&D	
541711	R&D in Biotechnology
541712	R&D in the Physical, Engineering, Life Sciences (except Biotech)
Testing & Medical Laboratories	
541380	Testing Laboratories
621511	Medical Laboratories
621512	Diagnostic Imaging Centers

Analysis Period

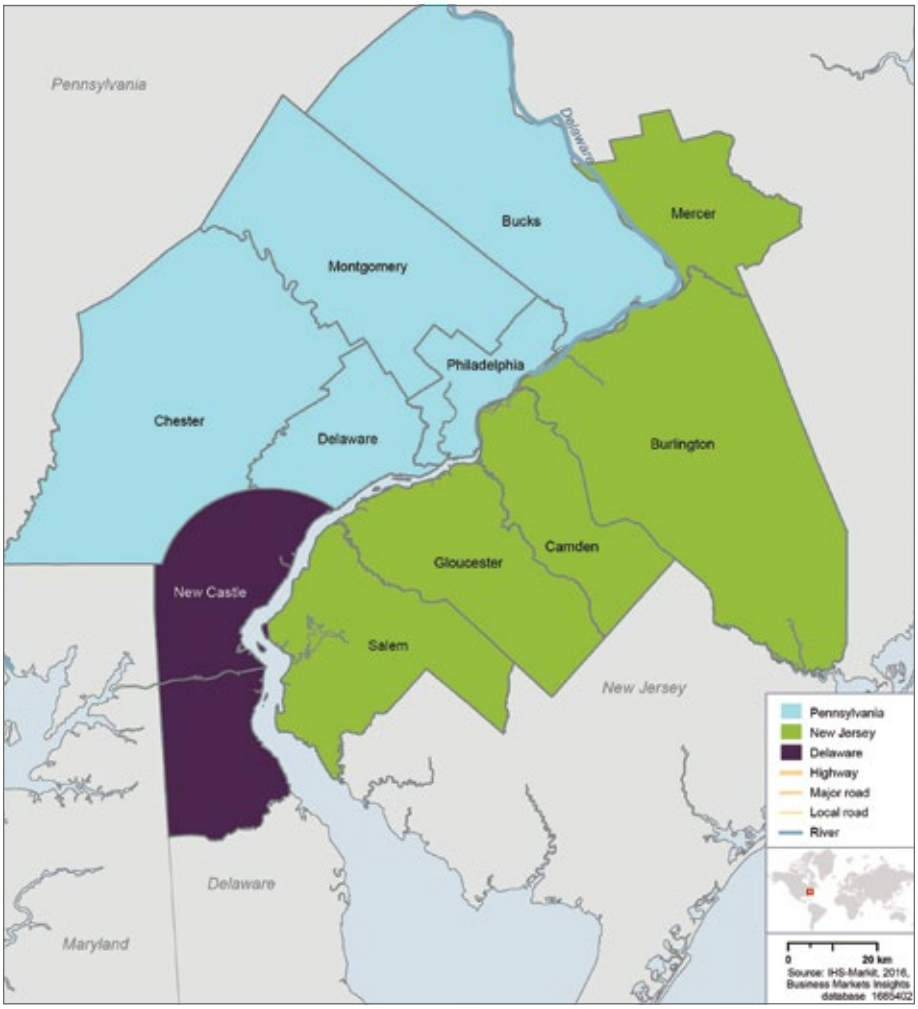
The analysis period for this report is 2011 to 2015. When available, data for 2016 is presented such as the employment, output, and establishment data from Markit's Business Markets Insights (BMI) database, lists of Life Sciences companies, and occupational data provided by Philadelphia Works. Other information such as investments, R&D spending, certificates and degrees, exports, etc. is presented for the most recent year for which it was available.

Report Area Definition

The report area is the 11-county Greater Philadelphia Region (GPR) as shown in the accompanying map. This is the definition used by a number of organizations such as the Chamber of Commerce for Greater Philadelphia and Select Greater Philadelphia Council. It is located within two metropolitan statistical areas (MSA): the Trenton-Ewing MSA, which consists of only Mercer County, NJ, and the Philadelphia-Camden-Wilmington MSA, excluding Cecil County, MD. Where feasible, data is presented for the GPR, but in some instances were available only at the MSA level.

The GPR is a large economic region, generally ranking between 5th and 7th largest among the nation's MSAs, depending on the measure of activity used. Markit estimates that in 2016 the region had a total population of 6.35 million; total employment of 3.1 million non-farm jobs; and produced a total of $448.7 billion in goods and services, also known as its gross regional product (GRP). An advantage of the GPR is its location in the Northeast U.S., situated between the New York and Washington, DC, MSAs. As Select Greater Philadelphia Council has estimated in prior studies, the size of the economy located within a 200-mile radius, based on its total GRP, would be the 5th largest in the world if it was considered as an individual country. The GPR's major locational advantage is its presence in the middle of a very large market as noted above, giving it close proximity to resources such as labor, financing, and suppliers that are required by Life Sciences companies to operate profitably.

The Greater Philadelphia Region



Opportunities for Life Sciences

The report sponsors want to build on the GPR's existing strengths and leverage its ranking as the second-highest performing region in the U.S. as shown in the Milken Institute's *The Greater Philadelphia Life Sciences Cluster 2009: An Economic and Comparative Assessment* study, to create new opportunities for investment and economic development in the Life Sciences.

The Life Sciences sector has a very close relationship with the health care sector, as most of the goods and services it produces are used, in turn, as inputs to provide health care services. The sales of goods and services by the Life Sciences sector to customers located in the GPR, including those in the health care sector, are referred to as forward linkages. The Milken 2009 study recognized this relationship, as it included within its estimate of total Life Sciences sector employment both 56,300 direct workers in Life Sciences plus an additional 38,100 workers in health care who meet regional demands for health care services. There is a strong symbiotic relationship between the two sectors, as both engage in and benefit from research and development, need similar types of skilled workers, and benefit from being located in close proximity to and interacting with each other. While the remainder of this document presents information specific to Life Sciences, it is useful to present some high-level information about the economic size of the GPR's health care sector in 2016.

- The health care sector (i.e., NAICS sectors 621, 622, and 623) had a total of 422,600 jobs at 14,865 establishments with payroll, producing a total $53.7 billion in real output.
- The employment location quotient was 1.28, showing that the GPR has an above-average concentration of its economic activity within health care.
- The health care sector accounted for 13.5% of total GPR employment and produced 8.9% of its total real output.

The GPR is also home to six medical schools (including four NCI-designated cancer centers), and its colleges and universities have large annual R&D expenditures in both Life Sciences and medical research. Several studies of the higher education sector that have been sponsored by the Select Greater Philadelphia Council in recent years showed that the GPR ranks second only to Boston among the 10 largest MSAs in terms of the relative economic importance of its higher education sector.

Characteristics of the GPR's Life Sciences Sector

Economic Contribution

The table on the following page presents total economic activity in the Life Sciences sector by county in 2016. The total number of payroll jobs is 48,864, comprising 1.6% of total regional employment. The figures presented in the accompanying table are adjusted to account for the fact that only a portion of the activity in sector 541712 - Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology) occurs in the Life Sciences. The data show that during the period from 2006 to 2016, total employment in the Life Sciences sector declined at an annual rate of 1.6%, primarily as a result of consolidation in this sector. Real output declined at an annual rate of 2.1%. The employment declines were especially significant in Montgomery, Camden, and New Castle counties, where a large number of jobs were lost over the 10-year period By way of comparison, both employment and real output in the U.S. Life Sciences sector between 2006 and 2016 rose at an annual rate of 1%.

Economic Activity in the Greater Philadelphia Life Sciences Sector in 2016 by County

	Employment				Establishments		Real Output		
County	Number of payroll jobs	% of All Sectors	Annual Growth Rate 2006 to 2016	Location Quotient	Number with Payroll	% of All Sectors	Level (millions of 2010$)	% of All Sectors	Annual Growth Rate 2006 to 2016
Bucks	5,062	1.8%	1.2%	1.81	186	0.9%	$2,238.1	4.7%	1.9%
Burlington	1,314	0.6%	-1.0%	0.61	65	0.5%	$528.2	1.2%	-1.5%
Camden	3,103	1.5%	-1.9%	1.46	82	0.6%	$1,298.2	3.3%	-3.1%
Chester	5,883	2.2%	2.1%	2.13	132	0.8%	$3,768.5	7.0%	4.7%
Delaware	1,423	0.6%	1.4%	0.59	90	0.7%	$427.8	1.0%	0.5%
Gloucester	955	0.8%	-8.2%	0.84	168	2.3%	$637.3	2.5%	-10.3%
Mercer	5,475	2.1%	1.5%	2.03	95	0.7%	$3,187.3	6.1%	0.7%
Montgomery	14,864	2.9%	-4.6%	2.84	224	0.8%	$6,932.0	6.8%	-5.9%
New Castle	6,452	2.1%	-0.2%	2.02	133	0.8%	$3,533.3	5.6%	-0.2%
Philadelphia	4,211	0.6%	0.0%	0.59	135	0.4%	$1,950.1	1.5%	0.4%
Salem	158	0.7%	-5.9%	0.69	8	0.4%	$88.1	1.5%	-8.5%
GPR	48,864	1.6%	-1.6%	1.53	1,192	0.7%	$24,610.6	4.1%	-2.1%

Source: IHS-Markit, 2016, Business Markets Insights data base

The employment location quotients (LQ) were above 1.0 in six counties that have been traditional centers of the Life Sciences sector in the GPR. A LQ > 1.0 indicates that the county has an above average share of its total employment in Life Sciences sector when compared to the U.S. as whole. Four counties have employment LQs > 2.0 – Montgomery, Chester, Mercer, and New Castle - indicating that they have well-above average concentration of Life Sciences activity; Bucks County also ranks high with an LQ of 1.81. Finally, the employment LQ for the GPR was 1.53, confirming that it continues to have an above average concentration of economic activity in the Life Sciences.

Because of its high level of productivity, as measured by the value of real output per worker, the GPR's Life Sciences sector accounts for 4.1% of the region's total real output in 2014 with a total value of just over $24.6 billion; this share is 2.6 times greater than its share of total employment.

The Business Markets Insights (BMI) data base identified a total of 1,192 business establishments with payroll present in the study area, with large concentrations in Montgomery, Bucks, New Castle, Philadelphia, and Chester Counties.

The table below presents current levels of economic activity in the GPR by the six Life Sciences groups. The largest amounts of economic activity, as measured by real output, are in the Life Sciences R&D group, more than three times higher than Biotechnology, and Pharmaceuticals. The largest relative concentrations of activity, as shown by their employment LQs, are Biotechnology, Life Sciences R&D, and Pharmaceuticals. Four of the six Life Sciences groups have employment LQs > 1.0, and Medical Devices is just below with a value of 0.91.

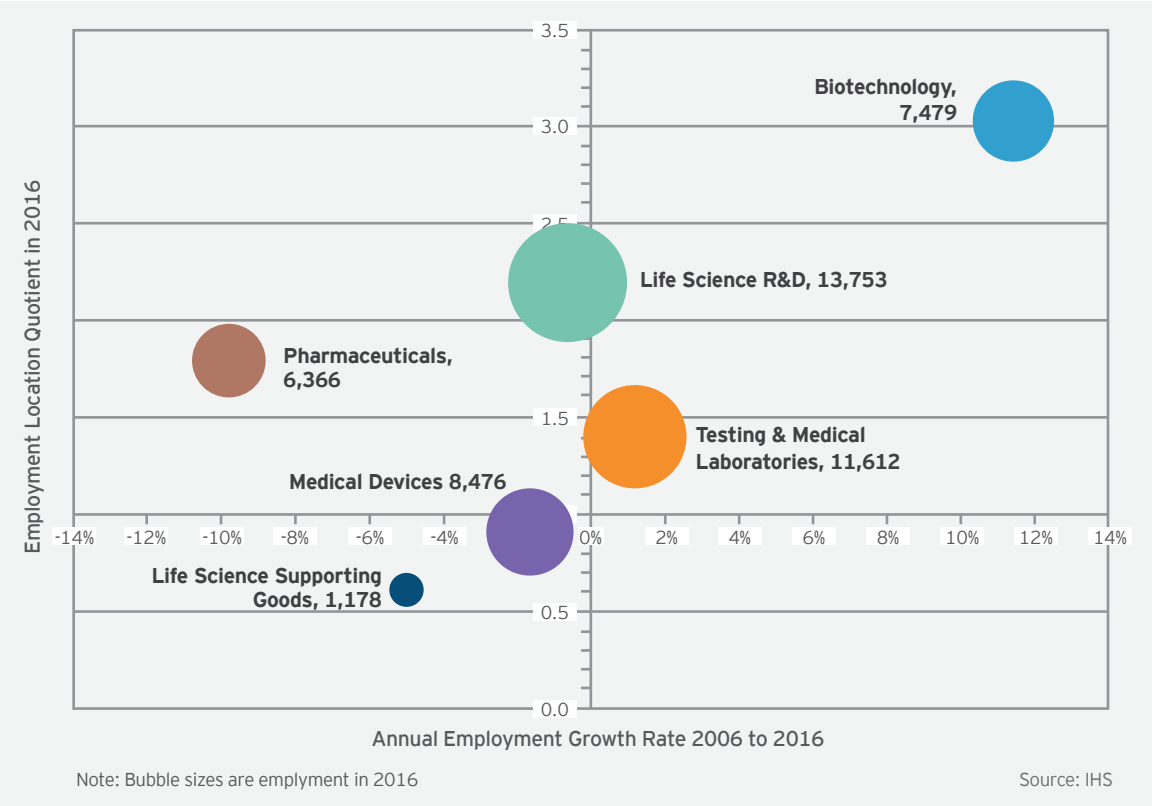
Economic Activity in the Greater Philadelphia Life Sciences Sector in 2016 by Life Sciences Group

	Employment				Establishments		Real Output		
Life Sciences Group	Number of payroll jobs	% of All Sectors	Annual Growth Rate 2006 to 2016	Location Quotient	Number with Payroll	% of All Sectors	Level (millions of 2010$)	% of All Sectors	Annual Growth Rate 2006 to 2016
Biotechnology Industries	7,479	0.2%	11.4%	3.02	36	0.0%	$3,771.7	0.6%	8.7%
Life Sciences R&D	13,753	0.4%	-0.6%	2.19	338	0.2%	$11,478.1	1.9%	1.5%
Life-Science Supporting Goods	1,178	0.0%	-5.1%	0.61	40	0.0%	$1,906.3	0.3%	-5.7%
Medical Device Industries	8,476	0.3%	-1.6%	0.91	274	0.2%	$2,318.7	0.4%	-0.6%
Pharmaceutical Industry	6,366	0.2%	-9.8%	1.79	39	0.0%	$3,350.8	0.6%	-11.4%
Testing & Medical Laboratories	11,612	0.4%	1.2%	1.40	465	0.3%	$1,785.1	0.3%	0.0%
Total life sciences	48,864	1.6%	-1.6%	1.53	1,192	0.7%	$24,610.6	4.1%	-2.1%

Source: IHS-Markit, 2016, Business Markets Insights data base

The chart below presents a visual representation of the performance and size of the six Life Sciences groups. The x axis measure the compound annual growth rate between 2006 and 2016, so the farther to the right a bubble is located, the higher its employment growth over the analysis period. The y axis presents the employment LQ in 2016, so the farther up this axis a bubble is located, the higher its relative concentration. Finally, the size of the bubble indicates total employment in 2016. The highest performing sectors, which have high employment growth and high LQs, are located in the upper right portion of the chart and so forth. The highest performing Life Sciences group is Biotechnology, followed by Life Sciences R&D, and Testing and Medical Laboratories. The chart clearly shows that the pharmaceutical group has been adversely affected over the last 10 years; while its employment LQ is still > 1.0 and it stills employs a large number of workers, its employment level declined substantially over the analysis period. As the chart above shows, its level of real output declined even more rapidly than did its total employment.

Performance of the Life Science Groups in the Greater Philadelphia Region



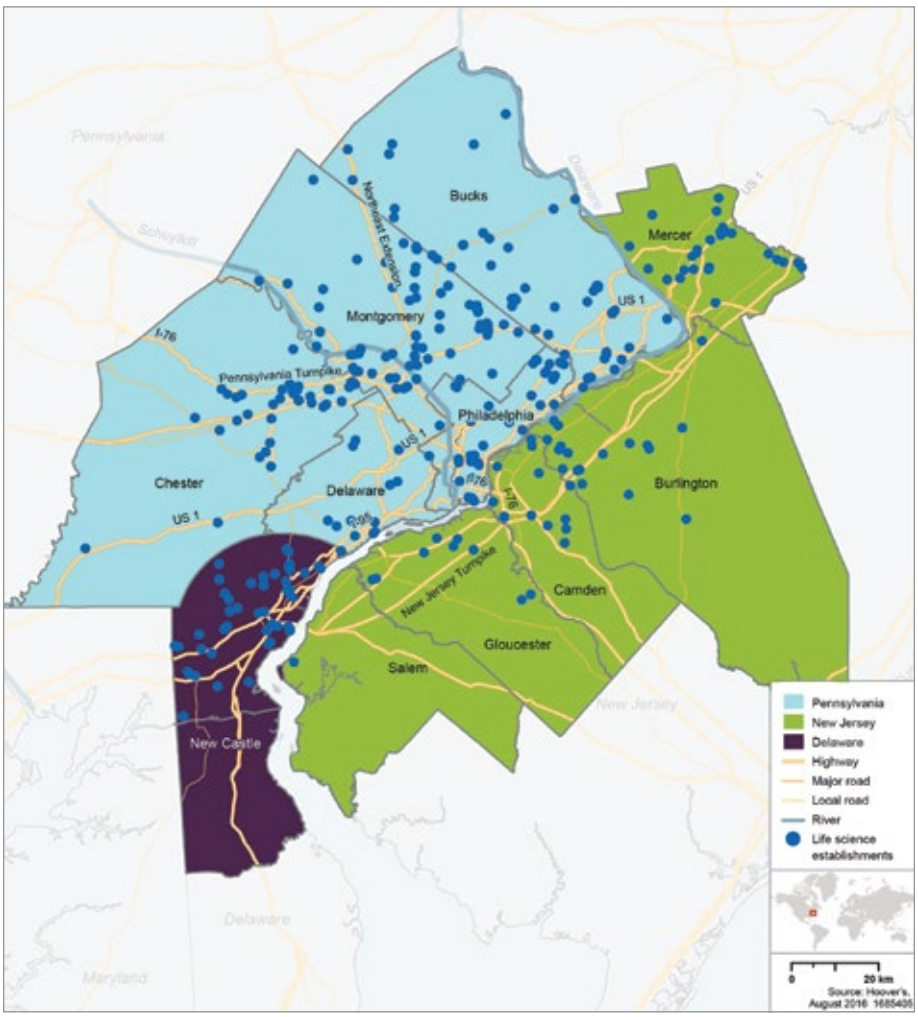
Note: Bubble sizes are emplyment in 2016

Source: IHS

Distribution of Life Sciences Activity

Life Sciences activity occurs in all 11 counties of the GPR, but is concentrated in clusters and corridors that have been traditional centers of this activity in Montgomery, New Castle, Chester, Mercer, Philadelphia and Bucks Counties. The accompanying map shows the spatial distribution of establishments with 25 or more employees for the six Life Sciences groups. Concentrations of Life Sciences companies are evident along the major highways such as US Routes 1 and 202, Interstates 95 and 76, the Pennsylvania and New Jersey Turnpikes; and in Philadelphia, in University City and at the Navy Yard.

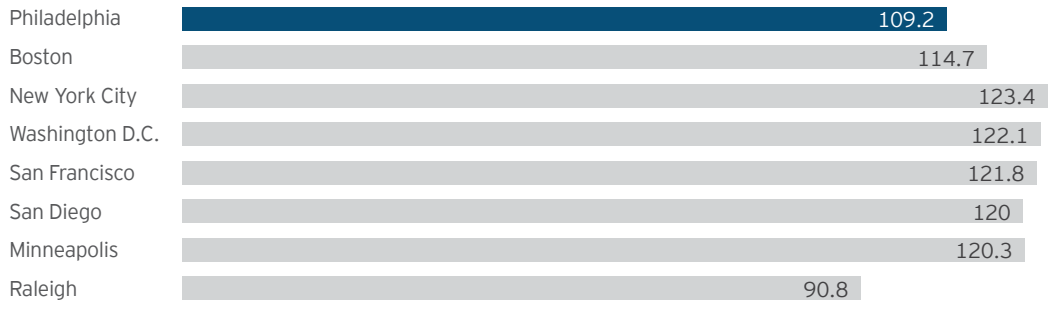
Location of Large Life Science Establishments by County in 2016



Competitiveness of Greater Philadelphia Region

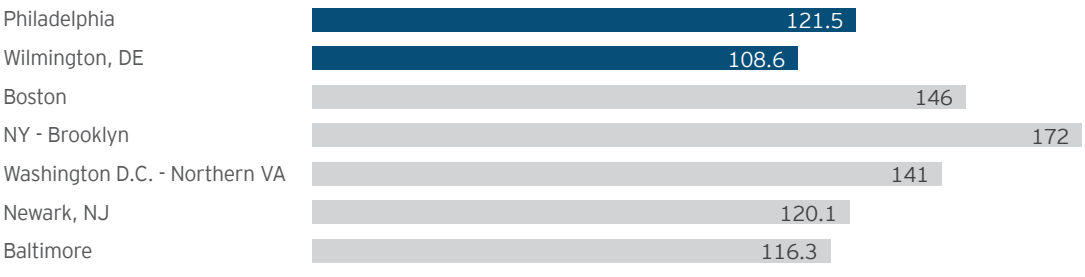
The GPR is a competitive location for Life Sciences companies in terms of the cost of doing business, living and wages. The region is attractive to a dynamic workforce; between 2006 and 2014, Philadelphia added more than 120,000 millennials, an increase of 41.2 percent.

IHS Metro Business Cost Index Value - 2015



US metro average = 100

Council for Community and Economic Research Cost of Living (COLI) index - 2016 Q2



US metro and non-metro average = 100

Average rental rate for Class A office space - 2016 Q2

Cushman & Wakefield, October 2016, MarketBeat U.S. Office and Industrial Snapshots Q2 2016

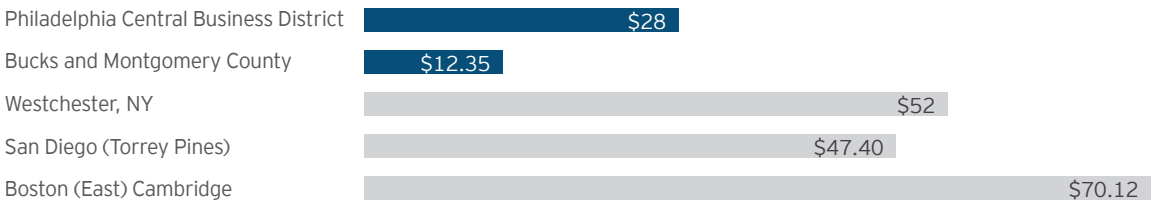
Average rental rate for manufacturing space - 2016 Q2

Cushman & Wakefield, October 2016, MarketBeat U.S. Office and Industrial Snapshots Q2 2016

Average rental rate for warehouse and distribution space - 2016 Q2

Cushman & Wakefield, October 2016, MarketBeat U.S. Office and Industrial Snapshots Q2 2016

Average rental rate for laboratory spaces 2015

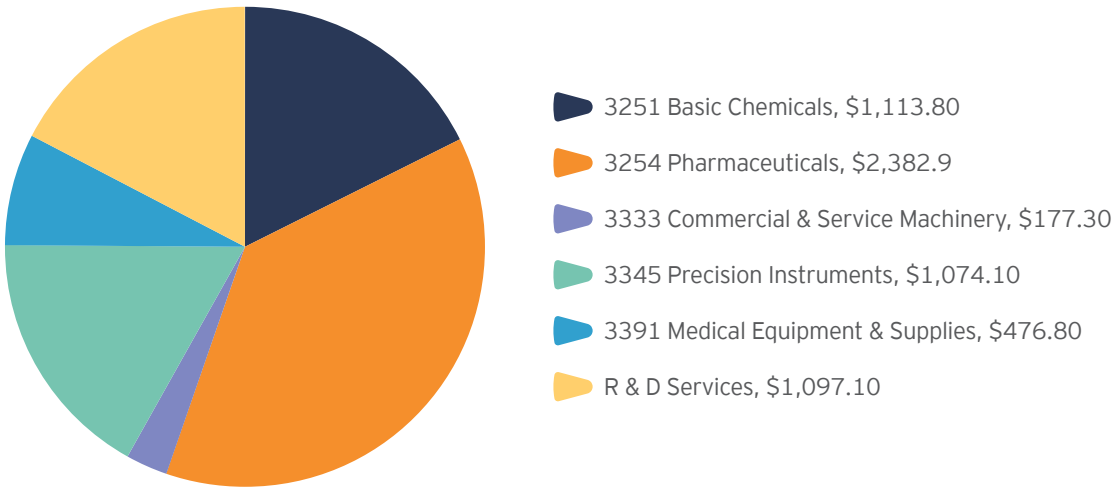


Jones Lang Lasalle (JLL), October 2016, Philadelphia Life Sciences Outlook.

Exports

The Economy League of Greater Philadelphia estimated that in 2014 the GPR exported almost $31.6 billion in goods and services that were produced here, comprising 9.1% of the total gross regional product. Our export intensity, or value of exports as a percent of gross regional product, ranked 7th among the 10 largest metros in U.S. The Economy League noted in their study that the top five goods exporting sectors, by value in the GPR, are, in descending order, pharmaceuticals, helicopters, medical devices, chemicals, and computers and electronics. Detailed export data for 2012 provided by the Economy League, and in turn prepared by the Brookings Institution, were analyzed to determine the export contribution from the Life Sciences. The value of Life Sciences exports from the GPR in 2012 was $6.3 billion, which comprised almost 20% of the total value of exported goods and services. The accompanying chart shows the value of exports from the six export sectors that align most closely with the definition of the Life Sciences sector used in this report. The pharmaceutical and basic chemicals sectors together accounted for almost $3.5 billion in exports. It should be noted that while the Life Sciences sectors, as we have defined them in this report, account for all, or nearly all, of exports in the pharmaceutical and medical equipment sectors, they account for only a portion of the exports in the other four sectors.

Value of Exports from the Philadelphia and Trenton MSAs in 2012 by Life Science Related Sectors (millions of $)



The data provided by the Economy League included a location quotient (LQ). An export sector with an LQ > 1.0 indicates that the region has an above-average concentration of exports from that sector when compared to other regions in the U.S. According to this table the GPR has a very high concentration of R&D Services and Pharmaceuticals and high concentrations of other Life Sciences industries. The combined LQs for both MSAs are all greater than 1.0, further confirmation of the above average concentration of Life Sciences economic activity in the GPR.

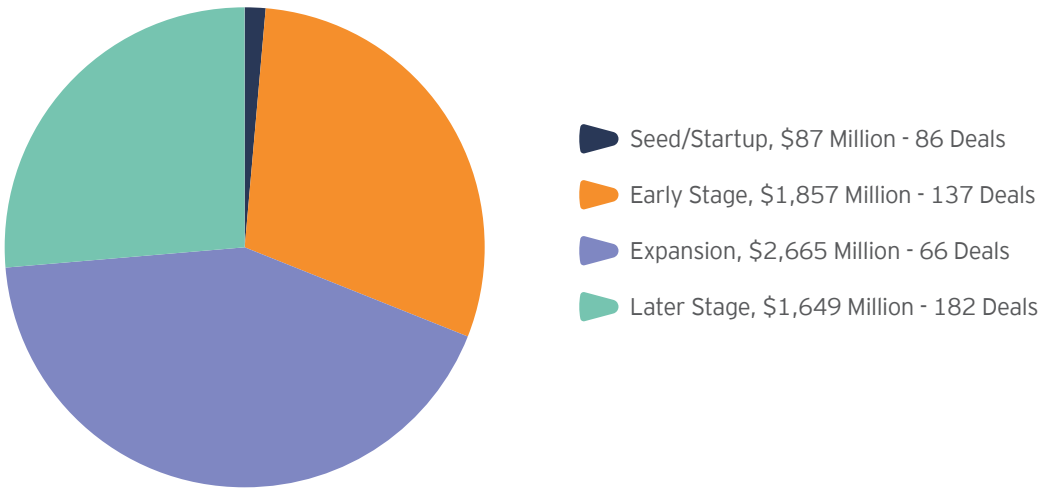
Exports in 2012 In Life Sciences Sectors

Export Sector	Philadelphia MSA		Trenton MSA		Total for Both MSAs	
	Value (millions of $)	Location Quotient	Value (millions of $)	Location Quotient	Value (millions of $)	Location Quotient
3251 Basic Chemicals	$770.7	0.82	$343.1	4.82	$1,113.8	2.05
3254 Pharmaceuticals	$2,219.1	3.09	$163.8	3.03	$2,382.9	3.08
3333 Commercial & Service Machinery	$138.1	1.04	$39.1	3.93	$177.3	1.68
3345 Precision Instruments	$1,009.2	1.41	$64.8	1.20	$1,074.1	1.40
3391 Medical Equipment & Supplies	$458.5	1.08	$18.3	0.58	$476.8	1.06
R & D Services	$898.1	2.60	$199.0	7.64	$1,097.1	3.51
Total	**$5,493.7**		**$828.2**		**$6,321.9**	

Funding

One of the primary indicators of the current and future economic viability of the region's Life Sciences sector is the amount and types of investments that have been made in recent years. The project team compiled and analyzed information on funding provided by the report's sponsors. Because the information came from multiple sources, used varying definitions of investment, and provided for data at different places along the funding timeline, considerable effort was spent in analyzing the data to eliminate duplications and assign the individual deals to the appropriate investment type. Life Sciences firms in the GPR received over $6.3 billion in funding from 2011 through the first half of 2016. This includes $2.3 billion in funding raised by companies which went public during the same time period. The accompanying chart shows the distribution of funding by type of investment.

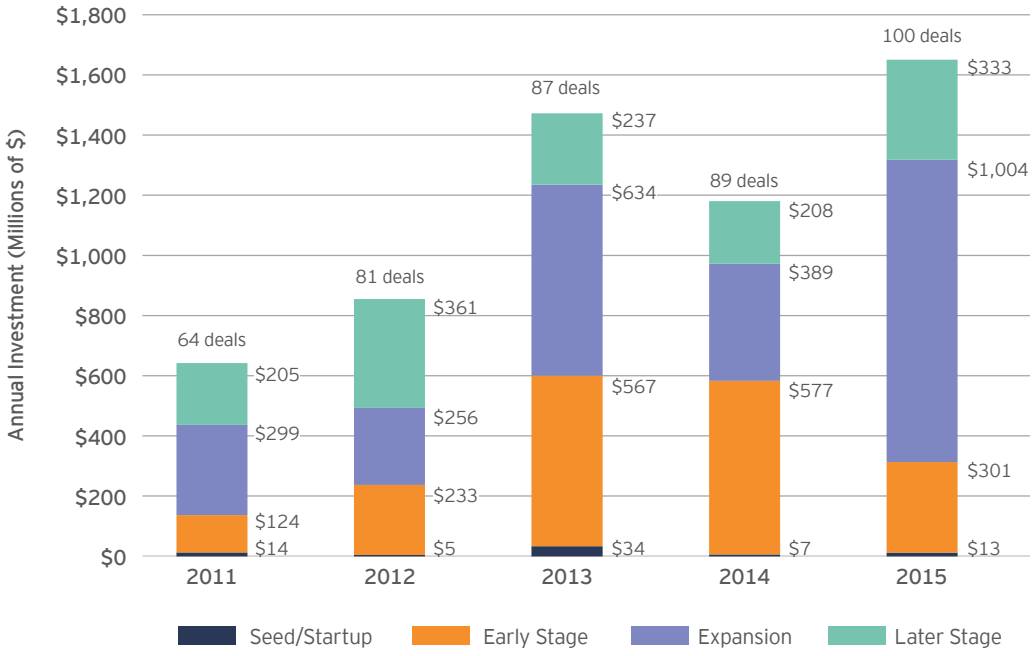
Life Sciences Combined Funding By Stage In GPR CY2011 through 1st Half of CY2016



For the investment in the GPR during the five-year study period, 42% was for expansion, 30% for early stage, and 26% for later stage. The accompanying chart also shows the number of deals, with a combined total of 526 deals. The average amount per deal ranged from a high of $22.8 million for expansion investments down to $1 million for seed/startup investments. Ben Franklin Technology Partners of Southeastern PA and BioAdvance represented over 28% of the number of Seed/Startup and Early Stage deals.

Total funding for Life Sciences activities in the GPR showed a strong upward trend between 2011 and 2015, as shown in the accompanying chart, rising at an average annual rate of almost 270%. Total annual investments in 2011 and 2012 are significantly less than that of 2013 and 2015. The risk aversion of investors and tight credit environment following the 2008 financial crisis could have played a role in the relatively lower levels of funding in 2011 and 2012.

Life Science Combined Funding In the GPR By Stage of Investment CY2011 - CY2015



In terms of growth by investment stage, Expansion funding grew fastest at more than 35% annually between 2011 and 2015, followed by Early Stage at just under 25%, and Later Stage with a 13% growth rate. Early Stage investment grew significantly from 2011 to 2013, leveled off, and then dropped in 2015. Expansion investment had highs in 2013 and 2015 mainly due to deals by The Medicines Company, Spark Therapeutics, and Integra Life Sciences Holdings.

There were a total of 471 private financings between 2011 and 2016 with a value of at least $20 million, including a $25 million Series A financing by Novira Therapeutics in 2012 and a $79 million venture capital financing by Aprecia Pharmaceuticals in 2016.

The region is also home to a number of companies that have become publicly traded over the last few years, such as Inovio Pharmaceuticals (INO), Globus Medical (GMED), and Trevena (TRVN). Several of these public companies have completed financings having a value of over $100 million during the report period, including:

- Adaptimmune: $104 million Series A financing in 2014, followed by a $191.3 million IPO in 2015.
- Auxilium Pharmaceuticals: $275 million in a debt/loan agreement in 2013, followed by an additional $50 million in 2014.
- IGI Laboratories, now called Teligent: $125 million in a debt/loan agreement in 2014.
- Integra Life Sciences: follow-on funding of $161 million in 2013 and $231.5 million in 2015.
- Spark Therapeutics: $72.7 million Series B financing in 2014, followed by a $161 million IPO in 2015.
- The Medicines Company: $201.3 million in follow-on funding in 2013.

The number of large funding deals and range of companies receiving them shows that the GPR offers a wide range of investment opportunities in the Life Sciences ranging from startups and small, newly established firms to mature companies.

Life Sciences Companies in the GPR

Data from the BMI database and the list of life establishments downloaded from Hoovers indicate that there are approximately 1,100 Life Sciences establishments in the GPR with payroll. This is only part of the story, as there are also a large number of self-employed persons and sole proprietorships that provide goods and services to the Life Sciences sectors, and thus depend on it for their income.

Major Life Sciences Companies in the GPR (partial list)
Agilent Technologies, Inc.
Almac Group Incorporated
Alphaimpactrx, Inc.
Arkema Inc.
AstraZeneca
Bio-Rad Laboratories, Inc.
CSL Behring
DSM Biomedical
E. I. Du Pont De Nemours And Company
Eon Labs Inc.
FMC Corporation
GSK
Johnson & Johnson Pharmaceutical Research & Development L.L.C.
Laboratory Corporation Of America
Merck
Quest Diagnostics, Inc.
Saint-Gobain Ceramics & Plastics, Inc.
Siemens Corporate Research, Inc.
Teva Pharmaceuticals USA, Inc.
Teleflex Inc.

Workforce

Occupations Used by Life Sciences Companies

The Life Sciences Sector uses many occupations, but the majority of its jobs come from a select group, as listed in the Top Occupations table presented below. In 2015, almost 60% of the jobs in the U.S. Life Sciences sector required some post-secondary education to obtain an entry level position, according the Bureau of Labor Statistics, while 45.6% of the them required a Bachelor's degree or higher. While the Life Sciences sector uses workers from 489 different detailed occupations, the top 31 shown in the table below account for over 50% of the total number of jobs. Employment in the 31 occupations is expected to grow 6% by 2020, according to a forecast by the Bureau of Labor Statistics.

Within the Life Sciences Sector, the largest occupation is Medical Scientists. Excluding Epidemiologists as shown on the following page, the largest number of whom work in R&D in Biotechnology sector. The occupations in the accompanying table are listed in descending order based on their shares of total employment in Life Sciences.

The average annual wage of Medical Scientists in the Philadelphia MSA in 2015 was $95,000, which ranks third amongst the top 10 occupations by total jobs within the Life Sciences sector. Thirteen of the 31 occupations listed in the accompanying table had average annual wages of at least $90,000 in 2015.

Twenty-four of the occupations shown in the accompanying Top Occupations table have location quotients greater than 1.0, indicating that the Philadelphia MSA has an above-average share of employment in them when compared to the U.S. **In other words, the region has an above average supply of workers in the occupations that are most important to the Life Sciences sector.**

Total employment in the Philadelphia MSA for the top 10 occupations listed above is concentrated in the Life Sciences. For example, 68% of all Medical Scientists are employed in the Life Sciences, along with 64% of all chemists, 63% of natural science managers, 53% of biological technicians, and 54% of chemical technicians.

Job Growth in Life Sciences Sector

Of the 121 occupations with 100 or more employees in the Life Sciences Sector in the GPR, 96 are expected to have growth in the number of jobs over the next ten years. These occupations have an estimated 71% of the total jobs within the Life Sciences sector in the Greater Philadelphia Region. The occupation with the greatest expected growth is Engineers (all other), where the number of jobs is expected to increase by over one-third by 2025. Biomedical Engineers, an occupation that is expected to grow 24% within the Life Sciences sector, has an employment in the sector that makes up an estimated 61% of the occupation's total jobs in the region.

Top Occupations Required by the Life Sciences Sector

SOC Code and Description	Average Annual Wage in 2016 Q2	Location Quotient	% Employed in Life Science
19-1042 Medical Scientists, Except Epidemiologists	$95,000	1.73	68.2%
19-2031 Chemists	$85,700	1.63	63.6%
51-9011 Chemical Equipment Operators and Tenders	$47,600	1.4	37.4%
11-9121 Natural Sciences Managers	$165,800	1.68	62.7%
19-4021 Biological Technicians	$46,400	1.71	53.2%
51-9111 Packaging and Filling Machine Operators and Tenders	$33,100	0.93	20.5%
19-4031 Chemical Technicians	$49,500	1.41	54.1%
17-2141 Mechanical Engineers	$94,700	0.92	22.1%
15-1132 Software Developers, Applications	$98,800	1.05	6.0%
51-9061 Inspectors, Testers, Sorters, Samplers, and Weighers	$44,000	0.82	17.6%
19-1021 Biochemists and Biophysicists	$95,100	1.97	83.3%
43-6014 Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	$38,700	1.06	1.8%
29-2032 Diagnostic Medical Sonographers	$72,400	1.12	11.1%
29-2012 Medical and Clinical Laboratory Technicians	$46,800	1.23	23.6%
11-1021 General and Operations Managers	$143,100	1.02	2.9%
29-2011 Medical and Clinical Laboratory Technologists	$64,300	1.2	22.9%
17-2112 Industrial Engineers	$91,700	0.86	24.0%
43-9061 Office Clerks, General	$34,200	1.03	1.3%
15-1133 Software Developers, Systems Software	$103,000	1.06	10.8%
51-9023 Mixing and Blending Machine Setters, Operators, and Tenders	$41,900	1.08	29.0%
13-2011 Accountants and Auditors	$80,500	1.09	2.4%
51-1011 First-Line Supervisors of Production and Operating Workers	$66,800	0.79	8.7%
43-4051 Customer Service Representatives	$37,500	1.05	1.4%
13-1121 Meeting, Convention, and Event Planners	$54,300	1.04	1.3%
13-1199 Business Operations Specialists, All Other	$75,900	1.09	3.5%
31-9097 Phlebotomists	$34,600	1.28	28.6%
11-9199 Managers, All Other	$122,800	0.99	4.7%
17-2071 Electrical Engineers	$100,600	0.99	18.3%
15-1121 Computer Systems Analysts	$92,400	1.14	4.4%
41-4011 Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	$109,700	1.03	8.0%
13-1111 Management Analysts	$91,600	1.17	3.2%

Note: the 31 occupations above account for 50% of total employment in the Life Sciences Sectors based on a staff pattern matrix for Greater Philadelphia

Source: Philadelphia Works and EMSI, 2016

Research and Development Spending

R&D Spending by Colleges and Universities

The table on the following page presents R&D spending by colleges and universities in 2014 in the academic areas that are most directly applicable to the Life Sciences sector. Total Life Sciences related R&D was $1.18 billion, which comprised 65% of total spending across academic areas. The most significant contributors to R&D expenditure by universities in Life Sciences in the region were Drexel University, Princeton University, Temple University, Thomas Jefferson University, and the University of Pennsylvania.

R&D Expenditures by Colleges and Universities in the Greater Philadelphia Region in 2014 in Academic Disciplines Related to Life Sciences (Thousands of $)

College or University	Biological Sciences	Chemical Engineering	Chemistry	Medical Sciences	Other Life Sciences	Total by School
Bryn Mawr College	$907	$-	$729	$-	$-	$1,636
Drexel University	$37,499	$3,233	$202	$31,020	$2,965	$74,919
Haverford College	$1,109	$-	$290	$-	$-	$1,399
La Salle University	$-	$-	$-	$163	$-	$163
Phila. College of Osteopathic Medicine	$200	$-	$-	$1,961	$-	$2,161
Princeton University	$46,685	$7,758	$21,810	$-	$-	$76,253
Rider University	$825	$-	$121	$-	$-	$946
Rowan University	$1,487	$316	$439	$2,470	$194	$4,906
Rutgers, Camden	$1,536	$-	$25	$-	$-	$1,561
Saint Joseph's University	$174	$-	$121	$-	$-	$295
Salus University	$1,190	$-	$-	$-	$-	$1,190
Swarthmore College	$745	$-	$456	$-	$-	$1,201
Temple University	$20,226	$-	$7,236	$92,573	$54,238	$174,273
Thomas Jefferson University	$54,449	$-	$-	$59,818	$4,111	$118,378
University of Delaware	$4,269	$17,814	$7,103	$-	$15,700	$44,886
University of Pennsylvania	$204,651	$4,152	$9,423	$440,513	$10,175	$668,914
Univ. of the Sciences	$438	$-	$315	$1,543	$55	$2,351
Villanova University	$1,596	$427	$793	$-	$540	$3,356
West Chester University	$245	$-	$119	$-	$132	$496
Total by discipline	$378,231	$33,700	$49,182	$630,061	$88,110	$1,179,284

Source: National Science Foundation, 2016.

R&D Spending Supported by the National Institutes of Health and other Federal Agencies

The GPR receives significant funding to support the life sciences from many sources—a total of $1.2 billion annually among the top 20 research institutions, including colleges and universities, non-profit research organizations such as The Wistar Institute, hospitals, and private corporations. Active National Institutes of Health (NIH) awards alone top $1 billion, representing over 3,000 awards over multiple years.

Colleges and Universities

One of the GPR's primary competitive advantages for the Life Sciences sector is the excellence, size, and diversity of its colleges and universities. There are more than 100 post-secondary institutions located in the GPR. According to QS World , some of the world's most highly ranked universities are located in or have a presence in the GPR including:

- Overall: Princeton University – 11; University of Pennsylvania – 18; Pennsylvania State University – 95; University of Delaware – 145; and Drexel University – between 501 and 550.
- Biology: Princeton University – 18; University of Pennsylvania – 29; Pennsylvania State University – 51 to 100.
- Chemistry: Princeton University – 26; University of Pennsylvania – 46.
- Medicine: University of Pennsylvania – 15.
- Pharmacy: University of Pennsylvania – 39.

Along with the R&D spending described above, colleges and universities are the primary suppliers of skilled workers needed by the Life Sciences sector. Because of the size and historic importance of the GPR's Life Sciences sector, over the years colleges and universities in the region have developed specific certificate and degree programs at all levels to meet its workforce needs. An analysis of the Integrated Post-secondary Education Data Set (IPEDS) maintained by the U.S. Department of Education identified a total of 38 schools that awarded post-secondary certificates and degrees in the Biological and Biomedical Classification on Instruction (CIP) area.

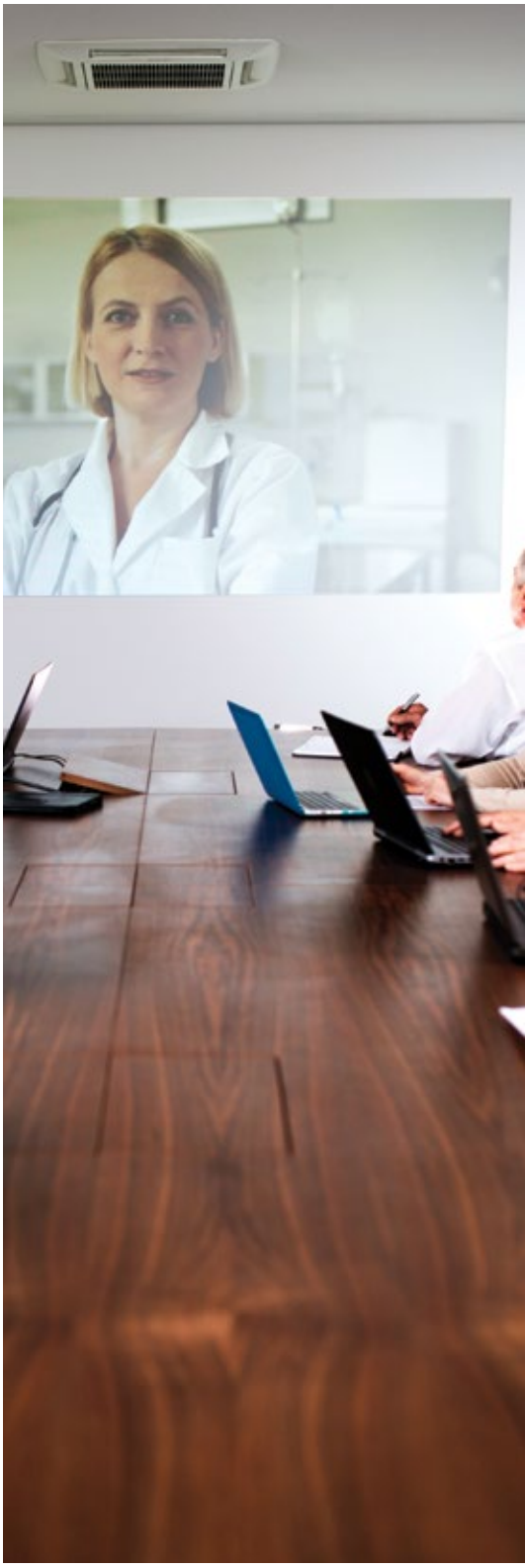
During the 2014 academic year, in fields associated with Life Sciences, 38 higher education schools awarded a total of 3,162 certificates and degrees at all levels, almost 74% of which were Bachelor's degrees and 16% of which were Master's degrees.

Innovation

One measure of a regional economy's capacity for innovation is the number of patents awarded to organizations and persons located there. We analyzed patent data from 2010 through 2015 for the Philadelphia and Trenton MSAs. During that period, a total of 5,400 utility patents in technology classes related to Life Sciences were awarded within the two MSAs, representing 38.3% of all patents awarded. In the Drug technology class alone, a total of 2,642 patents were awarded.

Programs, Partnerships and Incubators

The Greater Philadelphia innovation ecosystem has a long history but, compared to other regions, is less centrally organized—there is no nexus of innovation, but a community of innovation dispersed throughout the region. The region has established a number of nationally recognized, multi-institutional, public-private partnerships in nanotechnology, alternative energy, energy-efficient building technology, water, digital health, and advanced textiles and composites.



State Programs

In 2001, Pennsylvania pioneered a long-range commitment of almost $2 billion to promote the Life Sciences, using revenues from its settlement with tobacco companies. The initiative established a continuum of funding, with research institutions receiving an estimated $1.6 billion over the life of the settlement to support discovery activities; three Life Sciences "greenhouses" (BioAdvance being one of the three) were established with a one-time $100 million total allocation to fund early stage companies and technologies; and $80 million was set aside for investments in venture capital funds to support Life Sciences companies in Pennsylvania. Together, the greenhouses and the venture capital funds have invested $178 million in over 250 Life Sciences companies and technologies since 2003, using resources from this innovative program.

The Grow New Jersey Assistance Program (Grow NJ) provides tax breaks for Life Sciences companies that meet certain qualifications, and the New Jersey Technology Business Tax Certificate Transfer Program (NOL) allows New Jersey-based biotechnology companies to sell their New Jersey net operating tax losses and R&D tax credits to unrelated profitable corporations. The New Jersey Angel Investor Tax Credit Program provides refundable tax credits against New Jersey corporation, business or gross income taxes for corporations that meet certain conditions.

Currently, the Region supports over 30 programs, partnerships, and incubators focused on the accelerated commercialization of new technologies in Life Sciences. These include single institution programs such as Drexel's Coulter Foundation program; multi-institutional programs such as the Science Center's QED proof-of-concept program; the region's premier medical device co-working space, Plexus; ECRI Institute, that utilizes applied research to benefit patient care by promoting the highest standards of safety, quality, and cost-effectiveness in health care; and one of the nation's most successful biotech incubators at the Pennsylvania Biotechnology Center of Bucks

County. Recent ground-breaking programs include the region-wide Health Care Innovation Collaborative encompassing nine inaugural stakeholders focused on leveraging the region's digital health assets. Some of the programs established over the past few years include:

Programs in GPR

- **American Functional Fabrics of America (AFFOA)**. AFFOA's mission is to enable a manufacturing-based revolution by transforming traditional fibers, yarns, and fabrics into highly sophisticated, integrated and networked devices and systems. This MIT-led, $317M DOD-funded project includes Ben Franklin, Drexel, Temple, and Philadelphia University as members and leverages Drexel's new Center for Functional Fabrics.
- **Advanced Manufacturing for the Medical Device Industry (AMMDI)**, a Ben Franklin program supported by the U.S. EDA, assists entrepreneurs to accelerate the development, commercialization, and manufacture of the next generation of medical devices employing new materials, software, and advanced manufacturing processes in the Greater Philadelphia region.
- **Ben Franklin FabNet**, a network of 16 facilities that can reduce the time and expense of prototype construction through access to specialized facilities, instrumentation, equipment, and expertise required for design, characterization, synthesis, simulation, and fabrication of products.
- **BioStrategy Partners (BioSP)** is a not-for-profit organization dedicated to assisting commercialization of medical technologies from member academic institutions, including Fox Chase Cancer Center, Thomas Jefferson University, Lankenau Institute for Medical Research, Penn State University, Temple University, University of the Sciences, and The Wistar Institute. BioSP's "Germinator" initiative connects academic technologies with pharmaceutical company partners (GSK and Janssen). Selected projects are co-funded by academic and pharma partners to accomplish a commercial milestone as set by the industry partner. Thus far, 13 projects have completed the process, with 10 receiving follow-on funding and three new start-ups being created. Nine additional projects have entered the process this year.
- **Coulter-Drexel Translational Research Partnership**. Drexel is a recipient of the prestigious $20M endowment from the Wallace Coulter Foundation for the development of next generation medical technologies focused on advances in biomedical engineering.

- **DevelUPmed**. The newest program from the Penn Center for Innovation and PCI Ventures focuses on new medical device technologies. Internally supported through Penn's NSF I-Corp funding and PCI services, the technologies also benefit from candid, external advice from the region's investment community.
- **Digital Health Accelerator (DHA)**. The Science Center's DHA supports digital health companies ready to transition from research and development to sales. The program selects promising companies from around the world and provides them with funding, collaborative workspace, professional mentorship, and introductions to key health care stakeholders and investors in the GPR. Since the program launched in 2015, 13 DHA companies have created more than 100 new jobs, generated $14 million in revenue and raised over $16 million in investments. Of the 13 companies that have participated in the DHA, five are minority-owned and four are female-owned.
- The emerging Greater **Philadelphia MedTech Collaboration** will provide access to other important resources focused on bioinformatics, biomarkers, market research, testing, and validation.
- **Health Care Innovation Collaborative (HIC)**. The HIC was created under the auspices of the CEO Council for Growth and anchored by its nine inaugural partners, including Ben Franklin, The Children's Hospital of Philadelphia, Christiana Care Health System, Comcast Corporation, Drexel University, Independence Blue Cross, University of Pennsylvania Health System, Thomas Jefferson University and Jefferson Health, and Safeguard Scientifics. It was launched in 2015 with the vision of Greater Philadelphia claiming the deserved recognition as a global leader in health care innovation, based upon its key assets, culture and outcomes. Its first major activity was the release of its first Open Call for Innovation focused on chronic disease, which received 115 proposals for partnership. It will continue to focus on the important work of building a coalition of customers in the health care innovation marketplace.
- **Innovation Partnership Program (IPart)**: IPart is a Commonwealth of Pennsylvania program supported by the Small Business Administration through its FAST grant program and other regional partners. IPart is a highly successful program designed to assist small companies with their SBIR/STTR grant proposals.
- **Keystone Innovation Zones (KIZ)**: The Commonwealth of Pennsylvania created the regional KIZs as designated regions of innovation that provides small companies that reside

in these zones benefit from many different services and networking opportunities. Financial services are provided in the form of R&D tax credits; workforce services are provided through subsidized intern programs. There are five official KIZs that cover the Greater Philadelphia Region, including University City (Philadelphia), Philadelphia Navy Yard, 611 Corridor (Montgomery and Philadelphia counties), i2n – Ideas x Innovation Network (Chester and Delaware Counties), and Bucks County Biotechnology.

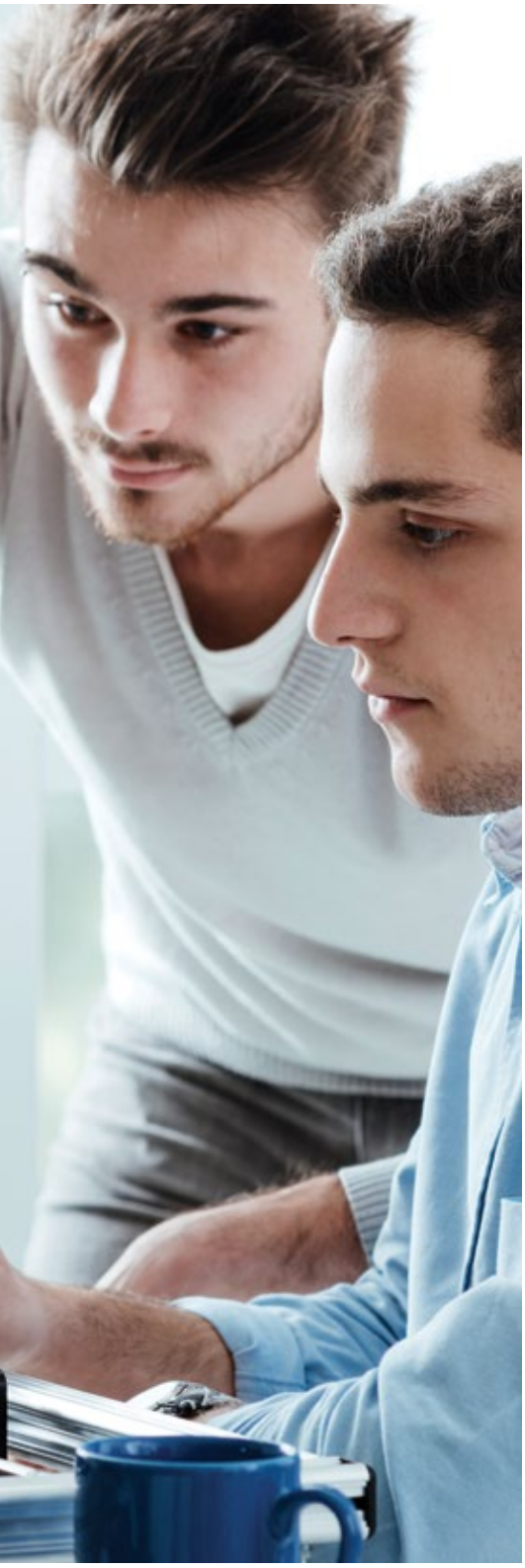
- **MENTOR CONNECT**. Mentor Connect is a partnership between Ben Franklin and PACT to bring the nationally recognized MIT-Venture Mentoring Service program to the Philadelphia region under the brand, MENTOR CONNECT. This program provides targeted mentoring services to technology company CEOs to help them address critical issues needed to grow leveraging the volunteer services of mentors.
- **Pediatric Medical Device Consortium (PMDC)**. The PMDC aims to assist pediatric medical device innovators along the pathway from concept to commercialization. This FDA-funded program led by Children's Hospital of Philadelphia and partners Drexel and Penn, provides innovators with the assistance and support needed to commercialize their technologies to improve pediatric medicine.
- **Phase 1 Ventures (P1V)**. The Science Center's P1V program supports the launch of new startups around research and development intensive technologies. Currently in its second year, P1V aims to support approximately 18 newly-launched ventures by the end of 2016. To date, the program has considered 28 opportunities, has selected 11 to participate, and has awarded or committed over $700,000 in direct support of participating ventures. Participants have raised approximately $1,200,000 in non-dilutive financing.
- **Philadelphia Healthcare IT Circle (PHITC)**. PHITC is a networking, education, and advocacy group for the region's digital health scene. Members include entrepreneurs, investors, health care providers, payers, patient-advocacy concerns, and academics who span the spectrum of developers and consumers of digital health products and services. Programs bring together a diverse group of stakeholders to address hot topics in health care and how technology can be best utilized to overcome barriers to innovation.
- **Primary Care Innovation Fund**. Philadelphia College of Osteopathic Medicine (PCOM) fund designed to stimulate innovation and entrepreneurship in the health care field, with a specific focus on primary care.

- **QED Proof-of-Concept Program**. The Science Center's QED program supports innovators at academic institutions to prove the feasibility of new Life Science technologies in preparation for licensing to private sector partners. To date, a total of 475 projects have been screened in the program, from among 21 academic institutions. Of these, 94 proof-of-concept plans have been developed; 28 projects have received a total of $4.9 million from QED (half of each award comes from the host institution, and the other half from the Science Center); and those program-funded projects have attracted over $19M in outside investment, and generated eight technology license deals.

Incubators, Accelerators, Co-working Spaces, and Other Regional Facilities

Incubators, Accelerators, and Regional Networking Programs provide residence and co-working spaces to nurture new technology companies. Anchored by the University City Science Center, the region's 1.5 million square feet of incubator space also includes several other regional facilities focused on Life Sciences.

- **University City Science Center**. The Science Center's business incubators support startup companies that have raised at least seed capital, and that are engaged in product development in a range of industry sectors. Comprising approximately 50,000 square feet of mixed laboratory and office facilities, the Science Center's Port incubator currently supports the activities of 29 startup companies which are putting over $50 million in risk capital to work – spanning seed-stage to Series A investment.
- **The Navy Yard,** which has successfully transitioned from a military installation to a commercial campus while retaining its roots in Research and Development. The Navy Yard's organically formed Life Sciences cluster that has thrived given its solution to a complicated problem, 'identifying a real estate solution in a major U.S. city, close to talent, an international airport, and the ability to build in a more horizontal format versus the traditional high rise format of a typical urban site.' The Navy Yard's campus format is conducive for building purpose built buildings with the ability to expand and its location is both close to the desired urban and suburban workforce. As a result, Life Sciences tenants that use more than 750,000 square feet of space have located at the Navy Yard, representing the highest concentration of the privately



leased Life Sciences space in the city of Philadelphia. This cluster includes large corporate North American headquarters (GSK), established and emerging companies (WuxiApptec, Iroko, Adaptimmune), Institutions (University of Pennsylvania, Vincera Institute), and Capital (Phoenix IP Ventures and Ben Franklin Technology Partners), and others. Leveraging the existing activity and well positioned for growth, the campus has the remaining land capacity to create the largest urban Life Sciences cluster in the United States.

The GPR has dozens of co-working spaces that accommodate all kinds of technology-enabled companies. Among the facilities are:

Plexus and MHV Innovation Hub at One Drexel Plaza (University City)

University of Pennsylvania's Pennovation Center (Grays Ferry)

Montgomery County Tech Center (Plymouth Meeting)

Protecs Innovation Center (King of Prussia)

PA Biotech Center (Doylestown)

Innovation Center @3401 (University City)

Innovation Center at Eagleview (Exton)

Bridge Business Center (Bristol)

Delaware Technology Park (Newark, DE)

Contract Research Organizations, Clinical Trials and Laboratories

The GPR has a wide range of Contract Research Organizations (CROs) that provide research support and services support to the pharmaceutical, biotechnology, and medical device industries. The region has over 320 CROs in the region that offer a range of services.

Greater Philadelphia had over 2,400 clinical trials from 2011 – 2015 with the majority of these occurring in Philadelphia. The clinical trials play a key role in the testing, evaluation and development of new medicines and devices.

According to JLL, the GPR has over 12.3 million square feet of rentable laboratory space. These laboratories play a key role in research and development in the Life Sciences sector. JLL also notes that Philadelphia ranks 4th among the major metros with approximately 1.2 million square feet of life sciences real estate projects currently under construction.

About Partners

Ben Franklin Technology Partners of Southeastern Pennsylvania

Ben Franklin is the most active early stage capital provider for the region's technology sectors, nearing $200 Million invested over the years in emerging regional companies. Ben Franklin combines best practices of venture capital with a public-spirited purpose: leading the region's technology community to new heights, creating jobs and changing lives for the better. Ben Franklin is an initiative of the Pennsylvania Department of Community and Economic Development and is funded by the Ben Franklin Technology Development Authority.

For more information, please visit: **www.sep.benfranklin.org**

BioAdvance

BioAdvance is a $50 million early stage life sciences fund, working with entrepreneurs in the mid-Atlantic region to build strong companies that have the potential to improve human health. Since making its first investments in 2003, BioAdvance has committed over $37 million in funding to 74 organizations developing over 90 products in the diagnostics, therapeutic, medtech, research tools and digital health sectors. BioAdvance portfolio companies have leveraged $2.5 billion in subsequent capital, including proceeds from eleven acquisitions. Ten products have received FDA approval.

For more information please visit: **www.bioadvance.com**

CEO Council for Growth

The Chamber's CEO Council for Growth leads our region forward by envisioning a stronger, more competitive community, convening decision makers, taking action, and advocating for policies and practices that strengthen our regional economy.

This team of devoted business, higher education, and civic leaders reaches across our 11-county Greater Philadelphia community. We are engaged advocates who are committed to innovation in business, improving regional mobility, and fostering talent as key opportunities that define our competitive advantage and drive economic growth.

For more information, please visit: **www.ceocouncilforgrowth.com**

The Chamber of Commerce for Greater Philadelphia

The Chamber of Commerce for Greater Philadelphia brings area businesses and civic leaders together to promote growth and create opportunity in our region. Our members represent eleven counties, three states, and roughly 600,000 employees from thousands of member companies and organizations. And by bringing all kinds of businesses and leaders to the table – the new, the established, the big, the small, the growing, the thriving, the perennial, the innovative, and the experimental – we build community and find commonalities among us all.

We advocate for regional development, business-friendly public policies, and economic prosperity. We support our members with practical, inspiring programs, resources, and events. And all that we do serves one clear, bold goal: to make Greater Philadelphia a great place for good business.

For more information, please visit: **www.chamberphl.com**

EY

EY is a global leader in assurance, tax, transaction and advisory services. Worldwide, its 230,000 people are united by its shared values and an unwavering commitment to quality. EY makes a difference by helping its people, its clients and its wider communities achieve their potential.

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For more information, please visit: **ey.com**

IHS-Markit

In July 2016, IHS Inc. and Markit Ltd. merged to form IHS Markit Ltd. (NASDAQ: INFO), a world leader in critical information, analytics and solutions for the major industries and markets that drive economies worldwide. Our Economics and Country Risk group prepares economic forecasts for emerging markets; developed countries including Canada, Europe, and Japan; US macroeconomic forecasts; US Regional forecasts for 50 states, 363+ metropolitan areas and 3,100+ counties; Financial Markets; and more than 170 industries in the energy, chemical, technology, maritime & trade, aerospace and defense, manufacturing and finance cluster. We have offices in 31 countries across the globe. Our Philadelphia office has operated for more 40 years since the founding of Wharton Econometric Forecasting Associates (WEFA), one of original tenants of the University City Science Center.

For more information, please visit: **www.ihsmarkit.com**

Life Sciences Pennsylvania

Life Sciences Pennsylvania is the statewide trade association for the life sciences in Pennsylvania and serves to ensure Pennsylvania is a global leader in the life sciences by developing a business and public policy environment which fosters life science growth and success.

For more information, please visit: **www.lifesciencespa.org**

Philadelphia Alliance for Capital and Technologies (PACT)

PACT's vision is to be the go-to resource for fast growing companies, and a driver of entrepreneurship and innovation in the Philadelphia region. PACT provides its members with valuable content and connections to capital, coaching, and customers that will accelerate their growth and success, and to collaborate with other organizations to drive innovation and entrepreneurship in the region. Visit www.philadelphiapact.com for more information.

For more information, please visit: **www.philadelphiapact.com**

Philadelphia Works

Philadelphia Works is a nonprofit investing in solutions and services to grow Philadelphia's economy by connecting employers to workforce talent and career seekers to jobs. We influence the public policies that support economic growth, and optimize funding and resources to invest in regional solutions to build a skilled and thriving workforce. Our dedicated board members and staff manage direct services, workforce research, and innovative initiatives to grow Philadelphia.

For more information, please visit: **www.philaworks.org**

Select Greater Philadelphia Council

Select Greater Philadelphia Council (Select) is the business attraction organization for northern Delaware, southern New Jersey, and southeastern Pennsylvania. A non-profit entity, Select highlights Greater Philadelphia's unique business assets to national and global audiences with the ultimate goal of growing the economic vibrancy of our collective community through attracting new businesses and new jobs to our 11-county region. Select assists companies interested in locating in Greater Philadelphia by providing resources, detailed information, and connections.

University City Science Center

Located in the heart of uCity Square, The Science Center is a dynamic hub for innovation, and entrepreneurship and technology development in the GPR. Founded in 1963 as the nation's first urban research park, it provides business incubation, programming, lab and office facilities, and support services for entrepreneurs, start-ups, and growing and established companies. Graduate firms and current residents of the Science Center's business incubator support one out of every 100 jobs in Greater Philadelphia and drive $12.9 billion in economic activity in the region annually.

For more information, please visit: **www.sciencecenter.org**

The data and information in this summary and the report came from a variety of sources, including Ben Franklin Technology Ben Franklin Technology Partners of Southeastern Pennsylvania, BioAdvance, CEO Council for Growth, Council for Community and Economic Research, Cushman & Wakefield, Economy League of Greater Philadelphia, EY, The Chamber of Commerce for Greater Philadelphia, Hoover's Business Intelligence, IHS-Markit, JLL, Life Sciences Pennsylvania, PACT, Philadelphia Works, QS World, Select Greater Philadelphia, University City Science Center, and US Patent and Trademark Office.

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