

City of Philadelphia: A National Life Sciences Leader

Technical Documentation

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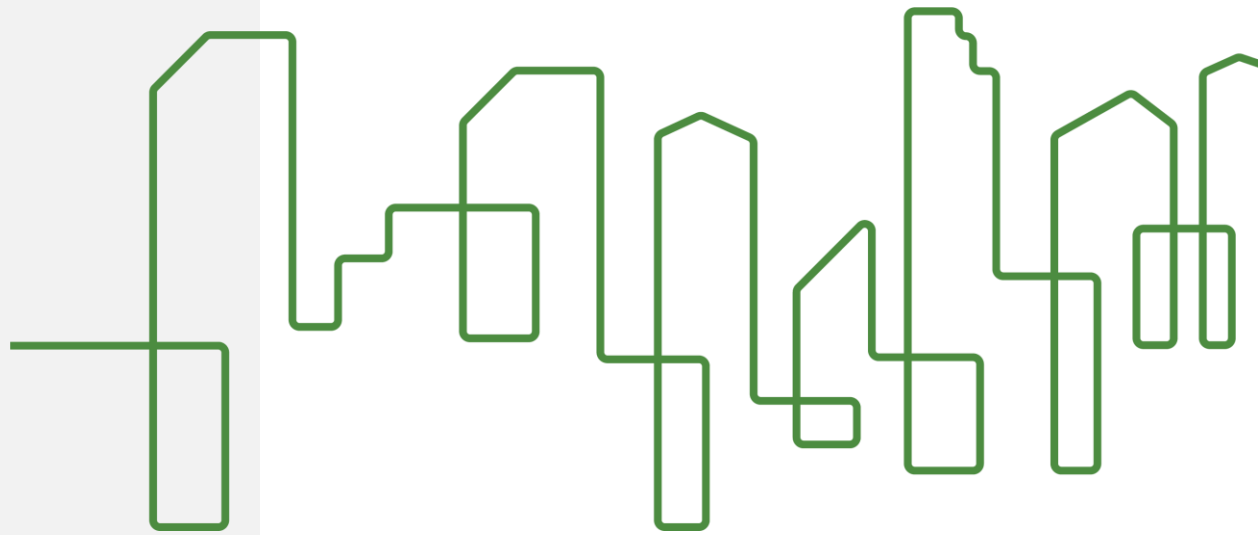


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1. Introduction

Purpose of Report

The City of Philadelphia Department of Commerce (“Commerce Department”) commissioned Econsult Solutions, Inc. (ESI) to complete a series of analyses that highlight the state and competitive positioning of the life sciences industry in the City of Philadelphia. Philadelphia has become one of the leading cities in the United States to conduct life sciences research and development; however, a series of metrics specifically targeting the city’s ecosystem as a standalone life sciences hub (as opposed to the regional ecosystem) had yet to be produced. To help Philadelphia’s life science ecosystem continue to grow, the purpose of this study is to establish a set of clear metrics regarding this industry as well as an understanding of its economic and tax contributions to the city’s economy.

The following technical report serves as a supplement to *City of Philadelphia, A National Life Sciences Leader; Key Drivers and Trends: Research, Employment, and Economic Opportunity* that was released in June 2024 and is intended to provide the data, assumptions, and methodology for the findings presented in this document.

Report Structure

The report is organized as follows:

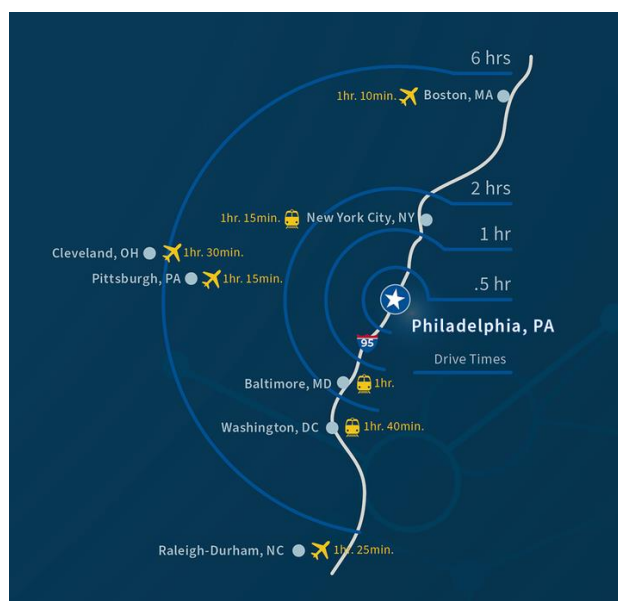
- **Chapter 2: City and Regional Assets:** This section identifies key citywide and regional assets that support business attraction and retention, including access to major markets, transportation infrastructure, presence of research institutions, cost of living, and other key site selection factors that contribute to economic growth.
- **Chapter 3: Real Estate Supply Overview:** This section focuses on key life sciences-focused real estate development metrics and trends, including documentation of existing supply, pipeline projects, and key districts or clusters of life sciences activities.
- **Chapter 4: Employment Overview:** This section quantifies total employment and average wages by life sciences industry sub-sectors and analyzes the talent pipeline from local institutions and economic opportunities.
- **Chapter 5: Funding and Research Output:** This section identifies key research activities supporting the life sciences ecosystem, including an analysis of funding and clinical trial data as well as private sector investment in the industry through venture capital.
- **Chapter 6: Economic and Tax Impacts:** Building up the findings in Chapter 4, the economic and tax impacts of life sciences employment, wages, and activities will be modeled to quantify the industry’s economic footprint in the city.

2. City and Regional Assets

Philadelphia is uniquely positioned on the East Coast to serve the growing Life Sciences industry. Philadelphia has an abundance of site selection assets and a variety of activity clusters throughout the city, making it an attractive location for a variety of life sciences enterprises. Notably, the city is within a day's drive of 40 percent of the U.S. population. Philadelphia also boasts an easily accessible international airport equipped with advanced temperature-controlled shipping technology and the largest refrigerated marine port in the U.S. This type of connectivity is important for any growing economy but is especially crucial for a life sciences ecosystem, which relies on infrastructure, density, collaboration, and engagement for success.

Philadelphia's Accessibility

A key narrative to Philadelphia's regional competitiveness as a life sciences hub is its highly accessible location within a two-hour drive of New York City or a short flight to Boston or Raleigh, both leading hubs for Life Sciences talent and development. Philadelphia also benefits from having a centrally located Amtrak station (30th Street Station), with direct service to New York's Penn Station within an hour and 15 minutes and Washington, DC's Union Station within an hour and 40 minutes.



Life Sciences Ecosystem

Philadelphia has a robust and interconnected life sciences ecosystem, enhancing both national and international competitiveness and positioning the sector for growth.

- **Research Ecosystem:** Philadelphia has four of Pennsylvania's five National Cancer Institute (NCI) Cancer Centers, including the Abramson Cancer Center (ACC) of the University of Pennsylvania, Fox Chase Cancer Center (Temple University Health System), Sidney Kimmel Cancer Center (SKCC) at Jefferson Health, and Ellen and Ronald Caplan Cancer Center of The Wistar Institute, which was the first NCI-Designated Basic Cancer Center.¹
- **Institutions:** Philadelphia has five medical schools, including the Perelman School of Medicine (University of Pennsylvania), Lewis Katz School of Medicine (Temple University), Drexel

¹ <https://www.cancer.gov/research/infrastructure/cancer-centers/find>

University College of Medicine, Sidney Kimmel Medical College (Thomas Jefferson University), and Philadelphia College of Osteopathic Medicine (PCOM).

- **Cost of Living:** Philadelphia emerges as a top life sciences hub in terms of overall cost of living, just behind Raleigh-Durham. With its affordability and lower real estate/operating costs compared to Boston, San Francisco, and San Diego, Philadelphia boasts a key advantage.²
- **Talent Pipeline:** Philadelphia's regional life sciences ecosystem thrives with world-class research institutions pioneering medical breakthroughs, 15 major health systems, and a deep talent pool from multiple universities producing over 96,000 graduates annually across various disciplines.³
- **Leading Life Sciences Market in U.S.:** Philadelphia secures the 4th spot among the nation's top life sciences markets due to its potent combination of a robust talent pipeline, significant research funding and activity led by institutions like the University of Pennsylvania and Children's Hospital of Philadelphia. In addition, the relatively affordable real estate costs along with an already well-established presence of major pharmaceutical giants like GlaxoSmithKline and Merck anchor a thriving life sciences ecosystem in the region.⁴
- **Real Estate Pipeline:** Philadelphia offers abundant space to support the expansion of the life sciences industry. In addition to the 5.8 million square feet of high-quality existing life sciences properties, there is a total of 15.7 million square feet in the pipeline. This includes 2.8 million square feet currently under construction, 4.4 million square feet in the proposal stage, as well as 8.5 million square feet ready and planned for conversion.

² <https://www.bizjournals.com/philadelphia/news/2024/04/30/colliers-philadelphia-life-sciences-hub-rankings.html>

³ Economic Impact of Graduate Retention in Greater Philadelphia, May 2023

⁴ <https://www.colliers.com/en/research/nrep-life-sciences-report-2024>

3.Life Sciences Real Estate Supply Overview

Philadelphia has 26 existing life sciences properties⁵ with a total of around 5.8 million square feet, of which, 2.4 million square feet are considered to being high quality built after 2015. The development pipeline includes six buildings that are under construction totaling 2.8 million square feet, and seven that are proposed totaling 3.4 million square feet. The completion of these pipeline projects will bring the city’s total life sciences supply to around 12 million square feet. Additionally, there are nearly 8.5 million square feet of existing office space that has been identified as suitable for conversion for life sciences uses. If these properties are converted, the total citywide supply could reach 21.5 million square feet over the next decade.

University City is the city’s primary life sciences hub with around 78 percent of Philadelphia’s life sciences real estate supply. This submarket benefits from its proximity to prominent educational institutions, including University of Pennsylvania and Drexel University, as well as healthcare facilities and William H. Gray III 30th Street Station (Amtrak, SEPTA and NJ Transit). Specifically, University City boasts 16 high-quality existing life science buildings, with three more under construction that are scheduled for completion within the next two years, and five additional buildings that are proposed. However, Center City’s positioning as a secondary life sciences sub-market could be bolstered as more conventional office buildings are converted to support life sciences activities.

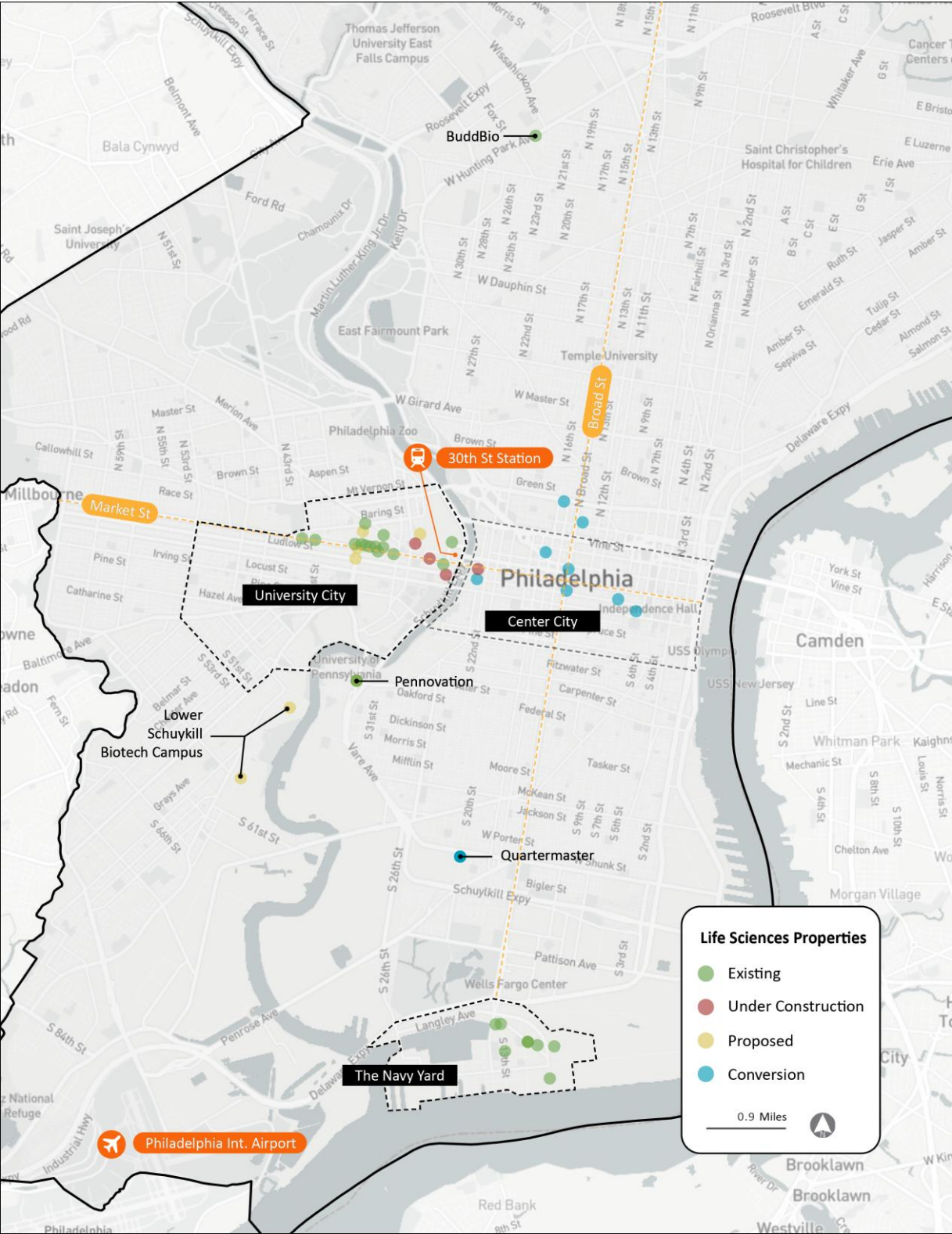
Figure 3.1: Rentable Building Area of Existing and Pipeline Life Science Properties (Square Feet), as of May 2024

Submarket	Existing	Under Construction	Proposed	Conversion	Total
University City	4,503,000	1,554,000	3,126,000	-	9,183,000
Center City	-	220,000	-	7,518,000	7,738,000
South Philadelphia	-	1,053,000	1,176,000	733,000	2,962,000
Navy Yard	1,107,000	-	128,000	-	1,235,000
Northeast Philadelphia	153,000	-	-	233,000	386,000
Total	5,763,000	2,827,000	4,430,000	8,484,000	21,504,000

Source: CoStar (2024), ESI (2024)

⁵ For the purposes of this analysis, life sciences real estate primarily includes lab and research and development (R&D) space, but the total square footage also includes office and other commercial space.

Figure 3.2: Life Sciences Assets in Philadelphia



Source: CoStar (2024), ESI (2024)

Existing Supply

Philadelphia offers abundant high-quality life science spaces with prime locations and competitive rents, catering to the evolving needs of life science companies and institutions. The largest share of the city’s supply is located in University City and The Navy Yard, with a total rentable building area of 4.5 million and 1.1 million square feet, respectively (Figure 3.3). Among these properties, 11 buildings have been constructed after 2015 providing more than 2.4 million square feet of modern, high-quality life science space.

In Q4 2023, the vacancy rate for existing life science buildings in Philadelphia was 18.2 percent, with an average rent of \$56.9 per square foot.⁶ Compared with all office buildings in Center City and University City, which had a total vacancy of 22.2 percent and average asking rent of \$37.3 per square foot, life science buildings had lower vacancy rate and significantly higher rent potential.⁷ This rent is approximately 65 percent lower than other top East Coast markets, making Philadelphia an attractive and cost-effective option for life science enterprises seeking high-quality space.⁸

Figure 3.3: Existing Life Science Supply in Philadelphia, as of May 2024

Submarket	Properties	RBA	Vacancy
University City	16	4,503,000	15%
Center City	-	-	-
The Navy Yard	9	1,107,000	21%
Northeast Philadelphia	1	153,000	0%
South Philadelphia	-	-	-
Total	26	5,763,000	16%

Source: CoStar (2024), ESI (2024)

Pipeline Projects

Boosted by the pandemic-era boom in the life science industry nationally, the commercial real estate community continues to shift investment from conventional office space into life sciences space, which has supported Philadelphia's growing list of pipeline projects. Among all ongoing and proposed projects, six buildings currently under construction are expected to add approximately 2.8 million square feet of state-of-the-art life sciences space to the Philadelphia market within the next two years. Further down the pipeline, an additional 4.4 million square feet of life sciences space has been proposed.

Additionally, multiple older office buildings with large floor plans and adequate ceiling heights are being prepared for conversion to life sciences spaces, actively attracting life sciences tenants. These conversions contribute to nearly 8.5 million square feet of potential life sciences space entering the market, further expanding Philadelphia's growing capacity to support the life sciences sector.

⁶ CBRE. Philadelphia Life Sciences, Q4 2023.

⁷ CBRE. [Philadelphia Office, Q4 2023](#).

⁸ CBRE. [Life Sciences, Q4 2023](#).

Under Construction

Over 2.8 million square feet of high-quality life sciences space are currently under construction and will be delivered in the coming two years, all featuring state-of-the-art quality and facilities. Strategically located in University City and Center City, the four buildings near the Penn and Drexel campuses offer prime proximity to higher education and medical conglomerations. Additionally, as part of the Bellwether District development, the large Hilco parcels in South Philadelphia mark the beginning of a major new innovation campus in Philadelphia, further enhancing the city's capacity to support its burgeoning life sciences sector.

Figure 3.4: Life Science Buildings Under Construction, as of May 2024

Property	Submarket	RBA	Expected Delivery
3201 Cuthbert St	University City	582,000	2024
Roche Global Center	University City	500,000	2025
3151 Market St	University City	472,000	2024
2300 Market St	Center City	220,000	2024
Hilco - Lot 1	South Philadelphia	326,000	2024
Hilco - Lot 2	South Philadelphia	727,000	2025
Total Under Construction		2,827,000	

Source: CoStar (2024), ESI (2024)

Proposed Projects

There are eight proposed developments totaling over 4.4 million square feet expected to be delivered in the next three years. There is confidence from the development community that the life sciences market will continue to flourish in the city, but this also emphasizes the need for continued marketing and promotion as part of a citywide economic development strategy. These proposed developments remain concentrated in the heart of University City, further establishing its role as the city's primary life sciences hub. Located a little further away from the center of University City, Pennovation and the Lower Schuylkill Biotech Campus will expand the submarket's footprint while maintaining strong connectivity within the network. However, as capital investment in life sciences cooled down in 2023, some speculative projects have slowed or paused in their early stages,⁹ awaiting a clearer understanding of supply and demand in Philadelphia's life sciences market.

⁹ CBRE. Philadelphia Life Sciences. Q4 2023.

Figure 3.5: Proposed Life Science Buildings, as of May 2024

Property	Submarket	RBA	Est. Delivery
Lower Schuylkill Biotech Campus	University City	1,000,000	-
uCity Square	University City	750,000	2025
Pennovation Building 100	University City	455,000	2027
uCity Square	University City	400,000	2026
3801 Chestnut St	University City	338,000	2025
Ultra Labs at University City	University City	183,000	2025
333 Rouse Blvd	The Navy Yard	128,000	2025
Hilco - Lot 4	South Philadelphia	1,176,000	2025
Total Proposed		4,430,000	

Source: CoStar (2024), ESI (2024)

Ready for Conversion

A significant number of traditional office buildings in Philadelphia are seeking opportunities to attract life sciences tenants through renovations and conversions. These properties are primarily located in the Center City area, offering a vibrant urban business environment and easy connections to University City. One prominent example is The Curtis, built in 1909 and recently renovated in 2023, has secured leases from leading life sciences companies such as Imvax Inc., Vivodyne, and Applied Genetic Technologies Corp.

Outside of Center City, two large campuses, Budd Bioworks in the Northeast and Quartermaster in the South, are also undergoing conversions to provide biomanufacturing and lab spaces. These campuses aim to meet the growing needs for life sciences diverse and evolving needs for research, development, and manufacturing.

Figure 3.6: Office Buildings Ready for Conversion for Life Sciences Space, as of May 2024

Property	Submarket	RBA	Year Built	Year Renovated
1500 Spring Garden St	Center City	1,215,000	1948	2002
2323 Chestnut St	Center City	128,000	1915	
833 Chestnut St	Center City	694,000	1926	2000
One South Broad Street	Center City	434,000	1930	
P3W Life Science Innovation Lab	Center City	627,000	1969	2018
Race Street Lab	Center City	2,106,000	1973	
The Curtis	Center City	912,000	1909	2023
401 N Broad St	Northeast Philadelphia	1,401,000	1929	2016
Pioneer Building @ Budd BioWorks	Northeast Philadelphia	233,000	1910	2023
Quartermaster - Building 11	South Philadelphia	6,000	1970	
Quartermaster - Building 12	South Philadelphia	150,000	2001	2023
Quartermaster - Building 14	South Philadelphia	195,000	1990	
Quartermaster - Building 15	South Philadelphia	25,000	1990	2023
Quartermaster - Building 6	South Philadelphia	357,000	1941	2023
Total Ready for Conversion		8,483,000		

Source: CoStar (2024), ESI (2024)

4. Employment Overview

The city has more than 13,000 life sciences workers with an average annual wage of more than \$120,000. Life sciences activities generates more than \$8.6 billion in economic output for the city and generates around \$77 million in city tax revenue annually (see Section 6 for full details). The following section provides an overview of key life sciences employment trends and business metrics in the City of Philadelphia.

Defining the Life Sciences Sector

The life sciences sector encompasses a wide range of activities from research and development to medical device manufacturing to pharmaceuticals, which encompass numerous industries as defined by the North American Industry Classification System (NAICS). After vetting with the Commerce Department, the list of targeted NAICS codes was compiled based on the Life Sciences PA's Industry Impact Report 2022, which included subsectors within the following:

- **Drugs and Biopharmaceuticals** - includes companies involved in the discovery, development, manufacturing, and marketing of pharmaceutical and biopharmaceutical products.
- **Medical Devices and Equipment** - covers the production of instruments, apparatus, and machines used in medical, surgical, dental, and veterinary applications.
- **Research, Testing, and Medical Laboratories** - involves organizations that provide specialized analytical or diagnostic services
- **Wholesale Trade** - includes establishments engaged in wholesaling merchandise and providing related logistics, marketing, and support services.
- **Agricultural Feedstock & Industrial Biosciences** - covers industries involved in producing and processing raw materials derived from agriculture, forestry, and other biological sources for industrial and commercial use. This sector includes a variety of activities and businesses focused on using biological resources to create products, energy, and technologies.

The universe of NAICS codes was expanded to include Agricultural Feedstock & Industrial Biosciences that was included in a life sciences industry report for Georgia Bio,¹⁰ although jobs in this sector represent only one percent of total life sciences employment in the city as presented in the following figure. The list of 6-digit NAICS codes used in this analysis is presented in the Appendix.

¹⁰ <https://cghi.org/wp-content/uploads/2022/11/TEconomy-Georgia-Life-Sciences-Report-final.pdf>

Employment Trends

Private Sector Jobs

Based on these NAICS codes, in 2023 the City of Philadelphia was home to approximately 9,800 private sector life sciences jobs, adding more than 1,300 jobs since 2018 for an increase of around 16 percent.

Figure 4.1: Private Sector Life Sciences Jobs in City of Philadelphia, 2018 to 2023

	2018	2019	2020	2021	2022	2023	% Growth 2018-2023
Agricultural Feedstock & Industrial Biosciences	119	133	179	106	99	107	-10%
Biopharmaceuticals	778	738	1,033	1,105	1,639	1,678	116%
Medical Devices and Equipment	533	547	458	410	329	335	-37%
Research, Testing, and Medical Laboratories	5,983	6,611	6,320	6,025	6,686	7,019	17%
Wholesale Trade	1,034	794	608	754	702	642	-38%
Total	8,446	8,823	8,599	8,400	9,456	9,780	16%

Source: Lightcast (2024)

Institutional and Academic Jobs

Since research positions at universities and colleges are not included in employment counts from the Bureau of Labor Statistics (BLS), ESI utilized an approach similar to that of KPMG for the 2022 PA Life Sciences report to estimate the number of research/academic jobs in Philadelphia. According to IPEDS, in 2023, there was a total of 42,426 employees in each of Philadelphia's seven academic research institutions.¹¹ ESI then calculated the proportion of life sciences research funding over total university expenditure for each of these institutions (See Figure 4.2) The resulting proportion of 8.2 percent was then applied to the total number of university employees. Consequently, this amounted to 3,479 research jobs in the industry.

Figure 4.2: Philadelphia Higher Education Institutions Total Expenditure and Life Sciences Research Funding, 2023

Organization	Total Expenditures (\$M)	Estimated Life Sciences Research Funding (\$M)
University of Pennsylvania	\$14,400	\$1,365
Temple Univ of the Commonwealth	\$586	\$223
Thomas Jefferson University	\$9,779	\$322
Drexel University	\$963	\$87
Philadelphia College of Osteopathic Med	\$180	\$157
Saint Joseph's University	\$273	\$5
La Salle University	\$143	\$0.09
Total	\$26,324	\$2,159

Source: Individual University Websites

¹¹ Universities and colleges included in the analysis are University of Pennsylvania, Temple University, Thomas Jefferson University, Drexel University, Philadelphia College of Osteopathic Medicine, Saint Joseph's University and La Salle University. Chestnut Hill College is not included in the list as it does not have a full-scale life sciences research program.

Talent Pipeline

Philadelphia's burgeoning life sciences industry is propelled by a robust talent pipeline cultivated by the region's diverse array of educational institutions. The intricate network of universities, colleges, and research centers that confer degrees in various life sciences fields drive innovation and growth within the industry. The pathways they offer for career development, and the partnerships they foster with local life sciences companies, provide a glance into how Philadelphia is positioning itself as a leader in life sciences.

In 2022, more than 2,200 graduate and undergraduate life sciences related degrees were conferred to students in Philadelphia. Evidently, the convergence of academic excellence, cutting-edge research, and industry collaboration creates a dynamic environment that not only attracts but also nurtures top-tier talent, ensuring a steady supply of skilled professionals to meet the evolving demands of the life sciences sector.

Figure 4.3: Number of Life Sciences Degrees (Graduate and Undergraduate) Conferred in 2022¹²

Institution	Degrees Conferred
Chestnut Hill College	30
Drexel University	603
Holy Family University	38
La Salle University	26
Philadelphia College of Osteopathic Medicine	26
Saint Joseph's University	188
Temple University	553
Thomas Jefferson University	72
University of Pennsylvania	684
Grand Total	2,220

Source: IPEDS (2024)

These bachelor's, master's and doctorate degrees were conferred in 14 different life sciences study areas. For a complete breakdown, see Figure 4.4.

¹² See Appendix for CIP codes included in analysis.

Figure 4.4: Number of Life Sciences Degrees Conferred in 2022, by Study Area

Study Area	Degrees Conferred
Biochemistry, Biophysics and Molecular Biology	169
Bioengineering and Biomedical Engineering	364
Biological and Biomedical Sciences, Other	85
Biology, General	888
Biomathematics, Bioinformatics, and Computational Biology	46
Biotechnology	50
Cell/Cellular Biology and Anatomical Sciences	71
Ecology, Evolution, Systematics, and Population Biology	103
Genetics	22
Microbiological Sciences and Immunology	51
Neurobiology and Neurosciences	295
Pharmacology and Toxicology	46
Physiology, Pathology and Related Sciences	30
Grand Total	2,220

Source: IPEDS (2024)

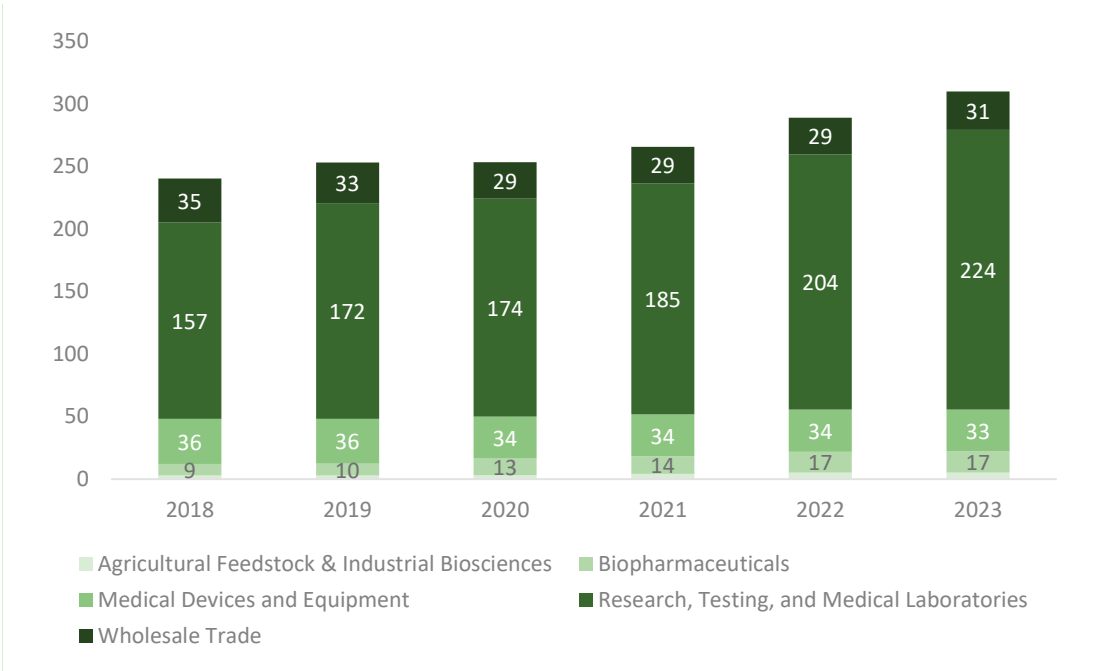
Economic Opportunities

As a leader in academia, industry, and innovation, Philadelphia not only attracts substantial investment but also creates fertile ground for job creation, entrepreneurial ventures, and technological advancements. As a result, the city ensures a thriving life sciences sector, offering a wealth of career opportunities and sustained economic growth.

According to Lightcast, as of 2023, there were 310 life sciences establishments in Philadelphia, growing by 29 percent since 2018 with the addition of 70 new establishments.¹³ The greatest percentage growth has been in the Biopharmaceutical sector, followed by Agricultural Feedstock and Industrial Biosciences.

¹³ This represents private establishments and not academic institutions or affiliated research institutes.

Figure 4.5: Yearly Trends of Payrolled Business in the Philadelphia Life Sciences Sector



Source: Lightcast (2024)

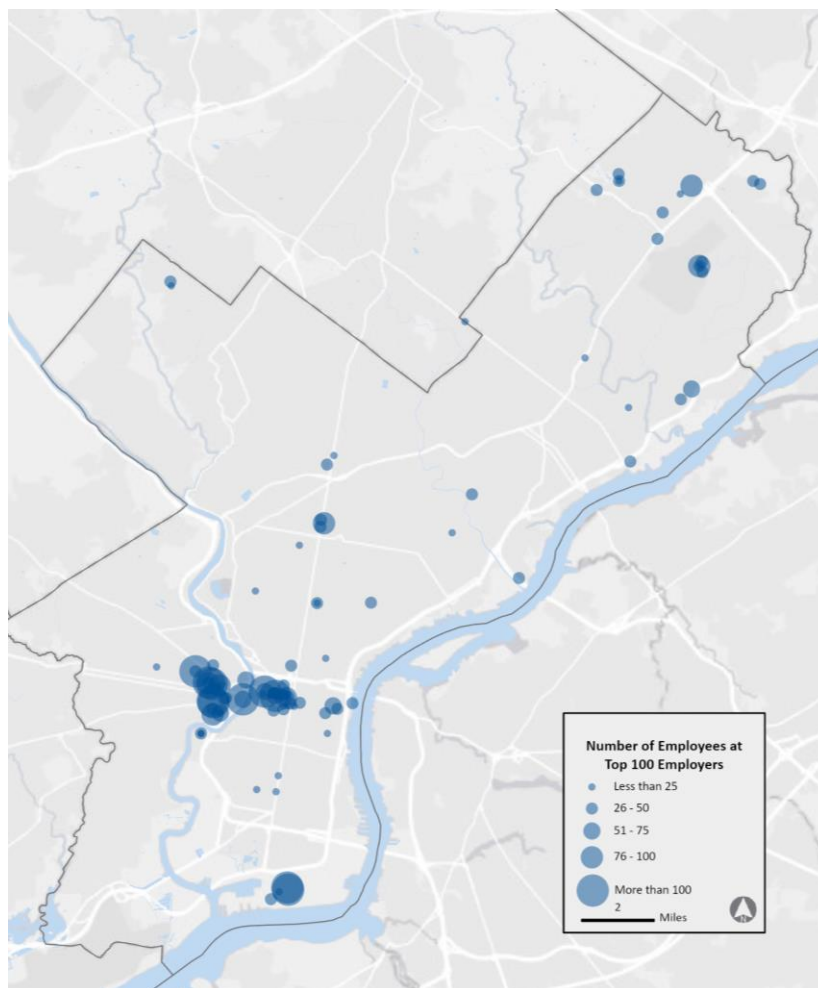
Figure 4.6: Yearly Number of Payrolled Businesses in the Philadelphia Life Sciences Sector

	2018	2019	2020	2021	2022	2023
Agricultural Feedstock & Industrial Biosciences	3	3	3	4	5	5
Biopharmaceuticals	9	10	13	14	17	17
Medical Devices and Equipment	36	36	34	34	34	33
Research, Testing, and Medical Laboratories	157	172	174	185	204	224
Wholesale Trade	35	33	29	29	29	31
Total	240	253	253	266	289	310

Source: Lightcast (2024)

Among the top 100 life sciences employers in Philadelphia (out of 546 total life sciences businesses), the majority are clustered in and around University City and Center City, although the footprint of the industry is citywide with employers located along North Broad Street, in The Navy Yard, and in Northeast Philadelphia.

Figure 4.7: Number of Employees at Top 100 Life Sciences Employers in Philadelphia



Source: Data Axle (2024), ArcGIS Pro (2024), ESI (2024)

Life sciences positions also pay substantially more in average earnings than the annual average wage in Philadelphia. Figure 4.8 shows that between 2018 and 2022, the average life sciences income was substantially higher than that of a typical job in Philadelphia. Additionally, the growth rate for the average annual wage across this period was 19 percent whereas it was 23 percent for life sciences jobs.

Figure 4.8: Average Annual Earnings by Life Science’s Sector in Comparison to Philadelphia’s Average Annual Wage

	2018	2019	2020	2021	2022
Agricultural Feedstock & Industrial Biosciences	\$136,122	\$128,331	\$129,234	\$139,272	\$153,010
Biopharmaceuticals	\$105,221	\$106,060	\$98,428	\$103,026	\$113,195
Medical Devices and Equipment	\$75,998	\$79,765	\$87,555	\$93,513	\$92,587
Research, Testing, and Medical Laboratories	\$108,142	\$128,179	\$124,073	\$136,549	\$143,647
Wholesale Trade	\$127,573	\$92,580	\$104,106	\$107,371	\$99,818
Weighted Av. Life Sciences Income	\$108,616	\$120,126	\$117,743	\$127,454	\$133,436
Average Citywide Wage (All Sectors)	\$65,845	\$69,095	\$74,204	\$75,127	\$78,273

Source: BEA (2024), BLS (2024), Lightcast (2024), ESI (2024)

5. Funding and Research Output

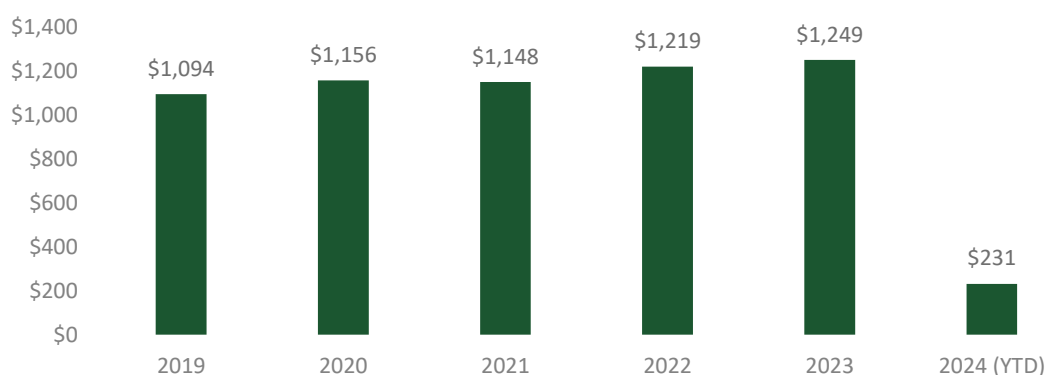
As global leaders in life sciences, research institutions in Philadelphia consistently generate groundbreaking innovations that translate into impactful products and services. These innovations attract significant funding and capital, supporting both current and future research and development efforts. This section evaluates public and private funding and investment in Philadelphia's life science industry, as well as the status of clinical trials, to illustrate the robust pipeline and innovative output in the region.

Research Funding

National Institutes of Health (NIH) funding is a critical source of support for life sciences research and development, serving as a key indicator of the competitiveness and scale of research institutions and the industry. Over the past five years, Philadelphia institutions have consistently received over \$1 billion annually from the NIH, reaching a historic high of \$1.25 billion in 2023, despite broader market downturns (Figure 5.1). In total, Philadelphia institutions were awarded more than \$5.8 billion in NIH funding from 2018 through 2023.

A significant portion of this funding was concentrated among the top ten recipients, all of which are globally recognized medical research institutions (Figure 5.2). In 2023, the University of Pennsylvania led with over 1,300 NIH awards, amounting to more than \$700 million, representing more than half of the NIH funding allocated to Philadelphia. This was followed by the Children's Hospital of Philadelphia (\$166 million), Temple University (\$80 million), Thomas Jefferson University (\$68 million), and Drexel University (\$65 million).

Figure 5.1: National Institutes of Health (NIH) Funding Received by Philadelphia Institutions, 2019-2024 YTD (in \$M)



Source: NIH RePORTER (2024)

Note there is a lag in reporting of awards; 2024 data is as of data pull in April 2024

Figure 5.2: Top 10 NIH Funding Receiving Institution in Philadelphia in 2023

Rank	Organization	Awards	Total Funding (\$M)
1	University Of Pennsylvania	1,322	\$703
2	Children's Hospital of Philadelphia	313	\$166
3	Temple University	192	\$80
4	Thomas Jefferson University	163	\$68
5	Drexel University	152	\$65
6	Wistar Institute	52	\$42
7	ECOG-ACRIN Medical Research Foundation	8	\$41
8	NRG Oncology Foundation, Inc.	6	\$32
9	Research Institution of Fox Chase Cancer Center	51	\$25
10	National Disease Research Interchange	2	\$4
Total		2,261	\$1,228

Source: NIH RePORTER (2024)

Beyond NIH, the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) also provide substantial funding for life sciences research and development. During the five-year period from 2019 to 2023, Philadelphia institutions received approximately \$524 million from the CDC and FDA, with funding peaking during the COVID-19 pandemic in 2020 and 2021 (Figure 5.3).

In addition to public funding, life sciences research and development in Philadelphia is bolstered by private and philanthropic donations. In 2023, nearly \$1.2 billion from private sources was invested in research and development across 19 top institutions, as reported by the National Science Foundation (NSF) and institutional R&D budgets.

Figure 5.3: Other Research Fundings Public Entities Received by Philadelphian Organizations from, 2019-2024 YTD (in \$M)

	2019	2020	2021	2022	2023	Total
CDC	\$33	\$138	\$237	\$52	\$52	\$512
FDA	\$2	\$2	\$2	\$2	\$3	\$12
Total	\$35	\$140	\$239	\$55	\$55	\$524

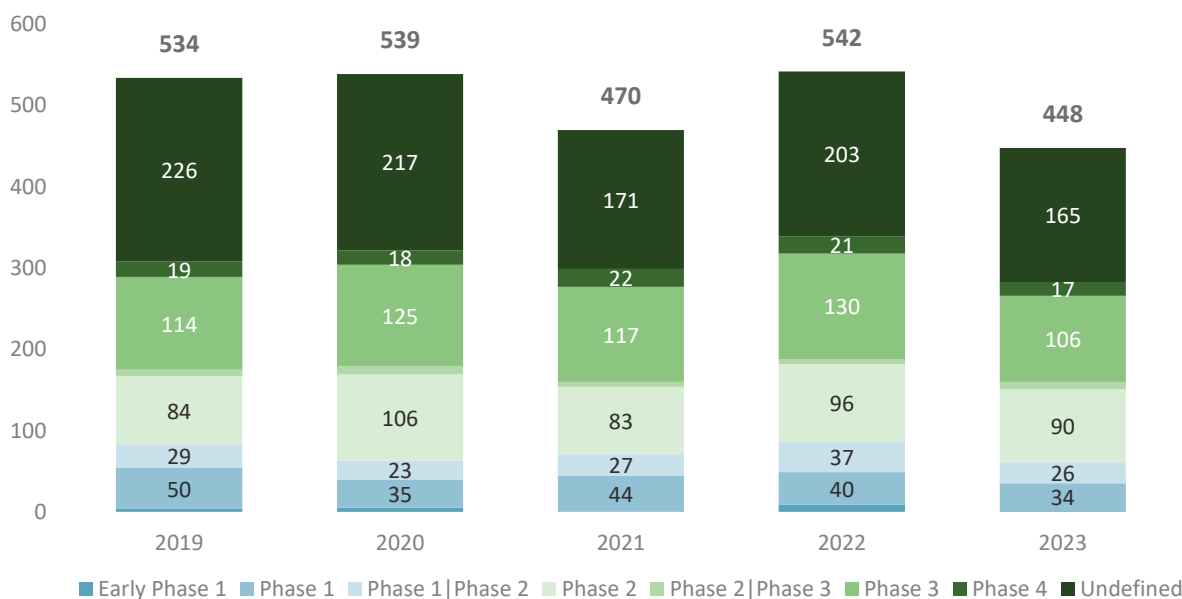
Source: TAGGS (2024)

Clinical Trials

Clinical trials are essential for advancing medical knowledge, developing new treatments, and improving patient outcomes. They also attract significant investment from pharmaceutical companies and research organizations, fostering innovation and economic growth.

Since 2019, over 2,500 clinical trials have been completed by companies and institutions in Philadelphia, averaging around 500 completions annually. This includes 1,090 Phase 2 or 3 trials, indicating significant progress in medical development (Figure 5.4). Additionally, nearly 3,600 clinical trials have commenced since 2019, with 795 completed and 2,388 ongoing. Of these ongoing trials, approximately 1,300 are in Phase 2 or 3, underscoring Philadelphia's critical role in advancing clinical research and maintaining its competitive edge in the life sciences industry (Figure 5.5).

Figure 5.4: Clinical Trials Completed between 2019 and 2023, by Phase



Phases	2019	2020	2021	2022	2023
Early Phase 1	4	5	-	9	1
Phase 1	50	35	44	40	34
Phase 1 Phase 2	29	23	27	37	26
Phase 2	84	106	83	96	90
Phase 2 Phase 3	8	10	6	6	9
Phase 3	114	125	117	130	106
Phase 4	19	18	22	21	17
Undefined	226	217	171	203	165
Total	534	539	470	542	448

Source: National Library of Medicine (2024)

Figure 5.5: Clinical Trials Started between 2019 and 2023, by Status

Phases	Completed	Ongoing
Early Phase 1	5	37
Phase 1	51	192
Phase 1 Phase 2	25	189
Phase 2	127	426
Phase 2 Phase 3	12	75
Phase 3	169	532
Phase 4	33	89
Undefined	373	848
Total	795	2,388

Source: National Library of Medicine (2024)

When compared with major peer cities, Philadelphia is approximately on the same scale as Chicago and Los Angeles, with around 2,500 clinical trials completed in the past five years and around 3,300 trials initiated. New York City and Boston have the largest life sciences agglomerations across the nation. Among the trailing cities, Philadelphia is the only one located on the East Coast and maintains a strong connection to the life sciences ecosystem.

Figure 5.6: Clinical Trials Complete and Started between 2019 and 2013, by Major Peer Cities¹⁴

City	Total Trials Completed	Total Trials Started
New York City	4,109	5,422
Boston	3,283	4,445
Chicago	2,596	3,323
Philadelphia	2,542	3,268
Los Angeles	2,429	3,447
Baltimore	2,022	2,462
Seattle	1,675	2,082

Source: National Library of Medicine (2024)

¹⁴ Major peer cities are defined as those that received over \$1 billion NIH funding in 2023.

Venture Capital Investment and IPO

Since 2019, a growing volume of research has been translated into commercial enterprises, further drawing venture capital to the city and growing new local businesses. Life sciences research and development are high-risk, capital-intensive endeavors requiring significant upfront investment. Venture capital (VC) is crucial for supporting biotech and pharmaceutical companies in their R&D efforts. Philadelphia, home to several leading biotech and pharmaceutical firms, has received over \$2.5 billion in venture capital through more than 220 deals since 2019 (Figure 5.7). VC investment peaked during the pandemic, particularly strong in 2019 and 2021, exceeding \$700 million in those years, but slowed in 2022 and 2023, reflecting a more cautious investment environment in the life sciences industry.

Figure 5.7: Venture Capital Investment Received by Philadelphia Companies, 2019-2024 YTD (\$M)

Deal Type	2019	2020	2021	2022	2023	2024 (YTD)	Total
Accelerator/Incubator	\$0.7	\$0.3	\$0.6	\$0.3	\$0.4	\$0.5	\$2.7
Angel (individual)	\$0.3	\$0.3	\$1.3	\$0.5	\$0.9	-	\$3.1
Seed Round	\$1.7	\$17.0	\$29.9	\$36.9	\$90.3	\$7.0	\$182.9
Early-Stage VC	\$760.7	\$134.9	\$293.8	\$81.4	\$225.3	\$9.2	\$1,505.2
Later-Stage VC	\$35.1	\$186.6	\$382.9	\$84.0	\$178.1	\$0.1	\$866.8
Total	\$798.5	\$339.0	\$708.5	\$203.0	\$494.9	\$16.8	\$2,560.7

Source: Pitchbook (2024)

Since 2019, VC investment in Philadelphia has been heavily concentrated in drug discovery, which captured over \$1.5 billion (59%) of the total capital and accounted for 30% of the deals. Biotechnology received \$540 million over the five years (Figure 5.8 & Figure 5.9).

Figure 5.8: Count of Venture Capital Deals by Life Sciences Subsector, 2019 - 2024 YTD

Subsector	Count	Share
Drug Discovery	58	28%
Healthcare and Enterprise Systems	39	19%
Therapeutic Devices	30	14%
Biotechnology	26	13%
Diagnostic Equipment	14	7%
Clinics/Outpatient Services	7	3%
Medical Supplies	6	3%
Surgical Supplies	6	3%
Drug Delivery	4	2%
Pharmaceuticals	6	3%
Other Healthcare Services	12	6%
Total	208	

Source: Pitchbook (2024)

Figure 5.9: Venture Capital Received by Philadelphia Companies by Life Sciences Subsector, 2019 – 2024 YTD

Subsector	Deal Size (\$M)	Share
Drug Discovery	\$1,513	59%
Biotechnology	\$540	21%
Enterprise Systems (Healthcare)	\$215	8%
Other Healthcare Services	\$151	6%
Other Pharmaceuticals and Biotechnology	\$35	1%
Medical Records Systems	\$29	1%
Therapeutic Devices	\$18	1%
Other Healthcare Technology Systems	\$18	1%
Other Health Services	\$42	2%
Total	\$2,561	

Source: Pitchbook (2024)

The top Philadelphia life sciences companies that received significant VC investment in the past year are listed in Figure 5.9. The top 10 companies attracted more than \$1.6 billion in venture capital to Philadelphia. Century Therapeutics, Passage Bio, Dispatch Biotherapeutics, Imvax, and HealthVerity each secured one or more \$100+ million deals, primarily supporting drug discoveries.

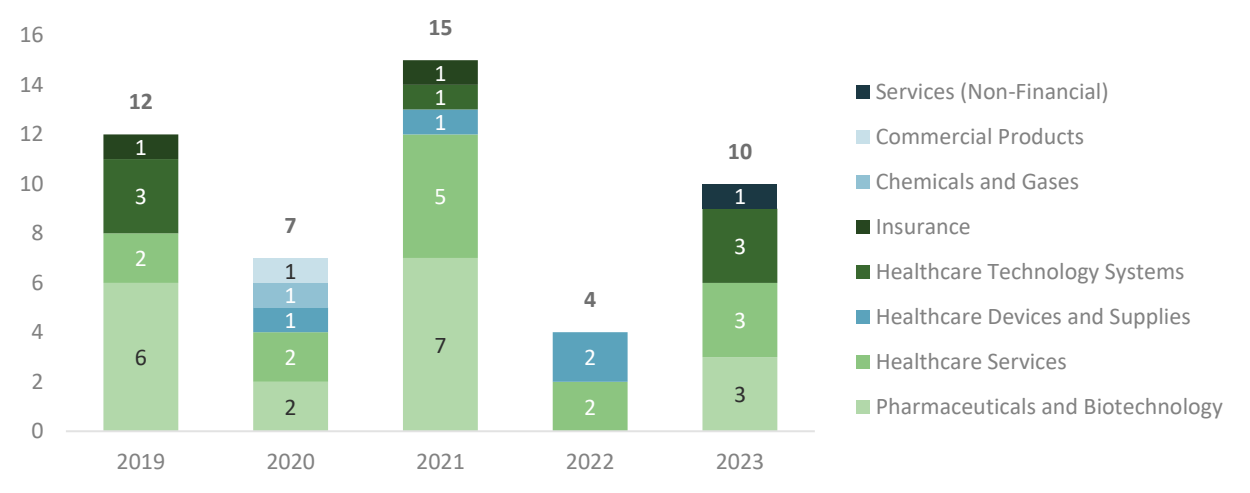
Figure 5.10: Top 10 Companies with Biggest Venture Capital Investment (2019-2024 YTD Total)

Company	Deal Size (\$M)
Century Therapeutics (NAS: IPSC)	\$410
Passage Bio (NAS: PASG)	\$226
HealthVerity	\$171
Imvax	\$137
Vitara (Healthcare Services)	\$135
Fore Bio	\$134
Aro Biotherapeutics	\$132
Carisma Therapeutics (NAS: CARM)	\$118
Dispatch Biotherapeutics	\$113
Interius BioTherapeutics	\$99
Total	\$1,674

Source: Pitchbook (2024)

Initial public offering (IPO) trends for life sciences firms in Philadelphia have shown strong performance, with a total of 48 IPOs in the past five years. Of these, 18 (38 percent) were pharmaceuticals and biotechnology companies, 14 (29 percent) were in healthcare services, and 7 (15 percent) were in healthcare technology systems (Figure 5.11). The remaining IPOs were in industries such as healthcare devices and insurance, indicating a robust and diverse life sciences ecosystem in Philadelphia.

Figure 5.11: Count of IPOs by Life Sciences Subsector, 2019-2023



Subsector	2019	2020	2021	2022	2023
Pharmaceuticals and Biotechnology	6	2	7	-	3
Healthcare Services	2	2	5	2	3
Healthcare Devices and Supplies	-	1	1	2	-
Healthcare Technology Systems	3	-	1	-	3
Insurance	1	-	1	-	-
Chemicals and Gases	-	1	-	-	-
Commercial Products	-	1	-	-	-
Services (Non-Financial)	-	-	-	-	1
Total	12	7	15	4	10

Source: Pitchbook (2024)

6.Economic and Tax Impacts

Life science’s most obvious and direct impact on the Philadelphia economy and beyond is through its continuing and growing operational presence. This is true for the entire industry, inclusive of research and development firms, biopharmaceutical manufacturing, wholesale trade, agricultural feedstock and industrial biosciences as well as research work at universities and colleges.

The industry plays a direct role in the purchasing of goods and services from local and regional vendors and the employment of faculty and staff. This direct, local economic activity has several spillover effects on the broader Philadelphia economy, further supporting regional employment and tax revenue.

Direct Economic Footprint

To quantify the direct, indirect, and induced economic impacts of the life sciences industry, ESI leveraged 2023 annual employment data from target sectors to estimate the direct footprint in Philadelphia. Using this direct employment figure, of 13,000 jobs as an input, ESI's economic impact model then quantified the indirect impacts on supply chains and supporting industries, as well as the induced impacts from changes in household spending tied to direct and indirect employment, providing a comprehensive analysis of the total economic footprint across the city and state.

Estimated Economic Impact from Life Sciences Operations

Overall, the life sciences sector has a direct impact of \$4.7 billion in the state and a total impact of \$8.2 billion. It supports more than 27,000 full-time employees in Pennsylvania with \$2.3 billion in employee compensation.

Figure 6.1: Estimated Economic Impact from Life Sciences Operations in Philadelphia, 2023

	Philadelphia	Pennsylvania
Direct Impact (\$M)	\$4,707	\$4,707
Indirect and Induced Impacts (\$M)	\$2,500	\$3,521
Total Impact (\$M)	\$7,207	\$8,228
Employment (FTE)	23,000	27,730
Employee Compensation (\$M)	\$2,056	\$2,341

Source: IMPLAN (2022) and ESI (2024)

Estimated Tax Impact from Life Sciences Operations

The direct, indirect and induced economic activity discussed above generates tax revenue for the city and the state. \$8.6 billion in total statewide economic impact accrues \$170 million in tax revenue for the Commonwealth of Pennsylvania. \$7.5 billion of total economic activity in Philadelphia generates \$74 million in tax revenue for the City of Philadelphia.

Figure 6.2: Estimated Fiscal Impact from Life Sciences Operations in Philadelphia and Pennsylvania, 2023¹⁵

	Philadelphia	Pennsylvania
Income/Wage Tax (\$M)	\$39	\$42
Sales Tax (\$M)	\$9	\$83
Business Taxes (\$M)	\$25	\$36
Total Tax (\$M)	\$74	\$162

Source: IMPLAN (2022), and ESI (2024)

¹⁵ This calculation does not include property tax revenue.

Appendix

Life Sciences NAICS Codes

NAICS Code	Industry Sub-sector
Drugs and Biopharmaceuticals	
325411	Medicinal and botanical manufacturing
325412	Pharmaceutical preparation manufacturing
325413	In-vitro diagnostic substance manufacturing
325414	Other biological product manufacturing
Medical Devices and Equipment	
325220	Artificial and Synthetic Fibers and Filaments Manufacturing
333314	Optical instrument and lens manufacturing
334510	Electromedical apparatus manufacturing
334516	Analytical laboratory instrument manufacturing
334517	Irradiation apparatus manufacturing
339112	Surgical and medical instrument manufacturing
339113	Surgical appliance and supplies manufacturing
339114	Dental equipment and supplies manufacturing
339115	Ophthalmic goods manufacturing
339116	Dental laboratories
Research, Testing, and Medical Laboratories	
541380	Testing laboratories
541713	Research and development in nanotechnology
541714	Research and development in biotechnology (except nanobiotechnology)
541715	Research and development in the physical, engineering, and life sciences (except nanotechnology and biotechnology)
621511	Medical laboratories
621512	Diagnostic imaging centers
Wholesale Trade	
423450	Medical equipment merchant wholesalers
423460	Ophthalmic Goods Merchant Wholesalers
424210	Druggists' goods merchant wholesalers
Agricultural Feedstock & Industrial Biosciences	
311224	Soybean and other oilseed processing
325193	Ethyl alcohol manufacturing
325199	All other basic organic chemical manufacturing
325311	Nitrogenous fertilizer manufacturing
325314	Fertilizer, mixing only, manufacturing
325320	Pesticide and other ag. chemical manufacturing

Economic Impact Methodology

Overview

Economic impact estimates are generated by utilizing input-output models to translate an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. This section summarizes the methodologies and tools used to construct, use, and interpret the input-output models needed to estimate this project's economic impact.

Input-Output Model Theory

In an inter-connected economy, every dollar spent generates two spillover impacts:

- First, a portion of that expenditure which goes to the purchase of goods and services gets circulated back into an economy when those goods and services are purchased from local vendors. This is the “indirect effect,” and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.
- Second, a portion of that expenditure which goes to labor income gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This is the “induced effect,” and reflects the fact that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of spillover impact to all industries of a dollar spent in any one industry. Thus, the total economic impact is the sum of its own direct economic footprint plus the indirect and induced effects generated by that direct footprint.

Input-Output Model Mechanics

To model the impacts resulting from the direct expenditures, Econsult Solutions, Inc. developed a customized economic impact model using the IMPLAN input/output modeling system. IMPLAN represents an industry standard approach to assess the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes within its surrounding area. IMPLAN has developed a social accounting matrix (SAM) that accounts for the flow of commodities through economics. From this matrix, IMPLAN also determines the regional purchase coefficient (RPC), the proportion of local supply that satisfies local demand. These values not only establish the types of goods and services supported by an industry or institution, but also the level at which they are acquired locally. This assessment determines the multiplier basis for the local and regional models created in the IMPLAN modeling system. IMPLAN takes the multipliers and divides them into 536 industry categories in accordance with the North American Industrial Classification System (NAICS) codes.

The IMPLAN modeling system also allows for customization of its inputs which alters multiplier outputs. Where necessary, certain institutions may have different levels of demand for commodities. When this occurs, an “analysis-by-parts” (ABP) approach is taken. This allows the user to model the impacts of direct economic activity related to an institution or industry with greater accuracy. Where inputs are

unknown, IMPLAN is able to estimate other inputs based on the level of employment, earnings, or output by an industry or institution.

Employment and Wages Supported

IMPLAN generates job estimates based on the term “job-years”, or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly “job-years” supported, over two years, that represents 50 annual jobs. Additionally, these can be a mix of a full and part-time employment. Consequently, job creation could feature more part-time jobs than full-time jobs. To account for this, IMPLAN has a multiplier to convert annual jobs to full-time equivalent jobs.

Income to direct, indirect, and induced jobs is calculated as employee compensation. This includes wage and salary, all benefits (e.g., health, retirement) and payroll taxes (both sides of social security, unemployment taxes, etc.). Therefore, IMPLAN’s measure of income estimates gross pay opposed to only wages.

Tax Revenue Impact

The economic impacts in turn produce one-time or ongoing increases in various tax bases, which yield temporary or permanent increases in various tax revenues. To estimate these increases, Econsult Solutions, Inc. created a tax revenue impact model to translate total economic impacts into their commensurate tax revenue gains. These tax revenue gains only account for a subset of the total tax revenue generation an institution or industry may have on the economy. Furthermore, where institutions are tax exempt, only the tax revenue generation from supported indirect and induced industries is accounted for.

About Econsult Solutions, Inc.

This report was produced by Econsult Solutions, Inc. (ESI). provides businesses and public policy makers with consulting and thought leadership services in urban economics, real estate, transportation, public infrastructure, economic development, public policy and finance, strategic planning, as well as expert witness services for litigation support.

ESI combines robust quantitative analysis with trusted expert insights to create sustainable solutions. The firm works collaboratively with its clients, and draws in expertise, when necessary, from our network of experts and partners across industries, regions, and management practices. Based in Philadelphia, the firm supports clients nationwide.



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1435 WALNUT STREET, 4TH FLOOR, PHILADELPHIA, PA 19102
ECONSULTSOLUTIONS.COM | 215-717-2777