Leading the way:

Cell and Gene Therapy in Greater Philadelphia

Sector Snapshot 2024



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List of key acronyms

CCGP = Chamber of Commerce for Greater Philadelphia CGT = Cell and Gene Therapy CHOP = Children's Hospital Philadelphia NIH = National Institutes of Health UPENN = University of Pennsylvania



Greater Philadelphia: Global Leader in Cell and Gene Advanced Therapies



Executive Summary

Highlights

Greater Philadelphia is a global leader in new therapeutic technologies related to cell therapy, gene therapy and mRNA technology. The region has emerged as a vibrant globally competitive ecosystem for the CGT industry with depth and scale across all the key elements of the CGT EcoSystem.

- There are an estimated 500 CGT companies worldwide Greater Philadelphia is home to 60 including 5 of the Top 100 "companies to watch" - only one city across the world has more;
- More than 7,000 employed by institutions and CGT companies;
- Second ranked region for NIH funded Cell and Gene Therapy combined and the clear leader in Gene Therapy;
- Leader in translational science Top 5 location for Phase I and II trials in both novel Cell and Gene Therapies;
- Two of the top 10 largest holders of patents in gene therapy.

Forward Momentum

Over the last 7 to 10 years there has been a major acceleration related to biotechnology overall and CGT:

- More than 5,000 work in biotechnology in the city of Philadelphia an 8x increase from a decade ago;
- Total life science venture funding doubled since 2018;
- NIH funding for CGT in Greater Philadelphia from 2019 to 2023 increased by \$150m or 71% from the 2014-2018 time period;
- Lab space square footage (built and in development) inside Philadelphia has increased by 150% since 2018;
- New additions to the ecosystem since 2018 including:
 - Core supportive infrastructure such as the Charles River CRADL facility and MISPRO, expansion of cryogenic capabilities across several vendors;
 - Creation of the IBX Advanced Therapeutics Network;
 - Creation of the Cencora CGT Integration Hub.

Impact of CGT on Greater Philadelphia's biotech sector

The growth of the CGT sector has been critical for the development of a biotech economy in Greater Philadelphia region. The success of CGT has provided the basis for private and institutional investment in a complete ecosystem that did not exist at this scale just a few years ago. The scale and maturation of the biotech ecosystem provides three important benefits to the Greater Philadelphia region going forward:

- Expansion of employment opportunities in research and development as well as manufacturing and support services that are accessible to a broader range of workers across a variety of educational levels;
- Development of critical infrastructure (space, specialized lab services, biotech training programs) for the next emerging biotechnology platform to immediately access and grow in Greater Philadelphia;
- Combined these factors create "stickiness," reasons for CGT companies and biotech overall, to stay, relocate to, and grow in Greater Philadelphia, which fuels continued investment across the industry and its supporting sectors.

Greater Philadelphia has always been an intellectual leader in biotechnology research, particularly in Cell and Gene Therapy technologies. The activity and scale of the ecosystem shows that the region has migrated from being a biotech R&D hub to a complete industry sector with all the components necessary to support the success of companies. The region's value proposition for CGT and biotech companies overall, has strengthened significantly from even five years ago. Greater Philadelphia is now poised to capture more of the economic impact and associated jobs in one of the key technology sectors of the 21st century economy. "The Greater Philadelphia region has already played a consequential role on the global cell & gene therapy stage, as measured by output from academic labs, biotechs and big pharma. There is every indication that this will continue, with Philadelphia being one of the leading epicenters for innovation in this space. I base this conviction on my observation of the next generation of researchers who are being trained right now, as well as the steady pace of new company creation, licensing, and other ventures that have, are, and will continue to lead to clinical trials in humans with otherwise intractable diseases where cell & gene therapy can play a particularly important role."

- Dr. Saar Gill, Associate Professor of Medicine and Scientific Co-Director of Cell Therapy and Transplantation, Perelman School of Medicine at the University of Pennsylvania; Co-Founder, Carisma Therapeutics and Interius Biotherapeutics



Highlights of Key Scientific and Technologic Milestones in Greater Philadelphia CGT History

Sources:

https://www.lancastergeneralhealth.org/health-hub-home/2022/june/how-penn-medicine-pioneered-car-t-cell-therapy-to-treat-cancer https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4442590/ https://retinahistory.asrs.org/milestones-developments/the-history-and-development-of-luxturna-gene-therapy

https://www.thegenehome.com/what-is-gene-therapy/history

https://penntoday.upenn.edu/news/katalin-kariko-and-drew-weissman-penns-historic-mrna-vaccine-research-team-win-2023-nobel https://pubmed.ncbi.nlm.nih.gov/21832238/

CGT and the Economy

CGT and the regional economy

Cell and Gene Therapy is a critical subsector of the life science economy in the region. The region is home to the 6th largest life science labor pool in the United States.¹ More than 50,000 people work in the life sciences sector. Additionally, over the last several years the region has received more than \$1 billion annually in NIH funding.

Biotech Establishments and Employment

Biotech is a subset of the life sciences industry. In 2022, the region employed at least 32,000 in biotech R&D and manufacturing in nearly 450 establishments, excluding institutional employment. The city hosts approximately 5,000 employees and more than 70 companies.²

The R&D sector has seen tremendous growth over the last decade. Establishments have more than doubled since 2013. Employment across the region has also doubled but the *city employment has increased by 8x*. The city has also become a hub for biomanufacturing. The city represents 58% of the employment in biologics manufacturing in Greater Philadelphia.

1 <u>https://insights.cushmanwakefield.com/story/life-sciences-update-2024-febru-ary/page/4</u> 2 Estimated from BLS.gov NAICS 541711/14

GROWTH RATES BIOTECH R&D,2013-2022

 2.1x
 2.2x
 2.2x
 1.9x

 Businesses
 Employment
 Total Wages

 City of Philadelphia
 Metro Area

The City's total wages in Biotech R&D have increased by 12.5x to over \$638m.

Source: Estimated from BLS.gov NAICS 541711/14

CGT Key Driver of Sector Growth in Greater Philadelphia Region

CGT has been the leading component of the growth in R&D particularly for the city. Regionally, 15% of the Biotech R&D sector is tied to CGT. More than $\frac{1}{2}$ of the city R&D companies are also tied to CGT technology.¹

CGT, including biomanufacturing and R&D, is estimated to represent:

- Employment across the region is estimated between 7,000 and 8,000² (including institutional employment);
- Wages \$900m to \$1.1b;

Role in the City

- 32 companies;
- Since 2015 nearly all the growth in biotech R&D businesses in the city is related to the creation of CGT businesses;
- Employment approximately 4,500 (including institutional);
- Total wages ~\$500m

The city of Philadelphia also hosts one of the highest numbers of CGT companies to watch. If you include Adaptimmune as a Philadelphia company instead of its status as UK headquartered business, Philadelphia trails only Cambridge, MA.

DRUG DISCOVERY TRENDS TOP 100 COMPANIES TO WATCH 2023

Source: <u>https://www.drugdiscoverytrends.com/100-top-cell-gene-therapy-companies-watch-2023/</u>



¹ Calculated based BLS establishment data and CCGP CGT company list and founding dates

² NP estimates based on SEC filings, ZoomInfo, Pitchbook, Bloomberg, PhilInno and other published reports

CGT IN ACTION

Bspirovant

Spirovant Sciences is a Philadelphia-based gene therapy company focused on novel therapies for cystic fibrosis and other respiratory diseases. Cystic fibrosis is a genetic disease caused by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene leading to death from respiratory failure. Spirovant's lead program (SP-101) utilizes novel Adeno-Associated Virus (AAV) technology to deliver a fully functional CFTR gene into human airway cells via a single inhaled dose to help combat cystic fibrosis. The approach is unique since it combines an inhaled AAV gene therapy coupled with a small molecule that enhances expression of the delivered CFTR gene. SP-101 has been granted orphan drug status in both the United States and Europe as well as rare pediatric disease designation in the US. Spirovant started as Talee Bio based on technology created at the University of Iowa and Children's Hospital Philadelphia. Early funders of the company's research included organizations like Emily's Entourage and the Cystic Fibrosis Foundation through a concept known as "venture philanthropy."

Spirovant is located at University City in the center of Philadelphia's life science corridor. Spirovant was acquired by the Japanese pharmaceutical company Sumitomo Dainippon Pharma in 2019. In 2022 Spirovant opened its headquarters and development facilities at UCity Square. In March of 2024 Spirovant Sciences was acquired by its management team and is now an independent company.

Greater Philadelphia CGT ecosystem

The CGT ecosystem in Greater Philadelphia

Ecosystem: A community of mutually supportive companies, organizations, institutions, and people that help an industry prosper and grow

EXPLAINING ELEMENTS OF THE CGT ECOSYSTEM

6 Specialized Support Services: the supply, logistics and facility solutions that support the industry with packaging solutions, storage, facility operations, and shipping unique to the biotech industry.

5 Talent and Community Building: The recruitment, development, and retention of talent – the fuel that drives the CGT industry. Also, the mobility of talent into startups to help fuel and manage their process to scaling. Community building helps with exchange of ideas, and talent networking to help with recruitment and retention.

4 Translational Science and Clinical Care: "Bench to bedside" activities that convert R&D into clinical programs and support the payment for these therapeutics.



1 Institutional and Company R&D: Academic and company research programs funded by the NIH, venture capital and/or philanthropy to develop new approaches and therapeutics.

> 2 Process Development and Manufacturing: Local contract development and manufacturing expertise with facilities to help small, early-stage companies scale their therapeutics and lower their investment costs.

3 Physical facilities: creation of spaces (building and land) and places (accessibility and amenities) that provide required facilities and amenities that support the growth, development and expansion of companies.

The Greater Philadelphia region has received more than \$362m in CGT NIH funding since 2019

1 INSTITUTIONAL & COMPANY R&D

The scale of research across the region but specifically in the city exceeds the funding in a number of leading states and cities.

The city of Philadelphia receives the 2nd most funding - more than San Francisco/ Oakland and more than 2x the Research Triangle.

Between 2019 to 2023, the city of Philadelphia received more NIH funding than the states of Texas, Washington, Maryland, and North Carolina, among the largest funded states in the US.

Eight companies received \$5.2 million in SBIR awards from the NIH to advance their research programs.



Greater Philadelphia is one of the key intellectual leaders globally in CGT

1 INSTITUTIONAL & COMPANY R&D



Since 2019, the city of Philadelphia has had the second highest number of NIH funded projects in Cell and Gene Therapy.

TOP 5 CITIES Source: NP analysis of NIH REPORTER data, March 2023 extract	LOCATION	PROJECTS
	Boston-Cambridge	923
	Philadelphia	712
	New York	704
	Houston	514
	Seattle	475

Key bellwether areas and competitive regions are substantially behind. For example, Greater Philadelphia has 78% more project activity than the Research Triangle area. It also has more activity than LA and San Francisco.¹

Moreover, two of the Top 25 institutions in numbers of NIHfunded projects between 2019 and 2023 are Philadelphia-based, the University of Pennsylvania (UPENN) and Children's Hospital Philadelphia (CHOP). UPENN has the most projects overall. CHOP has the largest number of projects for pediatric hospitals, and the 4th highest number of projects for clinical/medical institutions.

APPLICANT	GENE THERAPY PATENTS
Genzyme Corp.	492
Trustees of the Univ. of Pennsylvania	435
Univ. of Florida Research Fdn, Inc.	276
Institut National de la Sante et de la Recherche Medicale Inserm	227
Research Institute at Nationwide Children's Hospital	218
Genethon	212
The Regents of the Univ. of California	186
The Broad Institute Inc.	176
The Children's Hospital of Philadelphia	176
UNIQUREIP BV	174

Source: <u>https://www.geneonline.com/patent-landscape-analysis-of-gene-therapy/</u>

The city of Philadelphia's research base continues to be highly productive. It continues to be one of the key innovators in the CGT space. For example, two of the Top 10 institutional patent holders in the world for gene therapy are held by Philadelphia area institutions.

UPENN is also the lead patent holder for CAR-T across the globe with 134 patents.² This more than double the next largest patent holder with 62.

¹ Includes the city of South San Francisco and Oakland

² NP analysis based on Google patent search includes jointly assigned patents. Total of 2294 patents

Continued investment in the research and development side will help maintain that leadership

Continued Investment

Moreover, local institutions and companies continue to invest in key assets to continue the leadership of the region. Over the last several years more than \$1 billion in additional investment has been announced as well as several key awards and initiatives have launched.

New Investment Announcements Key Research Awards & Initiatives CHOP Center for Fetal Spark Gene Therapy Penn mRNA Institute **Diagnosis and Treatment PROPEL: National Center for** Innovation Center **CRISPR** Program \$350m investment Precision Medicine Initiative \$575m investment \$26m investment **Every Cure AI Powered** Wistar Institute Penn Arts & Sciences Drug indication Discovery Center for Advanced \$84m gift for Chemistry Application Therapeutics Research and Training \$48m investment \$20m investment

INVESTMENTS IN INNOVATION ASSETS



Since 2018 \$8.0b of capital has flowed into Greater Philadelphia's CGT sector



Life sciences, particularly biotech and pharma, are important contributors to bringing outside capital into the Philadelphia market. For example, in 2023 this sector represented 35% of venture capital raised in Greater Philadelphia.¹

Since 2018 over 547 life science companies headquartered in greater Philadelphia have raised \$18.7b in capital through venture capital, acquisitions, IPOs, licensing deals, and/or debt. Approximately \$8b is related to CGT.

UPENN has spun-out 40 companies and CHOP has the most commercially successful CGT spinout company to date – Spark Therapeutics.

As the chart shows, from year to year, there is substantial variability in capital. It is not unusual for there to be this level of variation from year to year because of difference in market conditions, the technology, and the type of capital raised. Overall, life science capital investment has steadily increased with the exception of 2022. 2022 reflects a national trend particularly in VC funding. As EY noted all sectors except energy saw declines in investment.²

PRIVATE CAPITAL INVESTMENT (AMOUNTS ARE ROUNDED)

Source: NP analysis of Pitchbook data pulled March 2023 – includes acquisitions, venture capital, IPO, PIPEs and debt raised



2019 includes the Spark acquisition. Excluding the Spark acquisition, 2019 still raised more than \$2.1b. By 2023 capital flows into Philadelphia life science companies more than doubled 2018.

¹ NP calculations based on <u>https://philadelphiapact.com/philadelphia-venture-re-port-2023/</u> Pg 3 and Pg 8

² https://www.ey.com/en_us/insights/growth/q4-2022-venture-capital-investment-trends

The Greater Philadelphia region has a number of key assets and programs to support product development and manufacturing in CGT



Biomanufacturing is one of the key issues in CGT as companies move from discovery of therapeutics to clinical production in the production process. As noted earlier, the city of Philadelphia has also become the regional center for biomanufacturing. The city represents 58% of the employment in biologics manufacturing in Greater Philadelphia.

In addition to continued growth in the R&D base of CGT, capturing additional growth in the process development and manufacturing of these products provides access to additional types of employment that require a range of skills and education more accessible to residents of Greater Philadelphia.



Bioreactor sampling at Montgomery County Community College Courtesy of Montgomery County Community College

The Greater Philadelphia region has a number of key assets and programs to support product development and manufacturing in CGT



In addition to the investments noted earlier such as Sparks Gene Therapy Innovation Center, there are several regional institutions and organizations working to increase capacity and promote process improvements in biopharmaceutical manufacturing.

National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) in Newark, Delaware is a public private partnership to advance biopharmaceutical manufacturing technology and workforce development. It is part of the Manufacturing USA network of federally sponsored manufacturing institutes. Since 2017, NIIMBL has invested more than \$100m across its various initiatives. Current initiatives such as the Big Data Program, and the Viral Vector program tie closely to needs in the Greater Philadelphia CGT sector. Jefferson Institute for Bioprocessing at Thomas Jefferson University is a CDMO and training organization. Located in Montgomery County, the Institute offers manufacturing and development services across a range of biotech platforms. It also offers a range of credentials (certificates through a Ph.D. program) in biopharmaceutical processing. It received a 2023 NIIMBL eXperience Award to support diversity in the workforce by

promoting career opportunities in biopharmaceuticals within the

Black, Latinx and Indigenous collegiate populations.

Villanova Center for Cellular Engineering, NovaCell, is a research center within the College of Engineering at Villanova University. The center conducts interdisciplinary research on Cell and Gene Therapy manufacturing processes. The center also houses the Consortium on Cell and Gene Therapy which is a vehicle for academic and industry partnerships on key issues related to Cell and Gene Therapy development, manufacturing and availability.

Physical facility expansion supports growth of CGT and the biotech industry overall



Lab Space Expansion

Prior to 2019 availability of lab space particularly within proximity to the major research institutions was a major challenge for biotech companies across technology platforms.

However, the growth of CGT and the biotech sector overall has led to substantial development of new space. For example, inside the city of Philadelphia, lab space expanded from 1.7msft in 2019 to over 4.0msft in 2023. Another 1.7msft is in development. Lab space, a necessary piece of infrastructure to allow life sciences to expand in Philadelphia, has more than tripled since 2019.¹

Overall lab space in the Greater Philadelphia region totals over 12msft.

Incubators

The growth in biotech overall fueled in part by CGT has also helped support incubator expansion. Seven incubators with more than 250ksft of space exist across the city and the metro.



Hard hat tour at Philadelphia's Navy Yard Courtesy of CCGP

Physical facility expansion supports growth of CGT and the biotech industry overall



Over the last few years, the Greater Philadelphia market saw multiple new real estate developments come online such as One uCity Square, Schuylkill Yards and University Place 3.0 in University City, 250 Radnor near King of Prussia as well as 1201 Normandy place and 2500 League Island Boulevard in the Navy Yard campus. The Navy Yard has long been a center for biomanufacturing, and the most recent master plan is poised to make the Navy Yard a comprehensive mixed-use life sciences campus which will bring along residential as well as commercial opportunities.

Additional developments under construction such as the Lower Schuylkill Biotech Campus and the Bellwether District will provide additional capacity for the industry to continue to grow. The Lower Schuylkill Biotech Campus is a 40-acre location across two sites within the Lower Schuylkill Innovation District anchored by Pennovation Works. It is located in



3 PHYSICAL

FACILITIES

Schuylkill Yards Courtesy of Brandywine Realty Trust

Physical facility expansion supports growth of CGT and the biotech industry overall





Bellwether District site facing the river Courtesy of Hilco Redevelopment Partners (HRP)

Southwest Philadelphia, one of the most disadvantaged sections of the city. The Bellwether District's Innovation Campus is further south down the Schuylkill river and offers 250-acres that can support research and development as well as biomanufacturing companies.

Delaware and New Jersey are also growing their life sciences campuses at a rapid pace. Northern Delaware is quickly becoming a premier life science location with developments at the Chestnut Run Innovation & Science Park (CRISP) and University of Delaware's Science, Technology and Advanced Research Campus (STAR). Similarly, Central New Jersey is continuing to grow with a new life sciences R&D incubator facility and BeiGene's new manufacturing site in the Princeton West Innovation Campus. Additionally, collaborations between Cooper Health, Coriell Institue for Medical Research, Rowan University and Virtua Health are bolstering the life science ecosystem in South Jersey.



Greater Philadelphia is a national leader in translational science and clinical care for CGT

Leading Local Clinical Trial Research Activity Pipeline

The region remains a major center for bench to bedside translational research. The comparative cities host the largest number of trials of these types in the US. Early Phase 1 and Phase 2 trials in recruitment were used to estimate future levels of trials activity. The city of Philadelphia is a top 4 location for upcoming novel Cell and Gene Therapy product trials.

EARLY PHASE 1 TO PHASE 2 CLINICAL TRIALS RECRUITING - NOT YET RECRUITING

Source: NP analysis of Clinical Trials.gov listings as of 3/18/23



4 TRANSLATIONAL

SCIENCE & CLINICAL CARE

Greater Philadelphia is a national leader in translational science and clinical care for CGT



Creation of Advanced Therapeutics Network and Supporting Technologies

The Greater Philadelphia area is at the forefront of supporting the transition from trials to models of care and supporting reimbursement. In part, continued growth in the industry is dependent on finding models of care and reimbursement that make sense given the expense of these advanced therapeutics and approaches.

Independence Blue Cross created the Advanced Network for Gene-Based Therapeutics in 2023 to provide patient access and develop the appropriate care tools for this new technologies.

Cencora, formerly Amerisource Bergen, launched the CGT Integration Hub which provides a technology platform that links across patient care settings to payment eligibility through the supply chain on potential delivery dates of the therapeutics to facilitate patient scheduling.



Pennovation Center North Facade Courtesy of Penn Facilities & Real Estate Services

The Greater Philadelphia region continues to invest in CGT workforce and community building



Talent

As noted earlier an estimated 8,000 people work in the CGT industry in the Greater Philadelphia region.

"The message is getting out to students - we have students telling us they want to work in CGT and how do we do that "

- Aleister Saunders, Executive Vice Provost for Research & Innovation, Drexel University

Talent Mobility

Talent mobility has been an important ingredient to fuel the growth the industry particularly in the start up segment. Companies such as Spark Therapeutics and GSK provide a local scientific and management talent pipeline that supports the growth of regional start ups. Several start-up companies have been the beneficiary of this talent mobility. Moreover, the continued growth of the industry provides additional "stickiness" to keep scientific and management talent local.

There are also a growing number of programs to open up opportunities for a broad range of Greater Philadelphia region residents to find employment in the growing CGT industry.

Workforce Initiatives

• Wistar Institute/WSPS/Chamber Biomedical Technician Training Program: an effort to reskill people to work in the life sciences industry. Wistar recently received a \$650,000 grant from the National Science Foundation to expand this program to 3 additional community colleges creating a total of 8 community colleges covering at least 10 counties across 3 states¹;

- Montgomery County Community College (MCCC) offers a biotechnology / biomanufacturing certificate program
- BULB Program by the University Sciences Center provides a basic skill development program for lab-based occupations and includes a CGT training module;
- Drexel University CGT-TEAMS is a cooperative education program providing undergrads and graduates students with real world experiential learning opportunities including a 6-month rotation with Bristol-Myers-Squibb;
- Community College of Philadelphia offers a certificate program in biotechnology;
- Temple's Master of Science in Advanced Biotherapeutics: Manufacturing and Regulatory Affairs in collab with Jefferson.

¹ Award Abstract # 2400830 Tri-State Expansion, Curriculum Evolution, and Equity during BioTechnician Training (Tri ExCEEd BTT)

The Greater Philadelphia region continues to invest in CGT workforce and community building



CGT IN ACTION

Montgomery County Community College (Montco) is a leader in biotechnology and biomanufacturing education. The program launched in 2004. Beginning in 2020 it expanded to include biomanufacturing training in cell therapy and gene therapy. It offers both an associate degree in biotechnology and a certificate in biotechnology and biomanufacturing. There are currently 70 students in the program which includes education and training in simulated cGMP (Good Manufacturing Practice) and cGLP (Good Laboratory Practice) environments. The students come from a mix of backgrounds including some students who already have bachelor's degrees but are looking for specific credentials in biomanufacturing. Graduates of the program move into industry or some pursue a bachelor's degree through an articulation agreement with Thomas Jefferson University.

In addition to its key role as an education and training center, Montco is an important national resource for other educational institutions. For example, for over a decade Montco was the lead institution for the Northeast Biomanufacturing Center and Collaborative (NBC2) https://biomanufacturing.org/, which is a National Science Foundation (NSF) Advanced Technology Education regional center. It provided curriculum support for colleges and high schools, teaching guides for faculty, skill standards, as well conferences and workshops.

In 2020 Montco received a joint award from the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) to develop the skills and competencies for technician training in the biomanufacture of Cell and Gene Therapies. The WEBET project (Workforce Expansion in Biomanufacturing of Emerging Technologies) resulted a published set of skills standards for educators to use when developing courses and training programs. This was followed by a \$573,000 NSF grant to develop curriculum to train the advanced therapy technical workforce and facilitate adoption of the curriculum at regional two-year colleges.

The Greater Philadelphia region continues to invest in CGT workforce and community building



Community Building Activities

Community building is a key attribute of a thriving innovation ecosystem. This typically includes several activities including outreach to the broader community to help create awareness of the sector and the opportunities available, networking opportunities for employees. In 2023 a number of community building activities took place across Greater Philadelphia:

Building Industry Awareness

- InteriusBio "Take Your Child to Work Day" open to students between age 6 to 14 with hands on lab experiments;
- Drexel Spark Symposium launched in December of 2023 with the intent to build community within the CGT space as well as build greater awareness about the sector and its opportunities;
- Philadelphia Education Fund's Explore STEM Philly program facilitates STEM professionals' classroom visits and field trips to explore STEM work environments.
- ChristianaCare Gene Editing 360 program is a STEM model for high school and college students to learn about gene editing technology. Created by the Gene Editing Institute they provide a CRISPR in a Box toolkit for high school students to introduce them to gene editing technology.

Networking and Info-sharing

There were also several organizations and activities that provide opportunities to share information about the state of the industry, networking opportunities, and support career advancement.

Broader Industry Awareness

- Keystone LifeSci Collaborative provides a forum for industry leaders alongside public and community partners to create sustainable talent pipelines and solve industry challenges;
- SAPA-GP: the Sino-American Pharmaceutical Professionals Association hosts a number of events across the region including hosting @Philly Cell and Gene Therapy Annual Conference aimed at helping support the maturation of the ecosystem;
- Cellicon Valley: Future of Cell and Gene Therapies is a conference organized by Penn Medicine to further the development of gene and cell therapy applications in medicine.

Specialized support services



Attraction of Specialized Support Services

There are more than 450 suppliers to the life sciences industry in the Greater Philadelphia area. The largest concentration is in suburban Philadelphia but a number of important support companies are located across the metro in New Jersey and Delaware.

With the growth of CGT, the following key services have been added that support further core industry growth:

- Cold Chain and Biomaterial Management services e.g., Tower Cold Chain Center of Excellence located near the airport to support shipping of temperature sensitive biotherapeutics; GenVault biorepository;
- Specialized Shipping and Packaging e.g., Catalent Packaging Center of Excellence;
- Specialized facilities e.g., Charles River CRADL and MISPRO which provide outsourced facility services critical to biotherapeutic research particularly for smaller start up and pre-clinical companies;
- BioComputing Services: Gene Editing Institute at ChristianaCare provides CRISPR gene editing evaluation technology as part of a suite of services.



Courtyard Philadelphia South at The Navy Yard Courtesy of Jeff Goldman for Visit Philadelphia



Appendix Sources and citations

METHODOLOGIES

One of the challenges of technology-driven sector study is the availability of information. Technologies do not fall easily into typical economic industry data such as NAICS codes. Accordingly, estimates were created based on a series of different data sources, and differences reconciled when available. Search term parameters when that option was available were limited to the minimal key word or phrase.

Also, all economic data reporting is point-in-time data and is subject to change. The important considerations are direction of trend, and order of magnitude of wages and employment.

CGT KEY DRIVER EMPLOYMENT METHODOLOGY (PG. 8)

Company names were gathered that are directly involved in the creation of Cell and Gene Therapies. Employment information was gathered from each company through a variety of sources, including:

- Public governmental filings such as with the Securities and Exchange Commission;
- Company and institutional interviews;
- News articles from the Philadelphia Inquirer, Philadelphia Business Journal, Daily Pennsylvanian;
- Industry sources such as Fierce Biotech, BioPharmaDive, Genetic Engineering and Biotechnology News;
- Data sources including Pitchbook, Crunchbase, Zoominfo, Manta, Dun and Bradstreet, among others – where employment ranges were provided the mid-point was used;
- For some institutional employment, manual counts of people associated with key labs and research cores based on institutional websites.

Wages were estimated using the annual wage based on NAICS code 541714 Biotechnology R&D from the BLS employment data.

NIH FUNDING (PG 12)

Determining the amount of NIH funding is based on the use of NIH Reporter <u>https://reporter.nih.gov/advanced-search</u>. Search parameters were limited to "cell therapy" and/or "gene therapy".

CAR-T PATENTS (PG 13)

The number of CAR-T patents is based on the google patent search engine and the search parameter "CAR-T". Institutional counts also include jointly assigned patents.

CLINICAL TRIALS (PG 22)

Clinical trial counts are based on the data set found at <u>https://</u> <u>clinicaltrials.gov/</u> with search parameters being "cell therapy" or "gene therapy". Phase I and Phase II recruiting and not yet recruiting trials were used to identify the future pipeline of trials.





This report was made possible through the generous support of Knight Foundation.

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