

Ohio Life Sciences Industry

Assessment and Economic Impact Report

Prepared for: Ohio Life Sciences Association

Prepared by: TEconomy Partners, LLC

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Ohio Life Sciences



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Executive Summary

Ohio's life sciences industry is large, dynamic, and growing. Its recent strong growth along the "Ohio Discovery Corridor" and in other parts of the state has attracted significant new investments and is a major driver of job growth. The industry's innovations and advanced manufacturing are focused on lifesaving and quality-of-life-improving products and services for Ohioans and others worldwide.

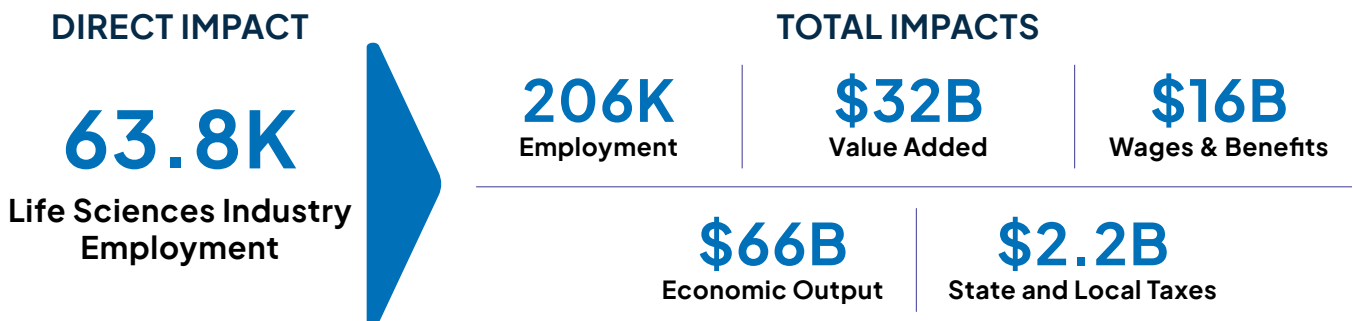
This *Industry Assessment and Economic Impact Report* examines Ohio's life science industry's growth, evolution, and impacts across the state. It also assesses several elements of the state's innovation ecosystem for life sciences development. The report identifies and highlights strengths and positive trends while also illuminating "*Ohio's Challenges*" for industry development. The assessment utilizes national comparisons and a significant benchmarking framework that directly compares Ohio's industry performance and position with broader ecosystem assessments of six states that Ohio often competes with for life sciences development opportunities.

Key findings and highlights from the industry and economic impact assessment include:

- In 2023, the industry employed nearly 64,000 Ohioans in almost 4,900 individual business establishments spanning every region of the state.
- Ohio's life sciences companies have increased their payrolls significantly, growing employment by 12.8% since 2019, well outpacing overall private sector growth of just 1.0% for Ohio during this latest 4-year period which includes the COVID-19 pandemic and subsequent economic recovery.
- Ohio's life sciences job growth has aligned closely with that for the nation, averaging 3.1% increases annually since 2019 compared with average annual growth of 3.5% for the U.S. The pace of hiring has slowed, however, in 2023 for both the state and the national sector with over-the-year increases at just 1.5% and 1.2%, respectively.
- Ohio has a sizable presence across each of the life sciences industry's five major subsectors. What stands out for Ohio is the strong, double-digit growth context for three of the five subsectors since 2019—life science-related distribution; research, testing, and medical labs; and pharmaceuticals. Ohio's life science-related distribution subsector is the largest individual segment and "specialized" in its concentration relative to national averages.

- Ohio’s life sciences industry is statewide in its geographic footprint. As one might expect, Ohio’s major population and employment centers in Greater Columbus, Cleveland, and Cincinnati are driving the largest regional footprints for the industry overall in Central, Northeast, and Southwest Ohio, respectively, where each leading region employs between 12,000 and 20,000 Ohioans in the industry. Five of seven Ohio regions have experienced net job gains since 2019 in the life sciences.
- The life science industry stands out for being a generator and source for high-quality jobs, including a breadth of entry-level opportunities. In 2023 Ohio’s life sciences industry workers earned nearly \$105,000, on average, which is more than \$42,000 or 67% above the state’s private sector average. Ohio workers in life science-related occupations earn more, on average, for entry-level job opportunities compared with the overall economy—and in most cases, significantly more. Entry-level workers in life science-related roles earn an estimated 48% more, on average, in Ohio compared with their entry-level counterparts in all occupations—approximately \$44,000 per year versus nearly \$30,000 for all occupations.
- Ohio’s large and steadily growing life sciences industry and its substantial wage premiums paid to its workforce translate into significant impacts on Ohio’s economy. In 2023, Ohio’s life sciences industry and its broader economic multiplier effects:
 - Employed and supported more than 206,000 Ohio workers, representing an employment multiplier of 3.24—for every direct job in the state’s life sciences industry, an additional 2.24 Ohio jobs are supported (see Figure ES-1).
 - Generated and supported more than \$66.0 billion in total economic (output) impacts.
 - Generated and supported \$32.4 billion in total value added impacts, which represent the industry’s contribution to gross state product (GSP). This value added impact accounts for 5.3% of Ohio’s private sector GSP.¹

Figure ES-1. The Economic Impacts of Ohio’s Life Sciences Industry, 2023



Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

¹ State of Ohio private sector GSP data is from U.S. Bureau of Economic Analysis (BEA) in current 2023 dollars. For comparison all of Ohio’s manufacturing industries combined account for 16.80% of Ohio’s private sector GSP.

Successful life sciences clusters require and are built upon a high-functioning ecosystem that supports both basic and applied research and development with the appropriate resources, protects intellectual property, and allocates capital to promising and innovative new, emerging, and existing businesses. Considered all together, Ohio's innovation ecosystem represents a significant base of research, innovation, and funding activity (Figure ES-2).

In terms of areas of strength for Ohio and where the state stands out relative to national and benchmark states, key findings and takeaways include:

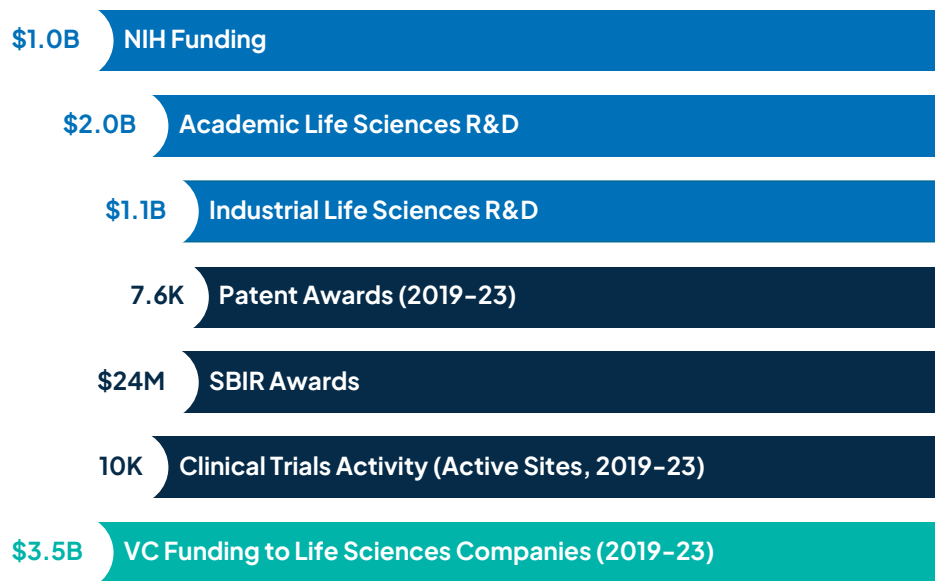
- In life sciences academic R&D, with a base of \$2 billion in activity in the latest year, Ohio has above-average levels of research expenditures. Ohio has seen rapid growth in university R&D since 2019, outpacing the national average and all six comparison states.
- In innovation activities, Ohio is well above the national average in its patenting activity in life science-related technologies relative to its GSP. The state has a relatively high level of clinical trials site activity.
- In growth capital, Ohio has seen above-average increases in VC investments in life sciences companies.

In terms of identified challenges for Ohio, key findings include:

- Capital/Funding: relative to U.S. averages, Ohio is well below in life sciences VC deal activity and funding levels; the state lags national averages in federal SBIR/STTR award and funding levels.
- Industry R&D and NIH Funding: Ohio is lagging in relative levels and growth of both life science-related industrial R&D and NIH funding relative to the nation and key comparison states.
- Limited Wet Lab Space: a study commissioned by Ohio Life Sciences (OLS) and its regional partners has found demand well outstripping the supply of available wet lab space in Greater Columbus², and OLS members and stakeholders point to broader challenges accessing wet lab space across the state for private life sciences firms.

2 Shift Health, "Enabling Innovation: Unpacking the Urgent Need for Wet Lab Space in the Columbus Region," January 2024.





Figure ES-2. Summarizing Ohio’s Innovation Ecosystem for Life Sciences Development



Note: Data represent totals for latest year available, generally 2023; exceptions are for clinical trials activity and VC funding levels, which both represent cumulative totals for the full 2019-23 period.

Ohio’s recent growth and its robust baseline of activity across its life sciences industry and associated innovation ecosystem signal a strong and exciting future for the state’s life sciences cluster. This future and continued success, however, are not guaranteed. Several areas of “Ohio’s Challenges” have been identified throughout this report and assessment. They are summarized and presented in Figure ES-3, along with a high-level directional assessment of each major area included in this report. OLS and its industry stakeholders and ecosystem partners must continue to monitor and address these areas to ensure the vibrant and competitive future for which Ohio is well-positioned in the life sciences.

Figure ES-3. Summarizing Ohio’s Position, Performance Across Life Sciences Industry and Innovation Ecosystem Elements

Industry or Ecosystem Element	OH Position, Performance	Ohio’s Strengths	Ohio’s Challenges
Industry Position, Performance		<ul style="list-style-type: none"> Ohio firms have increased employment by double-digits since 2019, well outpacing limited overall private sector growth. Ohio outpacing the nation in growth of two industry subsectors—research, testing, & med labs; pharmaceuticals. The state has a specialized employment concentration in life science-related distribution. 	<ul style="list-style-type: none"> Ohio slightly behind national pace of industry employment growth and middle of pack among comparison states in employment size, growth, and relative concentration.
Research and Development		<ul style="list-style-type: none"> Ohio has above-average levels of university life sciences R&D expenditures. Rapid growth in university R&D outpacing national average and all comparison states. 	<ul style="list-style-type: none"> Lagging in relative levels and growth of both industrial R&D and NIH funding relative to nation, comparison states.
Innovation		<ul style="list-style-type: none"> Among leading states and well above-average in life science-related patent awards and growth. Relatively high level of clinical trials site activity. 	<ul style="list-style-type: none"> Lagging national averages and nearly all comparison states in SBIR/STTR award and funding levels.
Growth Capital		<ul style="list-style-type: none"> Ohio has seen above-average growth in life science-related VC investments. 	<ul style="list-style-type: none"> Relative to U.S. averages, Ohio well below in VC deal activity and funding levels. Middle of the comparison states in VC investment levels.

Source: TEconomy Partners’ analyses.



Introduction

The life sciences industry and its supporting ecosystem represent a unique blend of opportunities for regions, states, and nations to advance both economic development and solutions to global challenges.

The industry, and the biotechnologies at its root, are at the forefront of innovation, generating significant market opportunities while addressing needs and challenges spanning human and animal health, food security, environmental resiliency, sustainable development, and more. At the same time, the life sciences industry is seen as a valued economic engine for growth that consistently creates high-quality jobs, bolsters economies even during economic downturns, and generates outsized economic impacts. Recognizing this unique value proposition and breadth of opportunities, Ohio is leveraging its unique constellation of assets and life science-related strengths and has targeted the industry for development.

This report aims to inform the life science industry's growth, its evolution, and advancement across Ohio by developing a data-driven, in-depth assessment of the industry's recent performance and position in the state and its major regions and its broader economic impacts that extend outward from its direct operations. Further, the report assesses several key elements of Ohio's innovation ecosystem for life sciences development.

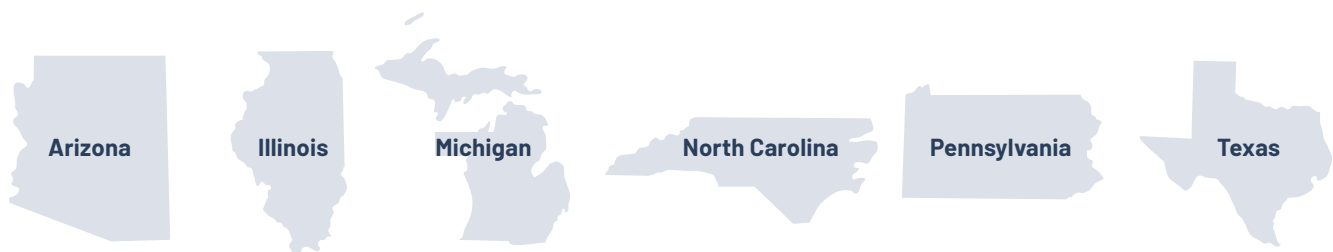
Overseeing and guiding the industry's development in the state is Ohio Life Sciences (OLS), which represents the state's life sciences industry by convening and advocating on behalf of its companies that span the wide array of life sciences industry markets and subsectors including biopharmaceuticals, medical devices, agricultural biotechnology, medical labs, digital health, and research and development operations. The trade association functions as the voice of the industry to advance its common interests across Ohio.

OLS, like many life sciences associations, has a need to closely track and understand the industry's growth, its evolution, and advancement across the state, what stands out with respect to unique strengths and specialization, and its far-reaching economic impacts to inform its members, state leaders and legislators, potential investors and site selectors, and other key stakeholders of the industry's importance to Ohio's economy.

This report aims to inform these dynamics by developing a data-driven, in-depth assessment of the industry's recent performance and position in Ohio and its major regions and its broader economic impacts that extend outward from its direct operations, its supply chain relationships, and its employee spending. Further, the report assesses several key elements of Ohio's innovation ecosystem for life sciences development spanning

industrial and academic R&D activities, NIH grant funding, clinical trials activities, VC and Angel investment activity, federal small business innovation awards to life science-related companies, innovation outcomes in the form of patent awards, and other elements.

The assessment makes key comparisons to national performance trends to contextualize those for Ohio. In addition, the analyses take on a significant benchmarking framework that directly compares Ohio's performance and position across the industry and broader ecosystem assessments to those of six comparison states. The set of comparison or benchmark states represent a highly competitive mix of established and emerging, high-growth life sciences states for which OLS and its industry stakeholders find useful comparisons. These six states, selected in close consultation with OLS, include:



This is a competitive set of comparison states that blends regional peers in the Midwest with high-growth aspirational leaders in the life sciences. States such as North Carolina have invested intentionally in life sciences workforce development, place-based development, and broader ecosystem building activities for four decades. The State of Texas has invested major resources in growing the life sciences, including \$6 billion in the Cancer Prevention and Research Institute of Texas (CPRIT), its 20-year initiative to fight cancer focused in research investments, enhanced life sciences infrastructure, and expediting innovation.

Benchmarking against other states, however, is vital to learning where you stand as a state, identifying your competition, and helping to isolate strategic issues and challenges. To that end, this report works to illuminate not only where Ohio has performed well and has strengths, but also to identify those challenges that are likely hampering the state's ability to compete and maximize its development potential. Issues identified are therefore called out throughout the report as *"Ohio's Challenges."*

The benchmarking analyses are embedded within the major sections of the report, which first set the context of the life sciences industry in Ohio and its regions, then measure the economic impacts generated in Ohio by the life sciences, and finally, assess the performance of the state's innovation ecosystem for life sciences development. These component assessments combine to tell the story of an industry playing an outsized and critical role in Ohio's economic development, while generating health dividends for Ohioans and addressing global challenges.

I. Ohio's Life Sciences Industry: A Large, Growing, and Dynamic Cluster Helps Drive the State's Economic Growth

Ohio's life sciences industry is large and growing, representing a dynamic and impactful cluster and a targeted economic development focus for the state. Ohio's companies are diverse in their market and innovation focus and, as this assessment will demonstrate, are generating high-quality jobs for Ohioans in every region of the state.

In 2023, Ohio's life science industry employed nearly 64,000 across almost 4,900 individual business establishments. The industry, as defined in this study, spans five major subsectors of the life sciences—a concept that is aligned with the national industry definition utilized by the Biotechnology Innovation Organization, or "BIO" in its biennial national reports.³ The subsectors and their respective employment totals and location quotients or "LQs" are shown in Figure 1.

A location quotient is a useful way in which to gauge and evaluate state strengths in terms of the employment concentration of an industry, in this case Ohio's life sciences industry and its major subsectors and detailed industries. State LQs measure the degree of job concentration within the state relative to the national average.

States or regions with an LQ greater than 1.0 are said to have a concentration in the sector. When the LQ is significantly above average, 1.20 or greater, the state is said to have a "specialization" in the industry.

³ TEconomy Partners, LLC and BIO, "The U.S. Bioscience Economy: Driving Economic Growth and Opportunity in States and Regions," December 2024. See also the Appendix to this report for a detailed listing of federal NAICS industry classifications defining the life sciences industry.

Ohio's Life Sciences Industry Represents:

63,765

jobs spanning five distinct industry subsectors

4,860

state business establishments

12.8%

job growth since 2019

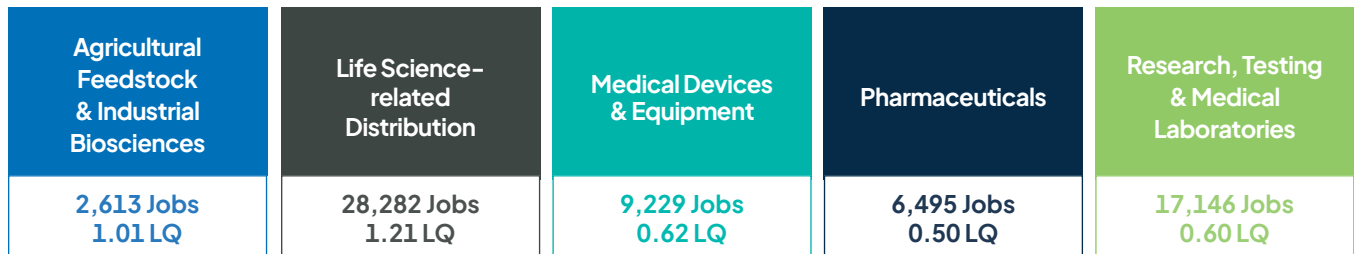
Average wages of nearly

\$105,000

Entry-level occupational wages exceeding those for the overall economy

Source: TEconomy Partners' analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics; Ohio Labor Market Information from the Occupational Employment and Wage Statistics Program (OEWS).

Figure 1. The Five Major Subsectors of Ohio’s Life Sciences Industry, Total Employment and Location Quotients, 2023

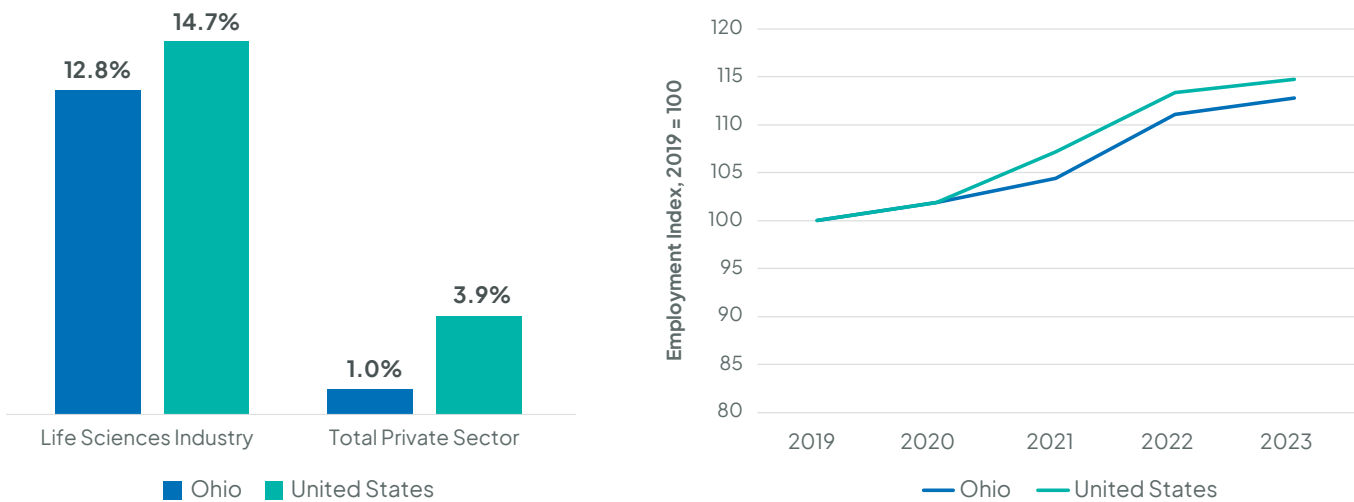


Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

The industry’s five subsectors, described in the callout below, reflect the diverse activities and market orientation of life sciences companies. As the employment totals in Figure 1 show, Ohio has a sizable presence in each of the five, with a “specialized” concentration in life science-related distribution, and a just above average concentration in agricultural feedstock and industrial biosciences. For the industry overall, Ohio has a LQ of 0.77, indicating the industry is relatively “under-concentrated” in the state relative to others. Despite this characterization, the industry’s strong overall growth and its innovative, value-adding context confirm its status as a strategically important cluster for Ohio.

The life science industry is a major driver of economic growth for Ohio. State life sciences companies have increased their employment levels by 12.8% since 2019, well outpacing overall private sector growth of just 1.0% for Ohio during this latest 4-year period which includes the COVID-19 pandemic and subsequent economic recovery (Figure 2). Ohio’s growth has aligned closely with that for the nation, averaging 3.1% increases annually since 2019 compared with average annual growth of 3.5% for the U.S. The pace of hiring has slowed, however, in 2023 for both the state and the national sector with over-the-year increases at just 1.5% and 1.2%, respectively.

Figure 2. Growth Trends for the Life Sciences Industry, OH and U.S., 2019–23



Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Defining the Life Science Industry

The latest (2024) biennial TEconomy/Biotechnology Innovation Organization (BIO) State Initiatives report, *The U.S. Bioscience Economy: Driving Economic Growth and Opportunity in States and Regions*, continues the nearly two-decade development and reporting out of an evolving set of major aggregated groupings that organize the life science industry into five major subsectors described below. The definition allows for comparable analysis of industry performance across states and metro regions. For a detailed list of the North American Industry Classification System (NAICS) industry codes that define each subsector, see the Appendix to this report.

- **Agricultural feedstock and industrial biosciences**—Firms engaged in agricultural research and development, processing, organic chemical manufacturing, and fertilizer manufacturing. The subsector includes industry activity in the production of ethanol and other biofuels.
- **Life Science-related distribution**—Firms that coordinate the delivery of bioscience-related products spanning pharmaceuticals, medical devices, and ag biotech. Distribution in the biosciences is unique in its deployment of specialized technologies including cold storage, highly regulated monitoring and tracking, and automated drug distribution systems.
- **Medical devices and equipment**—Firms that develop and manufacture surgical and medical instruments and supplies, laboratory equipment, electromedical apparatus including MRI and ultrasound equipment, and dental equipment and supplies.
- **Pharmaceuticals**—Firms that develop and produce biological and medicinal products and manufacture pharmaceuticals and diagnostic substances.
- **Research, testing, and medical laboratories**—Firms engaged in research and development in biotechnology and other life sciences, life science testing laboratories, and medical laboratories. Includes contract and clinical R&D organizations.

The five major life sciences subsectors provide insights into both the composition of Ohio's industry and what makes it unique, as well as the drivers of recent growth. The five subsectors have been assessed around three key employment-related variables to understand their performance and relative competitive position. These are plotted in the "bubble" chart in Figure 3 and include the relative employment size of the subsector in Ohio (represented by the size of the bubbles), the recent net growth rate for employment in each sector (plotted along the horizontal axis), and the industry's employment concentration relative to the national average, calculated as a location quotient and plotted along the vertical axis.

What stands out for Ohio is the strong, double-digit growth context for three of the five subsectors since 2019, all positioned well to the right of the vertical axis. Two subsectors have seen modest employment declines. Assessments for each subsector find:

- **Ohio's life science-related distribution subsector** is the largest individual segment and “specialized” in its concentration relative to national averages. The subsector employs more than 28,000 in nearly 2,900 business establishments across Ohio. Employment growth for Ohio has matched that for the U.S., with strong growth of 12.5% for the state versus 12.8% for the nation. This sizable life sciences distribution component represents 44% of overall life sciences jobs and nearly 60% of all industry establishments. All three of the detailed component industries within the subsector have contributed to its strong growth, led by nearly 18% growth in medical, dental, and hospital equipment and supplies distributors as well as 9% growth among drug and pharmaceutical distributors. Medical equipment and supplies distribution represents a specialized industry for Ohio with a LQ in 2023 of 1.40. This strength is due, in part, to the headquarters and significant presence in Ohio of Cardinal Health, a leading multinational distributor of pharmaceuticals and specialty products, a manufacturer and distributor of medical and lab products; and a provider of data solutions, based in Dublin.
- **Research, testing, and medical labs** has outpaced all other life sciences subsectors with its strong, 25% job growth since 2019. Ohio's hiring has been slightly faster than that for the nation overall in this fast-growing subsector (nearly 24%). In 2023, Ohio's employment in the research and testing subsector totaled more than 17,000 across 1,549 business establishments. The majority of state jobs in the subsector are within the commercial R&D segment that includes R&D sites for both established life sciences companies as well as those biotechnology companies with pre-commercial biotech products in development—this segment has grown by nearly 29% since 2019. Also contributing to the subsector's growth in recent years is the medical labs component, which has increased its jobs base by nearly 23%. Ohio companies with a commercial life sciences research and testing focus such as Battelle, as well as Clinical Research Organizations (CROs) such as AmplifyBio, NAMSA, Charles River Labs, InfinixBio, and CMC Pharmaceuticals are captured within this subsector.
- **Pharmaceuticals** represent another emerging area of Ohio's life sciences growth—with employment in the subsector up by nearly 16% since 2019 to reach almost 6,500 state jobs in 2023. Ohio's pace of growth has been above that for the U.S. (up nearly 13%). Like the national subsector, the state's is dominated by the pharmaceutical preparation manufacturing segment, which accounts for almost nine in ten pharmaceutical manufacturing jobs and includes traditional small molecule therapeutics production as well as in-vivo diagnostic substances. This detailed industry is helping to drive job growth and has increased by 7.5% since 2019. Smaller component segments are also growing in Ohio in medicinal and botanicals manufacturing and in biological products. Ohio is home to production and other operations of major biopharmaceutical companies including Amgen, Hikma Pharmaceuticals, Resilience, American Regent, Thermo Fisher, and others, as well as emerging companies such as Forge Biologics and Sarepta Therapeutics, focused in developing and manufacturing gene therapies.

- Ohio’s medical device and equipment** subsector is sizable, at more than 9,200 jobs across 263 state establishments in 2023. Since 2019, however, the subsector has experienced a modest employment decline of 1.7%, running counter to the national trend where employment is up by 6% over this period. Ohio’s largest detailed component industry is surgical appliances and supplies, where the state has an above-average concentration with a LQ of 1.08, and accounting for nearly half of medical device jobs. This and nearly all other industries within the subsector have seen job declines since 2019, with the exception of electromedical device production, which has increased employment by nearly 7%. Ohio medical device and equipment manufacturers include companies such as STERIS, based in Mentor and developing a wide array of products aimed at preventing infection among patients; and Form5 Prosthetics, based in Westerville and focused in developing affordable, custom application prosthetic devices using 3-D printing. Additionally, GE Healthcare operates multiple medical equipment production facilities in the state.
- Agricultural feedstock and industrial life science** companies in Ohio employ more than 2,600 in jobs that span 47 business establishments. The subsector has a just above average employment concentration relative to the U.S., with a LQ of 1.0. Subsector employment in the state has been relatively flat since 2019 and overall it has seen small net job declines since 2019 of 2.4% while nationally the subsector is up by more than 4% during this period. The subsector, in part, is engaged in bioprocessing to provide feedstocks for bio-based products and in soybean and other oilseed processing the state has a strong specialization with an LQ of 1.69 in 2023. This industry employs 600 Ohioans and has seen 9% growth since 2019, though that growth has been offset by employment declines in the state’s largest component industry—fertilizer manufacturing, where employment is down by 14% during this same period. Nitrogenous fertilizer is a very strong specialization for Ohio, with an employment concentration nearly four times higher than that for the nation (LQ is 3.67). Ohio is home to ScottsMiracle-Gro, a long-standing state company focused in consumer lawn, garden, and pest control products including pesticide production.

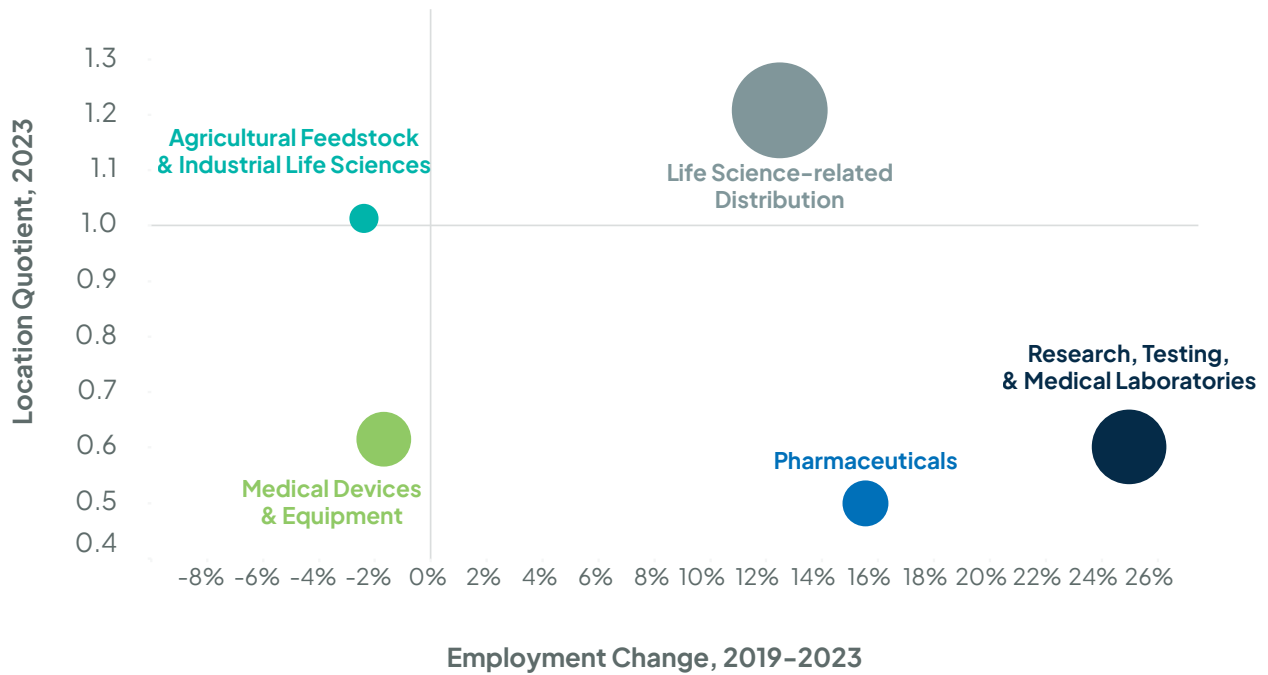
Who’s Hiring in Ohio’s Life Sciences Industry?

Leading companies with 500+ unique job postings over the latest, 2-year period include:

- Abbott Laboratories
- Cardinal Health
- Johnson & Johnson
- STERIS Corporation
- Quest Diagnostics
- McKesson
- Battelle Memorial Institute
- Thermo Fisher Scientific
- Labcorp
- Icon
- Resilience
- Bausch Health

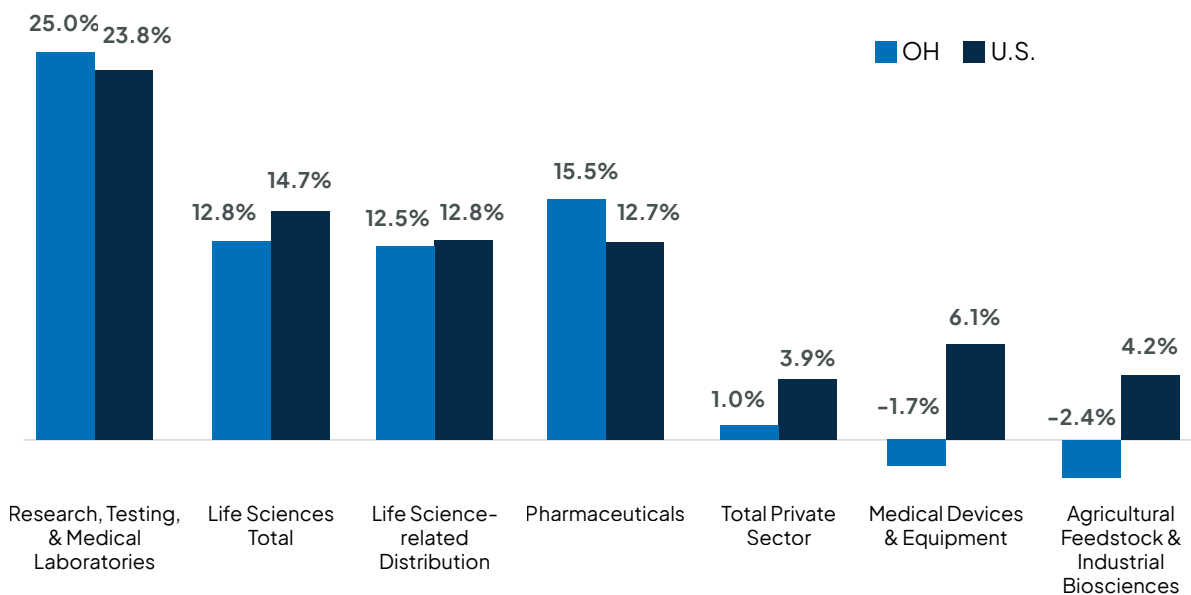
Source: TEconomy Partners’ analysis of Lightcast Job Posting Analytics Database, Datarun 2024.4.

Figure 3. Life Sciences Employment Levels (Size of Bubble), Concentration (LQ), and Growth, 2019–23, by Major Subsector



Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Figure 4. Employment Change for the Life Sciences Industry and Major Subsectors, OH and U.S., 2019–23



Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Life Sciences Wages Reflect Premium for Skilled Workforce Driving Innovation

The life science industry stands out for being a generator and source for high-quality jobs. The industry is especially skills-intensive, employing an outsized share of workers in both high-skilled and middle-skilled roles that are also especially STEM-intensive.⁴ Further, the life sciences are continually advancing innovations in a broad set of end markets and the industry is among the most R&D intensive globally. For all of these reasons, the industry pays wages that are consistently higher than those for the overall economy.

As shown in Table 1, in 2023 Ohio’s life sciences industry workers earned nearly \$105,000, on average, which is more than \$42,000 or 67% above the state’s private sector average. Each life sciences subsector has average wages significantly above those for the overall private sector. Employees in Ohio’s two most highly concentrated subsectors earn the highest average wages—life science-related distribution and agricultural feedstock and industrial life sciences, reflecting a strong value-adding context as well as the presence of corporate headquarters locations for leading companies in the state such as Cardinal Health in the distribution space, and ScottsMiracleGro in the agricultural biosciences.

Table 1. Average Annual Wages for the Life Sciences Industry and Total Private Sector, 2023

Life Sciences Subsector	Average Wages, 2023		Change in Average Wages, 2019-23	
	OH	U.S.	OH	U.S.
Life Science-related Distribution	\$120,015	\$133,088	18.8%	21.8%
Agricultural Feedstock & Industrial Biosciences	\$106,459	\$101,825	8.6%	21.8%
Life Sciences Total	\$104,853	\$132,314	19.3%	18.2%
Research, Testing, & Medical Laboratories	\$99,945	\$151,006	23.5%	20.4%
Medical Devices & Equipment	\$97,705	\$131,562	17.0%	11.1%
Pharmaceuticals	\$72,083	\$101,478	14.7%	8.3%
Total Private Sector	\$62,696	\$72,384	21.5%	22.6%

Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

The wage data presented above represent an overall “industry” wage concept which includes all types of skills, roles, and occupations across the breadth of companies and organizations within Ohio’s life sciences industry. So, the average industry wage combines and includes the pay across a wide distribution of roles from administrative professionals to maintenance teams, to production workers and their supervisors, to business and financial and sales professionals and even up through the company’s c-suite leadership. An additional and alternative lens on life sciences wages can be understood from an occupational perspective, namely, examining wage rates of industry professionals in “primary” life science industry roles, shown in Table 2.

⁴ TEconomy Partners, LLC and CSBI, “2023 Life Sciences Workforce Trends Report: A Rapidly Evolving Industry and its Impact on Talent Dynamics,” June 2023.

As the industry continues to grow and generate new job and career opportunities for Ohioans, the entry-level wage context is important to understand. The state's labor market information office develops and publishes average wage data for each occupation that includes averages for both entry-level workers as well as overall for these roles.

As Table 2 shows, Ohio workers in life science-related occupations earn more, on average, for entry-level job opportunities compared with the overall economy (the "all occupations" row in the table)—and in most cases, significantly more. Entry-level workers in life science-related roles earn an estimated 48% more, on average, in Ohio compared with their entry-level counterparts in all occupations—approximately \$44,000 per year versus nearly \$30,000 for all occupations. Across primary life sciences occupations, the wage premium paid to entry-level workers ranges from 15% to 149% higher than the overall economy-wide entry-level average. These primary life sciences roles span an array of technician jobs as well as scientists, engineers, and managers. Their overall and entry-level wage context demonstrates the strong job opportunities available to Ohioans throughout the state to capitalize on high-quality, entry-level jobs that pay family-sustaining wages. In addition, the overall occupational average wage shows the trajectory for significant wage growth for Ohio's life sciences workforce as they gain more experience.

Table 2. Average Annual Wages for Primary Life Science–Related Occupations, Entry–Level and Overall, 2023

Primary Life Sciences Occupations and Groups	Avg. Entry–Level Wage	Avg. Wage, Overall
All Occupations		
All Occupations	\$29,920	\$59,890
Ag, Food and Nutrition Scientists & Technicians		
Agricultural Technicians	\$34,400	\$45,050
Food Science Technicians	\$41,850	\$61,610
Food Scientists and Technologists	\$44,250	\$67,470
Soil and Plant Scientists	\$42,300	\$68,600
Agricultural Engineers		
Agricultural Engineers	\$74,400	\$101,930
Biological Scientists & Technicians		
Biochemists and Biophysicists	\$51,990	\$83,650
Biological Scientists, All Other	\$57,380	\$92,720
Biological Technicians	\$44,450	\$60,740
Epidemiologists	\$54,930	\$73,610
Medical Scientists, Except Epidemiologists	\$56,560	\$96,390
Microbiologists	\$56,720	\$93,000
Biomedical Engineers		
Bioengineers and Biomedical Engineers	\$67,930	\$101,100
Life Sciences Managers		
Natural Sciences Managers	\$80,200	\$134,170
Medical & Clinical Lab Technicians		
Clinical Laboratory Technologists and Technicians	\$40,920	\$60,570
Dental Laboratory Technicians	\$35,570	\$53,180
Medical Appliance Technicians	\$36,910	\$52,540
Ophthalmic Laboratory Technicians	\$34,710	\$42,350

Source: TEconomy’s analysis of Ohio Labor Market Information from the Occupational Employment and Wage Statistics Program (OEWS).

As will be highlighted in the next section of the report, these strong wage profiles across the life sciences industry and primary occupations further reflect the importance of the cluster as a statewide economic engine for Ohio that generates outsized economic impacts.

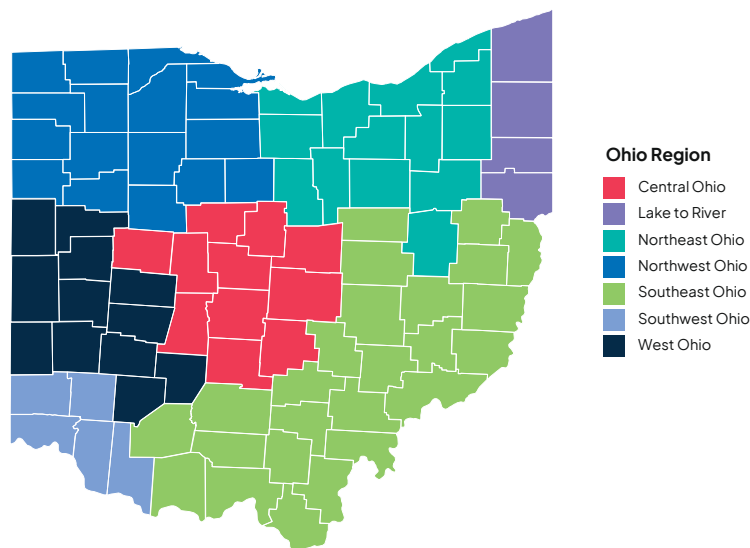
Ohio’s Life Sciences Employment Footprint Touches Every Region of the State

Ohio’s life sciences industry is statewide in its geographic footprint. Utilizing JobsOhio’s regional structure dividing the state into seven distinct regions⁵, a comparable analysis has been developed to understand the regional industry employment context for the state (Figure 5).

As one might expect, Ohio’s major population and employment centers in Greater Columbus, Cleveland, and Cincinnati are driving the largest regional footprints for the industry overall in Central, Northeast, and Southwest Ohio, respectively, where each leading region employs between 12,000 and 20,000 Ohioans in the industry (see Table 3).

Each of the three leading regions has increased employment since 2019, helping to drive the overall statewide growth of the life sciences industry. In fact, five of seven Ohio regions have experienced net job gains since 2019 in the life sciences, with the exceptions being among two of the smallest regions for the industry. The bubble chart in Figure 6 illustrates this widespread growth context, with most of the regional bubbles positioned well to the right of the vertical axis and strong emergence in the Northeast, Southwest, and West regions, and with Central Ohio positioned just above the horizontal axis indicating its above-average employment concentration with an LQ measured at 1.05 or 5% greater concentration relative to the national average.

Figure 5. Ohio’s Seven Major Regions as Defined by JobsOhio



Source: JobsOhio.

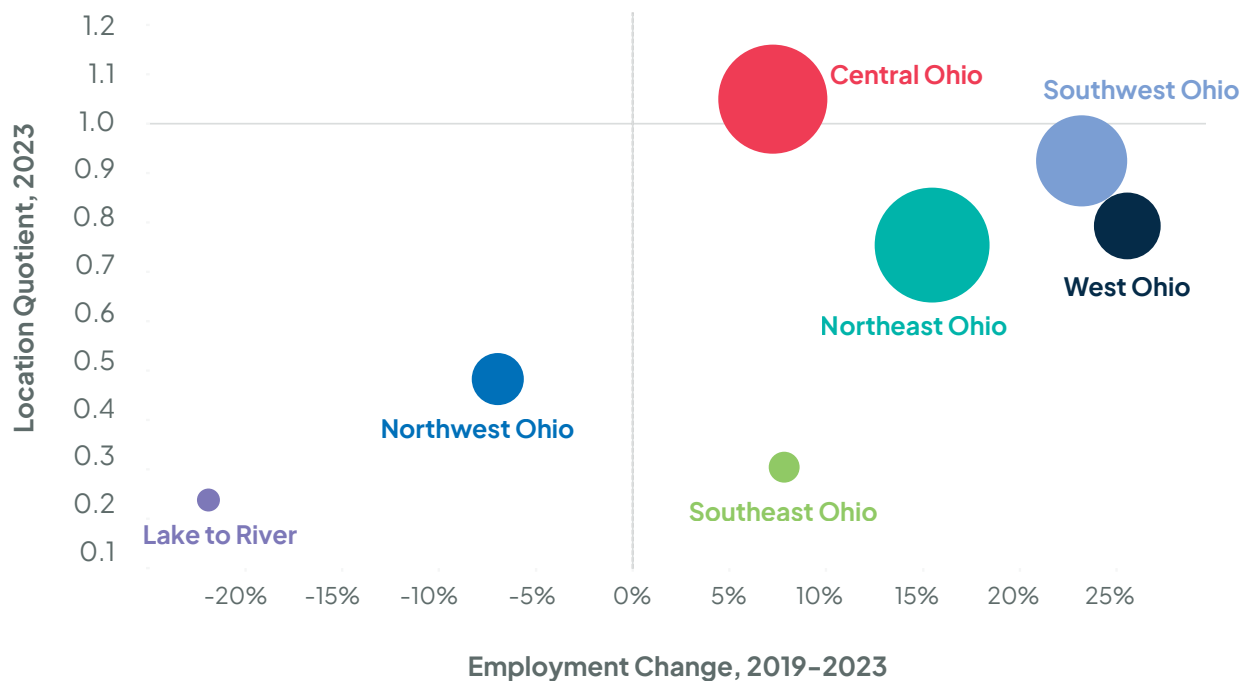
⁵ For more information, see: <https://www.jobsohio.com/ohio-regional-network>.

Table 3. Summary Employment Metrics for Ohio’s Life Sciences Industry by Region, 2023

Region	Establishments, 2023	Estabs. Change, 2019–23	Employment, 2023	Empl. Change, 2019–23	Location Quotient	Avg. Wages, 2023
Ohio, Total	4,860	29.3%	63,765	12.8%	0.77	\$104,853
Central Ohio	1,185	29.0%	18,041	7.2%	1.05	\$116,250
Lake to River	160	21.9%	800	-21.9%	0.24	\$76,159
Northeast Ohio	1,556	31.3%	20,016	15.5%	0.75	\$95,252
Northwest Ohio	325	20.1%	4,112	-7.0%	0.48	\$79,660
Southeast Ohio	171	17.2%	1,448	7.8%	0.31	\$72,038
Southwest Ohio	1,000	36.6%	12,592	23.2%	0.93	\$124,970
West Ohio	463	23.1%	6,756	25.5%	0.79	\$91,136

Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Figure 6. Life Sciences Employment Levels (Size of Bubble), Concentration (LQ), and Growth, 2019–23, by Ohio Region



Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Several regions have “specialized” concentrations or relative strengths in life sciences subsectors, as measured by location quotients and presented in Table 4. Reflecting the state’s overall specialized distribution subsector, three regions have LQs that meet or exceed 1.20—Central, Northeast, and Southwest Ohio. Likewise, three regions contribute to the state’s just above-average concentration in agricultural feedstock and industrial life sciences. Other highly concentrated subsectors where the LQ exceeds the national average (1.0) but does not quite meet the specialized threshold include the medical device subsector in Northeast Ohio, the pharmaceutical manufacturing subsector in Southwest Ohio, and in research, testing, and medical labs in West Ohio.

Table 4. Specialized and Concentrated Life Sciences Subsectors Among Ohio’s Seven Regions, 2023

Region	Agricultural Feedstock & Industrial Biosciences	Life Science-related Distribution	Medical Devices & Equipment	Pharmaceuticals	Research, Testing, & Medical Laboratories
Central Ohio	●	●			
Lake to River Ohio					
Northeast Ohio		●	○		
Northwest Ohio	●				
Southeast Ohio					
Southwest Ohio		●		○	
West Ohio	●				○

Note: Dark circles represent location quotients greater than or equal to 1.20 for a “specialized” employment concentration designation; light circles represent LQs greater than 1.0 but less than 1.20 for a “concentrated” designation.

Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

The Ohio Discovery Corridor: Leveraging World-Class Life Sciences Institutions and Assets to Drive Ohio-Based Innovations, Industry Competitiveness, and Excellence in Care



Led by JobsOhio, the state has established the Ohio Discovery Corridor to combine and leverage its impressive array of biomedical institutions, assets, and activities by connecting its three life science-focused innovation districts in Cincinnati, Columbus, and Cleveland. Each city and respective district along the corridor is home to world-class anchor institutions that are globally recognized for their excellence as well as their broader contributions to healthcare, research, and innovation. These top-ranked medical and academic institutions include:

- **Cincinnati Innovation District:** University of Cincinnati including its College of Medicine, Digital Futures Complex, and 1819 Innovation Hub; and Cincinnati Children’s Hospital Medical Center, ranked the #1 Children’s Hospital in the U.S.
- **Columbus Innovation District:** The Ohio State University, a national leader in biomedical research and talent generation, fostering innovation via the Pelotonia Research Center and centers and institutes; and Nationwide Children’s Hospital, ranked the 6th best children’s hospital and a leader in gene therapy research and innovation.
- **Cleveland Innovation District:** the Cleveland Clinic, ranked 2nd among all hospitals worldwide, and home to numerous innovation centers; University Hospitals, which hosts and manages more than 3,400 active clinical trials and research studies annually; Case Western Reserve University, home to a leading medical school and advancing innovations in neuroprosthetics; Cleveland State University, awarding thousands of STEM degrees; and MetroHealth Hospital serving underserved communities with advanced treatments.

Ohio’s Discovery Corridor has been launched and enabled by \$3 billion in investment from the anchor institutions, the State of Ohio, and JobsOhio. Over the coming decade, the Discovery Corridor is expected to inspire 47,500 additional STEM graduates and fuel an estimated 60,000 new jobs.

Considered all together, the Discovery Corridor represents a leading life sciences powerhouse and innovation ecosystem that boasts and can claim: the #1 state for pediatric healthcare, the #1 Midwest state for life sciences graduates, \$1B in NIH-funded research annually, \$2B raised by early-stage life sciences companies since 2022, more than 52,000 STEM graduates annually, the 2nd ranked hospital globally.

Each of these institutions and regional innovation districts individually stand out as being leading centers of biomedical research, talent, entrepreneurship, and care delivery but there is enhanced power and impact in collaboration and regional coordination—where the whole becomes even greater than the sum of its parts.

Source: Ohio Discovery Corridor (<https://www.ohiodiscoverycorridor.com/>) and partnering institutions.

Benchmarking Ohio’s Position and Performance in the Life Sciences Industry

To better understand Ohio’s broader competitive positioning in the life sciences industry, the benchmarking assessment has been developed comparing the state’s industry employment, its relative concentrations and strengths, and recent growth to the set of states selected in consultation with Ohio Life Sciences.

Ohio’s nearly 64,000 life science industry jobs are among the middle of the pack in the comparison set where employment among the states range from 40,000 in Arizona through nearly 130,000 in Texas (Table 5). Each of the states has grown its life sciences industry employment, with three well outpacing national growth since 2019 and exceeding 20% growth rates—Arizona, North Carolina, and Texas (Figure 7). These three states have consistently grown their life sciences jobs at a rapid pace in recent years.

Among the comparison states, Ohio can be seen as “*emerging*” in the life sciences industry—growing at a competitive rate though not as large as states like Texas, North Carolina, Pennsylvania, or Illinois, nor yet as “*specialized*” in its concentration as states like North Carolina.

Just one state in the benchmark set has a “specialized” overall concentration in the life sciences—North Carolina, where the industry is 44% more concentrated than the national average. Two additional states, Pennsylvania and Illinois, have above-average employment concentrations as measured by their LQs.

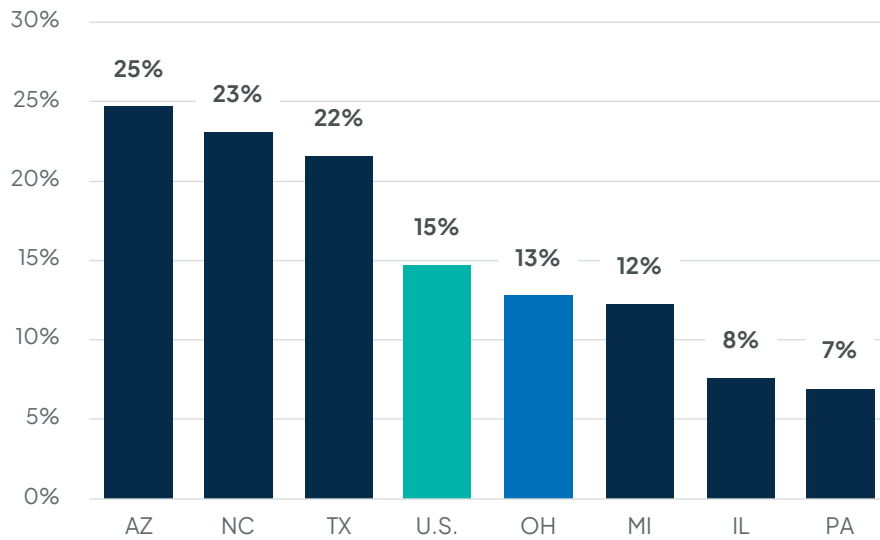
Among the comparison states, Ohio can be seen as “*emerging*” in the life sciences industry—growing at a competitive rate though not as large as states like Texas, North Carolina, Pennsylvania, or Illinois, nor yet as “*specialized*” in its concentration as states like North Carolina.

Table 5. Summary Life Sciences Employment and Wage Metrics for OH and Comparison States, 2023

State	Employment, 2023	Employment Change, 2019–23	Location Quotient	Avg. Wages
Texas	129,245	21.6%	0.64	\$121,919
North Carolina	103,107	23.1%	1.44	\$121,606
Pennsylvania	97,374	6.9%	1.06	\$137,925
Illinois	93,402	7.5%	1.03	\$153,544
Ohio	63,765	12.8%	0.77	\$104,853
Michigan	47,815	12.2%	0.72	\$110,204
Arizona	40,399	24.6%	0.84	\$102,161

Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Figure 7. Life Sciences Industry Employment Growth, OH and Comparison States, 2019–23



Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Just as Ohio has specialized employment strengths in life sciences distribution and a well-concentrated agbiosciences subsector, each state among the comparison set has a unique portfolio of existing and/or emerging industry strengths (Table 6). States like North Carolina, Illinois, and Pennsylvania each have a broad set of existing specialized subsectors that reflect their unique status as not only large and leading but also diverse and varied in their set of life sciences strength areas. Fast-growing states like Arizona and Texas continue to emerge in the life sciences, though given the relatively large size of their overall economies, they have yet to record outsized, specialized concentrations in industry subsectors. As Ohio continues to compete with leading states, it is important to understand where respective competitive strengths come into play.

Table 6. Specialized and Concentrated Life Sciences Subsectors, Ohio and Comparison States, 2023

Life Sciences Subsector	OH	AZ	IL	MI	NC	PA	TX
Life Sciences Total			○		●	○	
Agricultural Feedstock & Industrial Biosciences	○		●		●		
Life Sciences-related Distribution	●		●		○		○
Medical Devices & Equipment		○		○		○	
Pharmaceuticals			●	○	●	●	
Research, Testing, & Medical Laboratories					●	●	

Note: Dark circles represent location quotients greater than or equal to 1.20 for a “specialized” employment concentration designation; light circles represent LQs greater than 1.0 but less than 1.20 for a “concentrated” designation.

Source: TEconomy Partners’ analysis of QCEW data from Lightcast (Datarun 2024.3) and Bureau of Labor Statistics.

Supporting and Enabling the Ecosystem for Life Sciences Development: Ohio's Hospitals and Healthcare Strengths

Hospitals could be thought of as a fifth major subsector or pillar of the life sciences industry, however, the existing federal industrial classification scheme limits the ability to isolate academic medical centers and other research and education-focused hospital and health system establishments from those that are solely health services focused.

Ohio is a leading state in its hospitals and healthcare footprint; and unlike most states, Ohio's outsized concentration in the sector indicates it represents a "traded sector" context for the state that serves populations beyond Ohio's borders and drives new wealth generation as a destination for high-quality care. The state employs nearly 294,000 in hospitals and maintains a location quotient of 1.29 indicating Ohio is 29% more concentrated in its employment in the sector relative to national averages—a highly significant specialization for a population-driven industry where state and regional LQs tend to hover around 1.0.

Hospitals play several key roles in advancing biomedical innovations and a state's life sciences industry, serving as hubs for medical innovation, research, and talent development in the following ways:

- Partnering with research universities, biotech companies, and government agencies to advance clinical research and testing including with respect to drug development, and medical device testing.
- Hosting clinical trials and deploying new technologies, enabling environments where life sciences products and services can be tested, iterated on, and improved.
- Contributing to workforce development and training for medical and research professionals.

As will be shown in the ecosystem section of this report, Ohio is very active in hosting clinical trials and advancing new innovations through its institutional Principal Investigators (PIs). This occurs through the biomedical infrastructure and clinical excellence supported by its leading hospitals and hospital systems. Many of Ohio's are nationally ranked for their clinical excellence,⁶ including:

- **The Cleveland Clinic** – placed by U.S. News in its "Best Hospitals Honor Roll" among the nation's leading medical centers; ranked as the top hospital in Ohio; nationally ranked in 13 adult and 11 children's specialties.
- **The Ohio State University Wexner Medical Center** – ranked as the #2 hospital in Ohio; nationally ranked in 8 specialty areas.
- **University Hospitals Cleveland Medical Center** – ranked as the #3 hospital in Ohio; nationally ranked in 3 specialty areas.
- **Cincinnati Children's** – placed by U.S. News in its "Best Children's Hospitals Honor Roll" among the nation's leading medical centers for pediatrics; ranked as the top children's hospital in Ohio and the Midwest; nationally ranked in 11 children's specialty areas.
- **Nationwide Children's Hospital** – placed by U.S. News in its "Best Children's Hospitals Honor Roll" among the nation's leading medical centers for pediatrics; ranked as the top children's hospital in Ohio and the Midwest (along with Cincinnati Children's); nationally ranked in 11 children's specialty areas.

⁶ Rankings presented here are sourced from U.S. News and World Report, 2024-25.

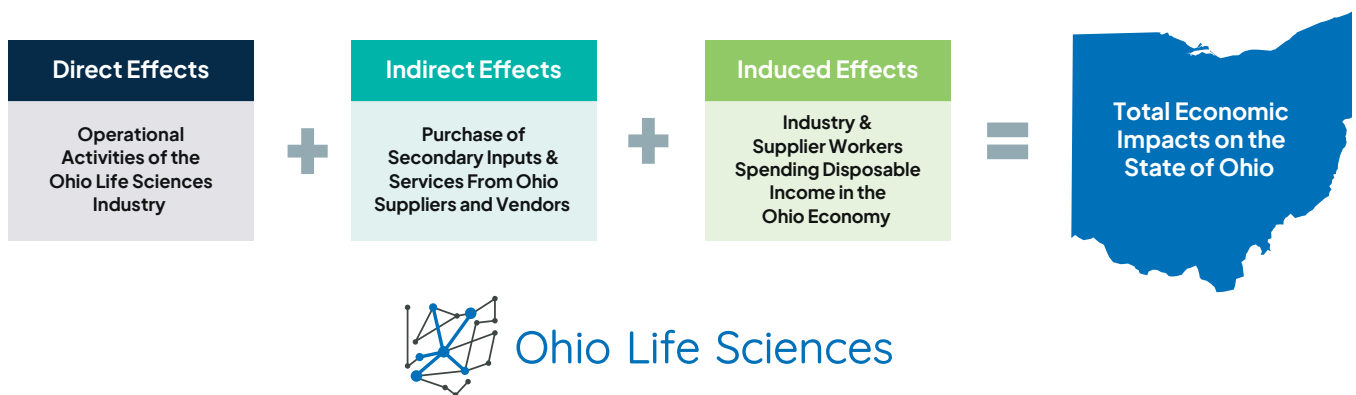
II. Economic Impacts of Ohio's Life Sciences Industry

Overview

With nearly 64,000 employees, Ohio's life sciences industry generates and supports significant economic activity and impacts within the state. This section defines, describes, and measures these impacts.

The impact of Ohio's life sciences industry can be measured using the well-established regional economic analysis technique of input-output (I-O) analysis. I-O analysis tracks and estimates the purchasing and production activities of a sector, in this instance the Ohio life sciences industry, and the related economic activity of its in-state suppliers and the suppliers' personnel. The premise is that every dollar spent by these life sciences firms within the state is re-spent again and again on the purchase of inputs and additional goods or services by suppliers and workers generating additional economic activity and impacts within the state as depicted in Figure 8. This spending and re-spending is termed the "multiplier effect".

Figure 8. Components of the Ohio Life Sciences Industry Economic Impacts



The economic impact analysis for this effort is driven by the state’s life sciences industry employment across the host of subsectors as described in Section I. These employment values then generate estimates, using a State of Ohio IMPLAN model, of the direct, indirect, induced, and the combined total impacts across several key metrics.⁷ These include: **employment** (full and part-time workforce including self-employed and sole proprietors), **labor income** (salaries, wages and the full cost of benefits, e.g., total compensation for employees and proprietors), **value-added** (the difference between an industry’s total output and the cost of intermediate inputs including labor income; sometimes referred to as “contribution to GDP”), **output** (the dollar value of industry production e.g., sales or revenue) as a measure of total economic activity, and **tax revenues** (estimates of local, state, and federal tax revenues generated by corporations and individuals).

Economic Impact Methodology

- Used Ohio Life Sciences Industry employment as developed in the earlier section.
- Used the most recently available 2022 IMPLAN model of Ohio (Aggregation of IMPLAN County models used for regional impact estimation).
- Financial impact metrics are reported in 2023 dollars.
- Multipliers are each relative to the metrics’ direct values, which count as the initial 1.00 of a multiplier.

Statewide Economic Impacts

The following discussion describes the state-level economic impacts of the Ohio life sciences industry for 2023 by key metric, an examination of the leading supplier sectors to the state’s life sciences industry, and comparisons to other Ohio industries and overall gross state product (GSP).

Employment and Compensation Impacts

Through the employment of nearly 64,000 (workers and owners), the Ohio life sciences industry serves as an important economic engine for the state’s economy. Through industry purchases of goods and services from in-state supplier firms an additional 85,300 workers are supported by the industry (indirect effects, see Table 7). In addition, as the industry and its supplier firms’ employees spend a share of their wages within the Ohio economy, more than 57,200 additional state workers jobs are supported (induced effects). **In total, the Ohio life sciences industry employs and supports more than 206,000 Ohio workers, for an employment multiplier of 3.24—for every direct job in the state’s life sciences industry, an additional 2.24 Ohio jobs are supported.**

⁷ For more information on the economic impact approach and methodology, including the IMPLAN Input/Output model, see the Appendix to this report.

Table 7. Economic Impacts of the Ohio Life Sciences Industry, 2023

Impact Type	Employment	\$ Billions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	63,765	\$7.614	\$16.881	\$38.391	\$0.484	\$0.576	\$1.700
Indirect Effects	85,308	\$5.722	\$9.762	\$17.965	\$0.277	\$0.328	\$1.145
Induced Effects	57,231	\$2.957	\$5.793	\$9.673	\$0.261	\$0.301	\$0.630
Total Impacts	206,304	\$16.293	\$32.437	\$66.028	\$1.022	\$1.205	\$3.475
Multiplier	3.24	2.14	1.92	1.72			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Direct labor income (or compensation), paid to employees and owners exceeded \$7.6 billion in 2023 or an average compensation of \$119,400 per industry worker.⁸ Through purchases from suppliers and employee purchases the indirect and induced labor income generated by the industry reached nearly \$8.7 billion. Overall, the Ohio life sciences industry generates and supports \$16.3 billion in annual compensation in the state.

Value Added Impacts

Value added or an industry’s contribution to gross state product (GSP), captures the total revenue of an industry minus the costs of purchased inputs and labor. The **Ohio life sciences industry generated nearly \$16.9 billion in direct industry value added in 2023, or 2.7% of total state private sector GSP. From a total impacts perspective, the \$32.4 billion generated and supported by the state’s life sciences industry accounts for 5.3% of Ohio’s private sector GSP.**⁹

Output Impacts

Output metrics consider the overall economic activity (typically sales or revenues) generated and supported by an industry, with the total output impacts often referred to as the “total economic impacts” of an impact analysis. Ohio’s life sciences industry is estimated to have generated \$38.4 billion in direct economic activity in the state. In generating this economic activity, the industry is estimated to have supported an additional \$27.6 billion in economic activity in Ohio (through industry purchases, industry and supplier worker incomes). Taking these impacts together estimates the **Ohio life sciences industry’s total economic impact reaches more than \$66.0 billion in 2023.** For every \$1.00 of industry output an additional \$0.72 of in-state economic activity is supported (an output multiplier of 1.72).

⁸ The concept of labor income is one of total compensation, which includes both wages and earnings as well as the value of benefits offered to employees.

⁹ State of Ohio private sector GSP data is from U.S. Bureau of Economic Analysis (BEA) in current 2023 dollars. For comparison all of Ohio’s manufacturing industries combined account for 16.80% of Ohio’s private sector GSP.

Tax Revenue Impacts

The Ohio life sciences industry, its companies and its workers, paid an estimated \$1.1 billion in direct state and local taxes in 2023, consisting of \$484 million in local/county taxes and \$576 million in state taxes. Including in-state suppliers and worker income and spending, the Ohio life sciences industry generated and supported more than \$2.2 billion in total state and local taxes. From a federal tax perspective, the state's industry generated and supported nearly \$3.5 billion in total federal tax revenues in 2023.

Impact Multiplier Comparisons to Other Ohio Sectors

To provide additional and relative context to these results, comparisons are made to other sectors of the Ohio economy in terms of both employment and output multipliers. The sector multipliers in Table 8 are developed through the same State of Ohio IMPLAN model used for the Ohio life sciences industry impact assessment.

- From an employment multiplier perspective, the Ohio life sciences industry generates and supports a larger employment impact on a jobs basis by supporting 2.24 jobs for every industry job compared to other Ohio sectors ranging from 1.04 to 1.74 jobs per sector job.
- From an output perspective, the Ohio life sciences industry, with a multiplier of 1.72, exceeds that of many of Ohio's traditional manufacturing sectors. It is, however, somewhat lower than both the professional, scientific, and technical services and computer and electronic product manufacturing sectors.

Table 8. Ohio Life Sciences Industry Comparison Multipliers, 2023

Ohio Industry or NAICS3 Sector	Employment Multiplier	Output Multiplier
Ohio Life Sciences Industry (multiple NAICS)	3.24	1.72
Transportation Equipment Manufacturing (NAICS 336)	2.44	1.51
Professional, Scientific, and Technical Services (NAICS 541)	1.81	1.78
Food Manufacturing (NAICS 311)	2.74	1.61
Plastics and Rubber Products Manufacturing (NAICS 326)	2.04	1.60
Machinery Manufacturing (NAICS 333)	2.13	1.64
Computer and Electronic Product Manufacturing (NAICS 334)	2.63	1.75

Source: TEconomy Partners analysis using IMPLAN State of Ohio model.

Ohio’s In-State Supply Chain to the Life Sciences Industry

Economic impact analysis models the purchases that one industry makes from all other industries in the analysis region. Within this economic impact analysis of the Ohio life sciences industry are detailed estimates of the size and involvement of other industry sectors in the Ohio economy in supplying nearly \$18 billion in products and services to the state’s life sciences industry in 2023.

Output

An examination of the Top 25 suppliers to the Ohio life sciences industry in terms of output yields a diverse in-state supply base, in part, reflecting the diversity within the life sciences industry itself (Table 9). By combining the five sectors of the life sciences industry, many of the Top 25 supplier sectors reflect standard inputs to commercial and industrial activities regardless of product or service. For example, management of companies and enterprises (i.e., corporate or administrative offices), other real estate (i.e., real estate leasing and other non-residential real estate services), employment services (i.e., temporary workers), and others are key supplier sectors to many industries. However, some like oilseed farming are supplying a key input to the agricultural feedstock and industrial life sciences sector of Ohio’s life sciences industry.

Table 9. Top 25 Supplier Sectors to the Ohio Life Sciences Industry Based on Output, 2023

Sector of Ohio Economy	Estimated Supplier Output (\$M)
Management of companies and enterprises	\$1,744.5
Oilseed farming	\$1,397.6
Other real estate	\$1,254.3
Employment services	\$722.2
Insurance carriers, except direct life	\$665.5
Truck transportation	\$573.5
Natural gas distribution	\$560.8
Warehousing and storage	\$541.3
Wholesale - Professional and commercial equipment and supplies	\$505.3
Monetary authorities and depository credit intermediation	\$486.3
Wholesale - Other nondurable goods merchant wholesalers	\$481.1
Couriers and messengers	\$396.4
Legal services	\$364.4
Management consulting services	\$331.1
Electric power transmission and distribution	\$319.7
Advertising, public relations, and related services	\$306.6

Sector of Ohio Economy	Estimated Supplier Output (\$M)
Scientific research and development services	\$300.6
Petroleum refineries	\$264.7
Data processing, hosting, and related services	\$253.9
Insurance agencies, brokerages, and related activities	\$248.6
Postal service	\$241.8
Internet publishing and broadcasting and web search portals	\$236.2
Accounting, tax preparation, bookkeeping, and payroll services	\$236.2
Wholesale - Wholesale electronic markets and agents and brokers	\$231.4
Business support services	\$227.1
All Other Suppliers (Indirect Effects)	\$4,166.4

Source: TEconomy Partners analysis using IMPLAN State of Ohio model.

Employment

The more than 85,000 jobs among Ohio’s suppliers to the life sciences industry reflect a different supporting dynamic, one that reflects uniqueness within Ohio. In terms of employment, the largest single supplier to the diverse Ohio life sciences industry is the courier and messengers sector (which includes FedEx and UPS) with nearly 9,500 employees supplying and supporting the state’s life sciences sector (Table 9). Undoubtedly, this importance within the state of Ohio stems from Ohio’s overall logistical strengths, and in this instance especially supporting Ohio’s life sciences distribution sector—7,500 of the 8,500 courier and messenger jobs are tied to the state’s life sciences distribution. Also, it is important to note that three agricultural production-related supplier sectors made it into the Top 25 overall (oilseed farming, grain farming, support activities). This indicates the importance of Ohio-based farm production in support of an industry beyond food processing/food product manufacturing.

Table 10. Top 25 Supplier Sectors to the Ohio Life Sciences Industry Based on Employment, 2023

Sector of Ohio Economy	Estimated Supplier Employment
Couriers and messengers	9,488.6
Management of companies and enterprises	6,800.1
Employment services	6,372.5
Other real estate	6,088.6
Warehousing and storage	4,923.7
Oilseed farming	3,344.1
Business support services	2,690.9
Truck transportation	2,485.9
Postal service	2,394.0
Management consulting services	2,036.3
Legal services	1,632.6
Wholesale - Professional and commercial equipment and supplies	1,475.8
Services to buildings	1,435.3
Accounting, tax preparation, bookkeeping, and payroll services	1,407.1
Wholesale - Wholesale electronic markets and agents and brokers	1,372.7
Support activities for transportation	1,288.4
Scientific research and development services	1,269.5
Investigation and security services	1,253.3
Advertising, public relations, and related services	1,214.9
Wholesale - Other nondurable goods merchant wholesalers	1,194.0
Architectural, engineering, and related services	1,153.1
Full-service restaurants	1,148.4
Office administrative services	1,143.9
Grain farming	1,066.8
Support activities for agriculture and forestry	1,010.5
All Other Suppliers (Indirect Effects)	19,618.1

Source: TEconomy Partners analysis using IMPLAN State of Ohio model.

Regional Impacts of Ohio's Life Sciences Industry

To further characterize the economic impacts of Ohio's life sciences industry, TEconomy, using the employment data described in Section I, Table 3, also estimated distinct regional economic impacts for each of the seven JobsOhio regions (Figure 9).

Figure 9. JobsOhio Regions Used for Ohio Life Sciences Industry Regional Impact Analysis



Source: JobsOhio

This regional economic impact estimation was performed using a Multi-Regional Input-Output (MRIO) modeling approach. Performing the impact analysis in this manner also estimates the indirect (supplier) and induced effects that one region's firms will purchase from the other region's firms (e.g., a Northwest Ohio life sciences firm purchasing from a Central Ohio supplier).

From an employment impact perspective, while Northeast Ohio currently has the largest life sciences industry employment, Central Ohio has the largest employment multiplier at 3.71 (Table 11). For every single life sciences job in the Central Ohio region, the state's life science industry supports 2.71 additional jobs in the Central Region.

Table 11. Regional Economic Impacts of the Ohio Life Sciences Industry, 2023

Impact Metric/ JobsOhio Region	Employment			Output (\$M)			State & Local Tax Revenues (\$M)	
	Direct	Total	Multiplier	Direct	Total	Multiplier	Direct	Total
Central Ohio	18,041	66,878	3.71	\$13,114.1	\$22,804.8	1.74	\$321.6	\$747.9
Lake to River Ohio	800	2,333	2.92	\$422.0	\$684.4	1.62	\$16.7	\$28.4
Northeast Ohio	20,016	60,991	3.05	\$9,576.8	\$17,232.3	1.80	\$283.6	\$612.0
Northwest Ohio	4,112	14,237	3.46	\$3,317.9	\$5,488.5	1.65	\$95.6	\$184.8
Southeast Ohio	1,448	3,363	2.33	\$736.0	\$1,096.0	1.49	\$19.8	\$37.0
Southwest Ohio	12,592	37,834	3.00	\$7,415.7	\$12,204.8	1.65	\$207.2	\$397.9
West Ohio	6,756	20,670	3.06	\$3,808.6	\$6,517.6	1.71	\$115.6	\$220.0
State of Ohio	63,765	206,304	3.24	\$38,391.2	\$66,028.3	1.72	\$1,060.2	\$2,226.6

Source: TEconomy Partners analysis using IMPLAN State of Ohio county models.

Considering output impacts, the Central Ohio region is estimated to generate more than \$13.1 billion in direct output impacts, while supporting the state’s life sciences industry with more than \$22.8 billion in total economic activity. For every \$1 of output generated by the Central Ohio region’s life sciences industry an additional \$0.74 in output is generated to support the state’s life sciences industry. While Northeast Ohio has the second-largest direct and total output impacts, it has the largest output multiplier of 1.80.

The results shown in Table 11 reiterate a central message of this report, that even though the “three C’s” corridor represents significant life sciences industry employment and economic impact, the industry is a driving force across all the regions of Ohio’s economy.



III. Assessing Ohio’s Innovation Ecosystem for Life Sciences Development

Successful life sciences clusters require and are built upon a high-functioning ecosystem that supports both basic and applied research and development with the appropriate resources, protects intellectual property, and allocates capital to promising and innovative new, emerging, and existing businesses.

Each of these elements, combined with access to, and a strong pipeline for well-aligned talent with the appropriate skills mix and levels, combine to determine the industry’s success and economic outcomes.

The life sciences have unique development requirements and differ from other advanced industries in several key ways. Cluster development in the life sciences calls for especially close ties between industry, clinical care, and academic research and development, with at least one study showing, for example, that a majority of the most transformative drugs in recent decades resulted from collaborations between industry and academia.¹⁰ Industry innovations are driven by complex science and rigorous regulatory oversight, involving clinical testing and post-approval monitoring. Due in part to these long time horizons, the industry often faces a significant “valley of death” between discovery and clinical testing that requires funding to see it through and survive as a firm. In addition, highly specialized skills and lab requirements can pose hurdles and challenges. Because of these unique dynamics, it is vital for Ohio to continually track the performance and evolution of its innovation ecosystem for industry development.

This section of the report assesses this evolution and compares Ohio’s performance and position against both the nation and the set of comparison states in several key life science-related ecosystem elements shown in Figure 10.

Figure 10. Key Elements Assessed for Ohio’s Life Sciences Innovation Ecosystem

Research & Development	Innovation	Growth Capital
<ul style="list-style-type: none">• NIH Funding• Academic R&D• Industrial R&D	<ul style="list-style-type: none">• Patent Awards• SBIR Awards• Clinical Trials Activity	<ul style="list-style-type: none">• Venture Capital Funding

¹⁰ Tufts Center for the Study of Drug Development, Public and Private Contributions to the R&D of the Most Transformational Drugs of the Last 25 Years, January 2015.

RESEARCH

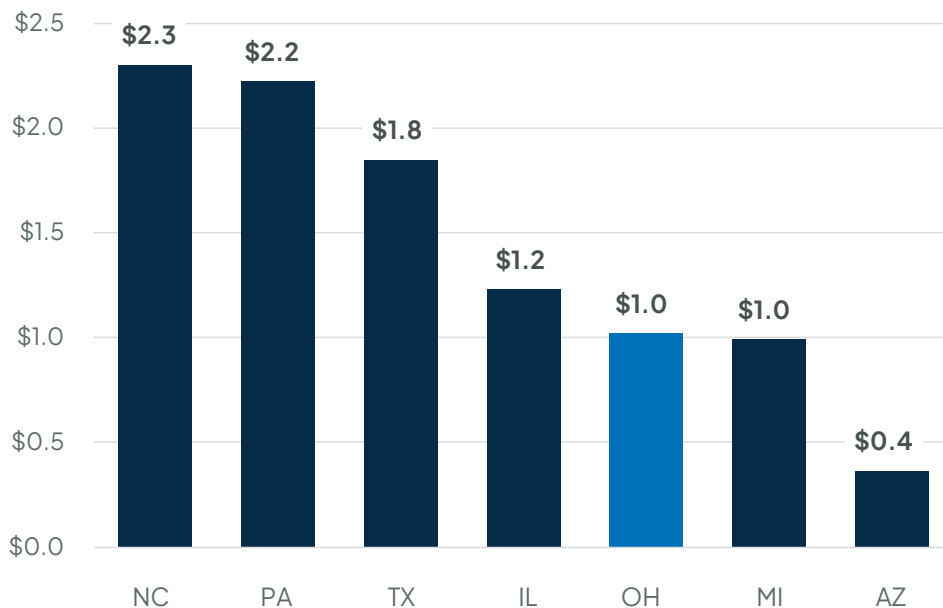
NIH Funding

Federal funding for life science-related research and discovery is a critical element to advance a science-driven industry. Several agencies fund life sciences research at U.S. colleges and universities, with the National Institutes of Health (NIH) recognized as the “gold standard” for the largest component of bioscience research—biomedical. NIH also funds research at hospitals and other biomedical research institutions.

This key source of federal funding supports innovation and early-stage, foundational research that fuels the pipeline for new biomedical technologies, therapeutics, vaccines, and other life-saving solutions. Further, NIH funding supports talent development for the next generation of scientists and clinicians, it supports public-private partnerships when private sector companies step in to accelerate discoveries to commercial applications, it generates its own significant economic impacts through R&D spending, and it enhances and maintains national competitiveness.

Ohio institutions received \$1 billion in NIH funding in 2023, an impressive total that ranks Ohio 10th nationally among all states. Four of those leading ten states are among the comparison states and shown in Figure 11 where Ohio, on the sheer basis of funding totals, ranks fifth among the benchmarks.

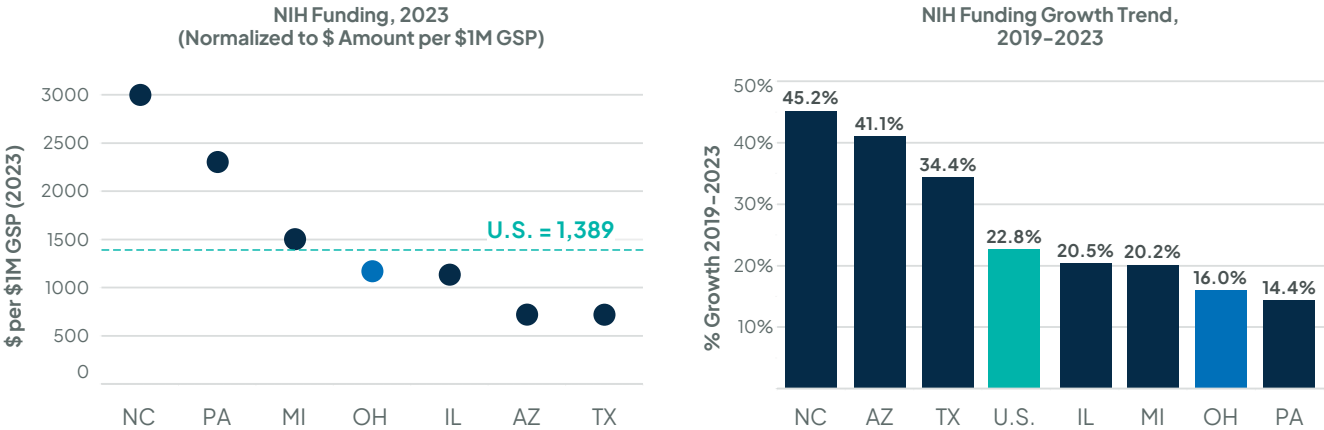
Figure 11. NIH Funding for Ohio and Comparison States, 2023 (\$ in Billions)



Source: TEconomy Partners’ analysis of NIH RePORTER data.

A normalized metric can and should be considered for understanding funding levels relative to the size of each state’s overall economy—calculated and shown in Figure 12 as NIH funding per \$1M in Gross State Product or “GSP”. On a normalized basis Ohio is, in fact, just below the national average in NIH funding relative to its overall economy and positioned in the middle of the pack among the comparison states. At the same time, Ohio’s growth in NIH funding has lagged that for the U.S. overall and is well behind leading growth states of North Carolina, Arizona, and Texas.

Figure 12. NIH Funding Relative to Size of State Economy and Growth Since 2019



Source: TEconomy Partners’ analysis of NIH RePORTER data; GSP data from BEA.

Ohio’s Challenges: NIH Funding and Growth

On a normalized basis Ohio is just below the national average in NIH funding relative to its overall economy and positioned in the middle of the pack among the comparison states. At the same time, Ohio’s growth in NIH funding has lagged that for the U.S. overall and is well behind leading growth states.

Academic Life Sciences R&D

Universities and university-led R&D in the life sciences play an important role in scientific discovery and innovation that helps to fuel the industry’s innovation ecosystem. The life sciences and the varied disciplines they encompass, represent a majority of the nation’s academic R&D activity and expenditures—60% in 2022, the latest year of data available. These disciplines, structured in the National Science Foundation’s (NSF) annual Higher Education R&D (HERD) Survey, span and include agricultural sciences, biological and biomedical sciences, health sciences, biomedical engineering, natural resources and conservation, and other life sciences fields. Among these fields, health sciences represents the largest component and is the primary driver of R&D spending and trends at the nation’s medical schools and biomedical research institutions.

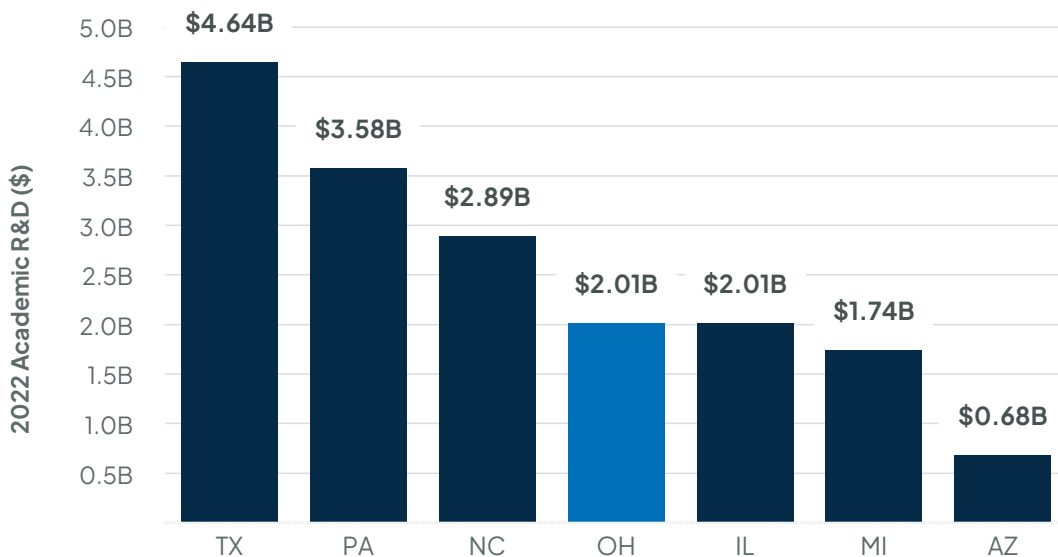
Ohio’s life science-related academic R&D expenditures have grown significantly faster than the U.S. overall and have outpaced growth for all of the comparison states since 2019.

Ohio’s research universities spent \$2 billion in life science-related R&D in 2022, a significant total that places the state 8th among all U.S. states. Ohio’s large academic research complex is led by the states’ leading medical schools and life sciences research institutions, including:

- The Ohio State University (OSU) at \$902 million in 2022
- University of Cincinnati (UC) at \$511 million in 2022
- Case Western Reserve University (CWRU) at \$424 million in 2022.

The state’s \$2.01 billion in R&D activity ranks fourth among the comparison states, matching the level for Illinois but significantly behind the level of spending seen in Texas, Pennsylvania, and North Carolina (Figure 13).

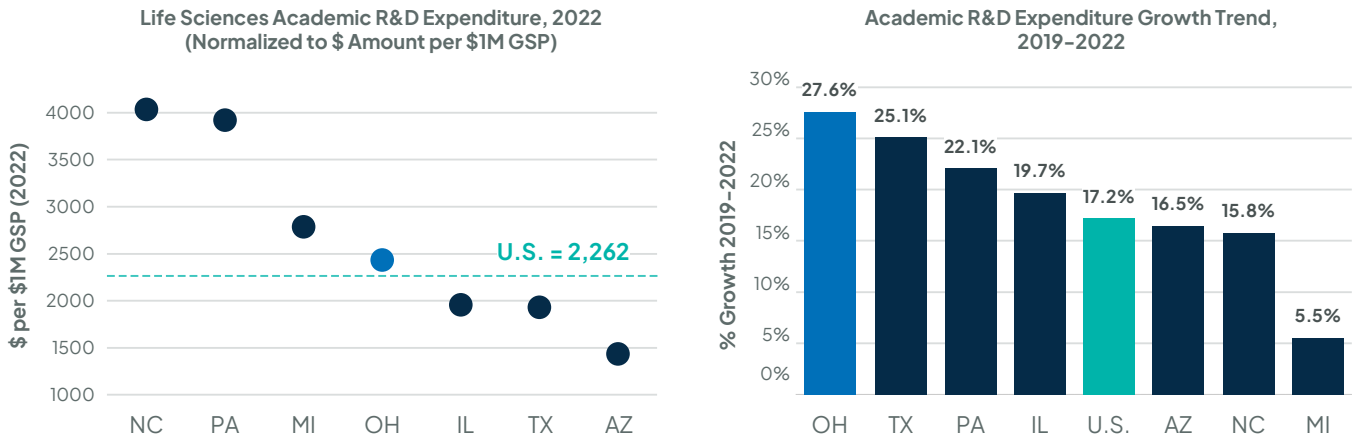
Figure 13. Life Science-related Academic R&D Expenditures, 2022 (\$ in billions)



Source: TEconomy Partners’ analysis of NSF NCSES Higher Education R&D Survey data; GSP data from BEA.

Ohio's life science-related academic R&D expenditures have grown significantly faster than the U.S. overall and have outpaced growth for all of the comparison states since 2019 (Figure 14). This nearly 28% growth is 10 percentage points higher than the national average, a strong performance for Ohio in recent years. On a normalized basis, Ohio's academic R&D expenditures are greater than the national average relative to the state's GSP (Figure 14). Though Ohio is positioned behind the competitive set of comparison states, it is clearly a top-tier state in university life sciences R&D, and it is a leader in recent growth.

Figure 14. Life Science-related Academic R&D Expenditures Relative to Size of State Economy and Growth Since 2019



Source: TEconomy Partners' analysis of NSF NCSSES Higher Education R&D Survey data; GSP data from BEA.

Wet Lab Space: An Identified Ecosystem Gap for Early-Stage Life Sciences Companies in Ohio

While not a focus of this ecosystem assessment, OLS has been hearing from its members and life science industry stakeholders a consistent ecosystem gap in the state around a lack of wet lab space for private companies. Wet labs are facilities equipped with experimental and safety features to facilitate research that involves liquid chemicals and biological hazards and are a vital ecosystem requirement for life sciences research and manufacturing. This deficiency has the potential to constrain industry growth, particularly among promising, innovative small and mid-sized companies in early-stage development.

OLS and its ecosystem partners in Greater Columbus commissioned a recent study by Shift Health to assess the need for wet lab space in the Columbus Region. The study and resulting report confirm the demand for lab space is there in this emerging regional life sciences hub, but that the "wet lab space supply for private companies in the Columbus Region is effectively non-existent."¹¹ The report cites a recent ranking by JLL where Columbus ranked 20th in terms of its overall supply of lab space, lagging behind numerous regional peers and competitors.¹²

To meet the demand and to ensure early-stage life sciences startups and spinouts are not leaving the region due to this constraint, the Shift Health report recommends considering a coordinated, long-term strategy for wet lab space development. The report makes recommendations for near-term approaches to addressing the gaps.

¹¹ Shift Health, "Enabling Innovation: Unpacking the Urgent Need for Wet Lab Space in the Columbus Region," January 2024.

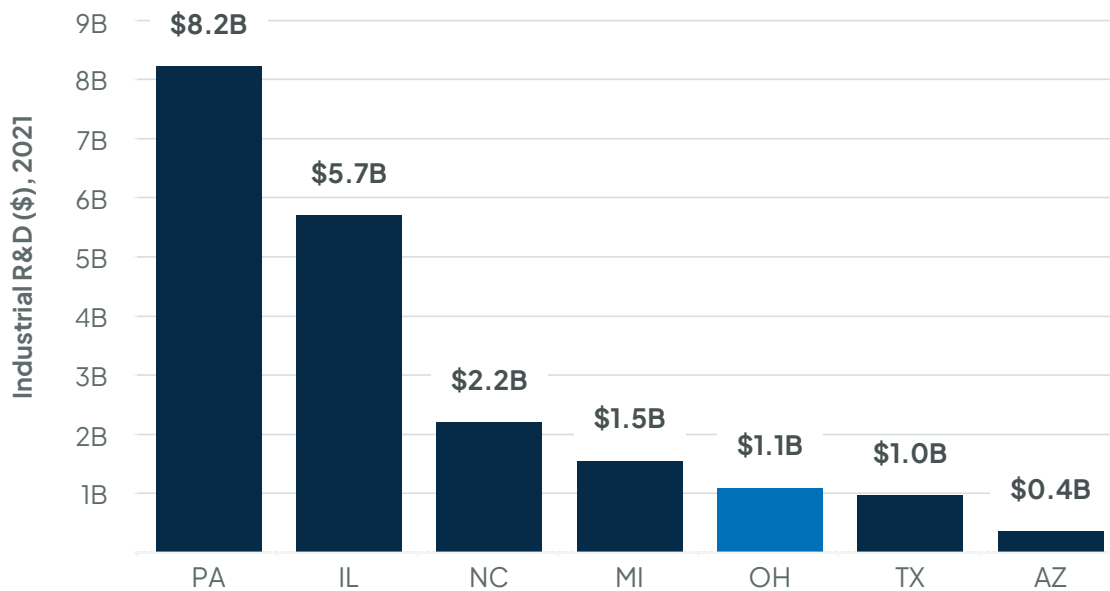
¹² Jones Lang LaSalle IP (JLL), Life Sciences Outlook, April 2023.

Industrial Life Sciences R&D

Leading companies in advanced industries, like the life sciences, tend to be R&D-intensive to drive leading edge innovation. The life sciences industry is advancing new technologies across an impressive range of markets spanning agriculture and food; bio-based industrial solutions in energy, chemicals, plastics, and more; biopharmaceuticals; MedTech and HealthTech; and others. The extent to which companies select states for siting their R&D establishments and operations is often a signal of the availability of high-skilled STEM talent, proximity to research partners such as universities and other research institutions, and related factors. While the survey data regarding industrial R&D across U.S. industries and states tends to lag in its timeliness—the latest data, for example, are only available through 2021—they nevertheless offer another useful vantage of innovation activities rooted in a given state.

Ohio-based companies and operations performed \$1.1 billion in industrial R&D in life science-related sectors in 2021. Nearly two-thirds of this activity in Ohio is within the pharmaceutical industry (\$702 million), with the other significant component in medical supplies and equipment (\$296 million). Pharmaceuticals represent one of the nation's most R&D-intensive industries, and as in Ohio, account for the vast majority of the life science-related industrial R&D in comparison states such as Pennsylvania (93% of life sciences R&D) and Illinois (79%), both states that are home to significantly greater industrial R&D spending relative to Ohio by orders of magnitude (Figure 15).

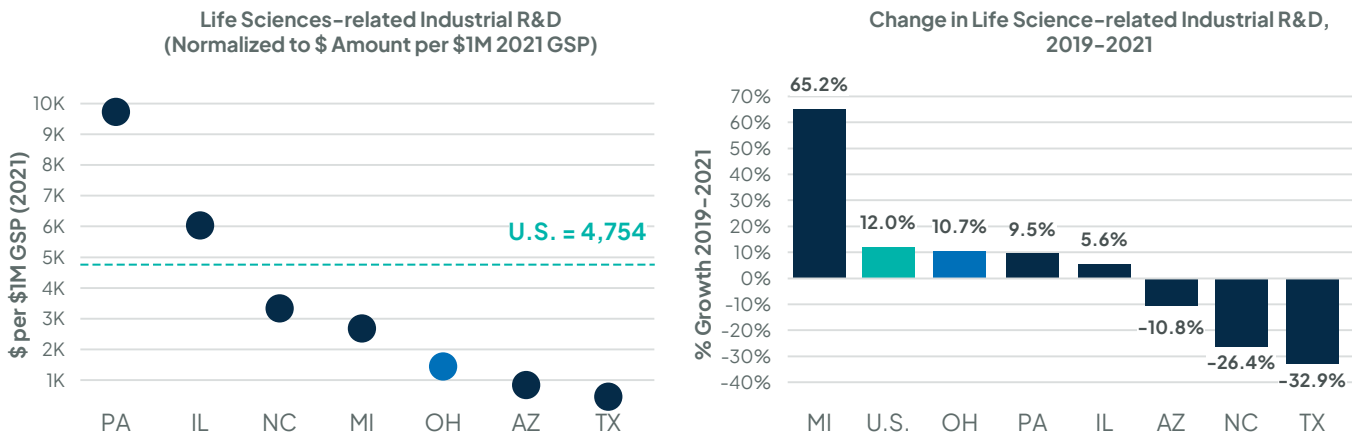
Figure 15. Life Science-related Industrial R&D Expenditures, 2021 (\$ in billions)



Source: TEconomy Partners' analysis of National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2021.

Ohio's level of life science-related industrial R&D is well below the national average on a normalized, per GSP basis (Figure 16). Among the comparison states, Ohio ranks among the lowest levels under this same, normalized frame. On a positive note, the state has seen double-digit growth in its industrial R&D expenditures of nearly 11% since 2019, just slightly below the nation's 12% growth and above most of the benchmark states.

Figure 16. Life Science-related Industrial R&D Expenditures Relative to Size of State Economy and Growth Since 2019



Source: TEconomy Partners' analysis of National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2021.

Ohio's Challenges: Life Sciences Industrial R&D Activity

Ohio's level of life science-related industrial R&D is well below the national average on a normalized, per GSP basis. Among the comparison states, Ohio ranks among the lowest levels under this same, normalized frame.

INNOVATION MEASURES AND OUTCOMES

Life Science–Related Patent Awards

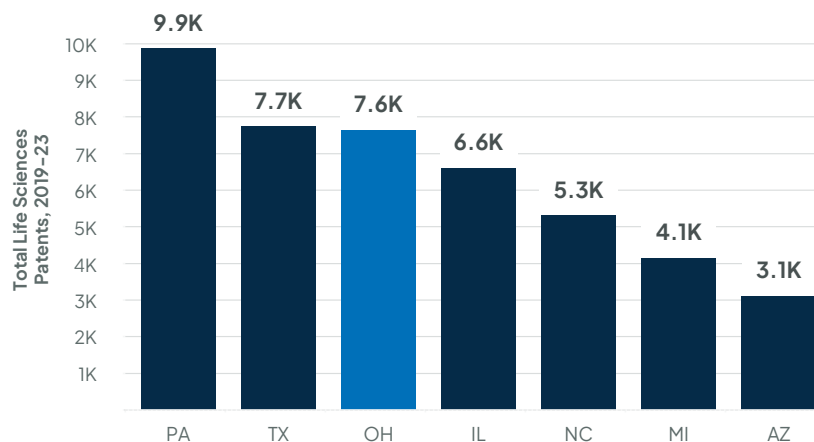
Commercial innovation in the life sciences is uniquely challenging. The length of time and levels of resources required to successfully navigate the research and development and regulatory requirements of a commercial therapeutic, medical device, or a biobased product is daunting. Tufts University, for example, has estimated the cost to develop an FDA-approved new prescription drug at more than \$2.5 billion, and finds that drug development often takes more than a decade. Robust and enforced legal protections of intellectual property, in the form of patents, are necessary to encourage and incent these types of investments both in the U.S. and globally.

Ohio inventors are very active in patenting and from 2019 through 2023 they are associated with more than 7,600 patent awards in life science–related technology areas (Figure 17). This level of activity places Ohio among the leading states in the comparison set. In terms of patent technology classes or segments, Ohio’s innovation activities as signaled by patents are highly focused in medical and surgical devices which represent 70% of all awarded patents in the life sciences (Table 12). This volume of patent activity places Ohio first in this technology area among the comparison states. Ohio is also quite active in drug and pharmaceutical patenting, the next-largest volume exceeding 1,100 since 2019. And while significantly lower in volume, Ohio inventors lead the comparison states in the new and emerging area of biopolymers, an area in which the state has focused its innovation and cluster building focus to be awarded a prestigious and highly competitive regional “Tech Hub” award.

Among the leading companies and institutions patenting in life science technology classes and segments during this 5-year period (each with at least 100+ patent awards), include:

- Ethicon (Endo-Surgery)
- Cilag GmbH International
- Procter & Gamble Company
- Case Western Reserve University
- The Cleveland Clinic Foundation
- The Ohio State University
- Bayer Plant Science (Monsanto Technology)

Figure 17. Life Sciences Patent Awards, Ohio and Comparison States, 2019–23 (Cumulative Totals)



Source: U.S. Patent and Trademark Office, TEconomy calculations.

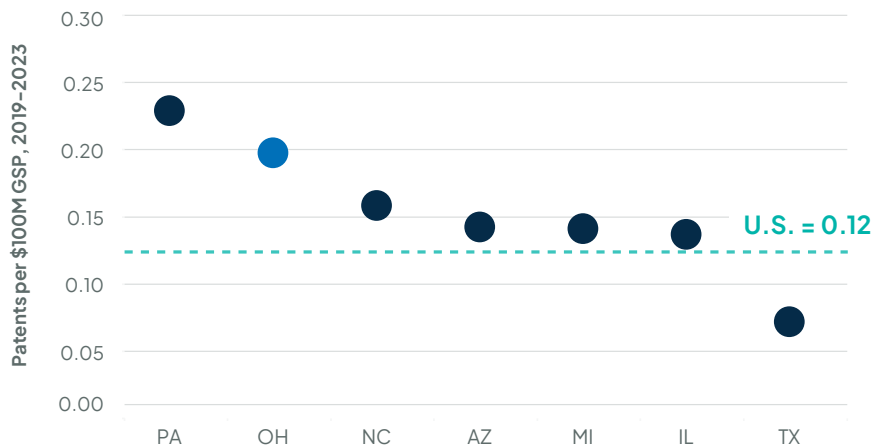
Table 12. Life Sciences Patent Awards, by Technology Segment, Ohio and Comparison States, 2019–23, Cumulative Totals and Rankings Among the Comparison States

State	Metric	Agricultural Chemicals and Fertilizers	Biochemistry	Bioinformatics & Health IT	Biological Sampling & Analysis	Biopolymers	Drugs & Pharmaceuticals	Genetic Engineering	Medical & Surgical Devices	Microbiology & Enzymes	Novel Plant Types	Novel Animal Types	Totals
Ohio	Number	83	217	217	201	16	1,121	133	5,323	131	181	5	7,628
	Rank Vs. BMs		5	6	5	4	1	3	5	1	6	4	3
Arizona		7	7	7	5	4	7	6	7	5	7	N/A	7
Illinois		4	3	1	3	5	4	4	4	3	1	5	4
Michigan		6	5	6	7	2	6	7	5	6	2	5	6
North Carolina		1	4	4	6	5	5	1	6	2	3	3	5
Pennsylvania		2	1	2	2	7	1	2	2	4	6	2	1
Texas		3	2	3	1	3	2	3	3	1	5	1	2

Source: U.S. Patent and Trademark Office, TEconomy calculations.

Ohio’s strong position in patent activities is further illustrated when normalized relative to the size of its economy. On a per GSP basis, the state is well above both the national average and most comparison states—ranking 2nd among the comparison set in this measure of innovation activity and outcomes (Figure 18).

Figure 18. Life Science–related Patent Awards Relative to Size of State Economy



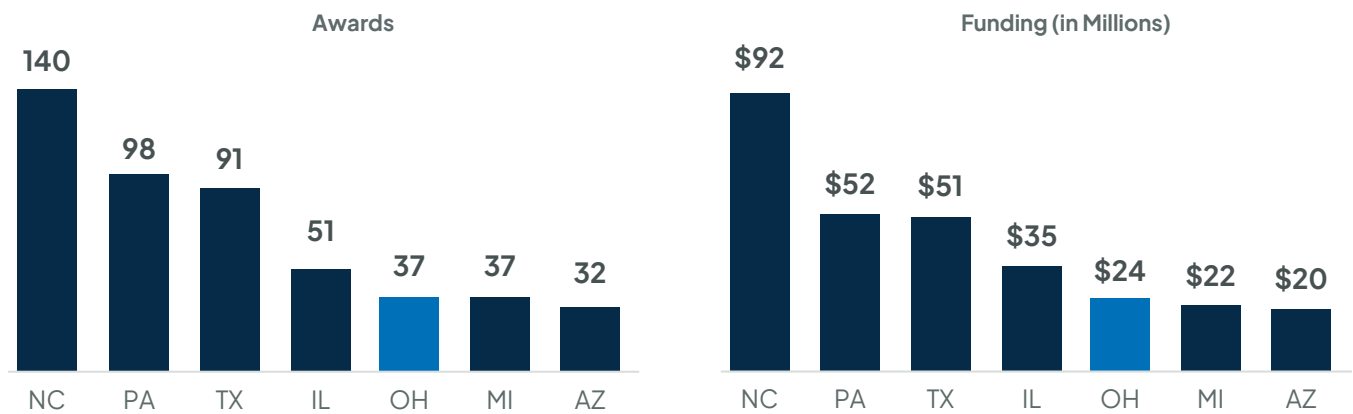
Source: U.S. Patent and Trademark Office, TEconomy calculations.

Federal SBIR/STTR Awards

For innovative, emerging life sciences startups and smaller firms, access to capital is critical to advance product development and commercialization. Access to seed- and early-stage capital is especially important for life sciences companies developing products and in some cases conducting and meeting rigorous pre-clinical and clinical testing requirements. In addition to privately-funded risk capital, profiled in the next section, federal Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards represent a key source of non-dilutive innovation capital.

In 2023, Ohio's small, innovative life sciences firms received 37 SBIR and STTR awards from the Department of Health and Human Services (HHS) that totaled \$24 million. At these levels, Ohio lags behind most of the comparison states in the latest year (Figure 19).

Figure 19. Life Science-related HHS SBIR/STTR Awards and Funding (\$ in millions), 2023

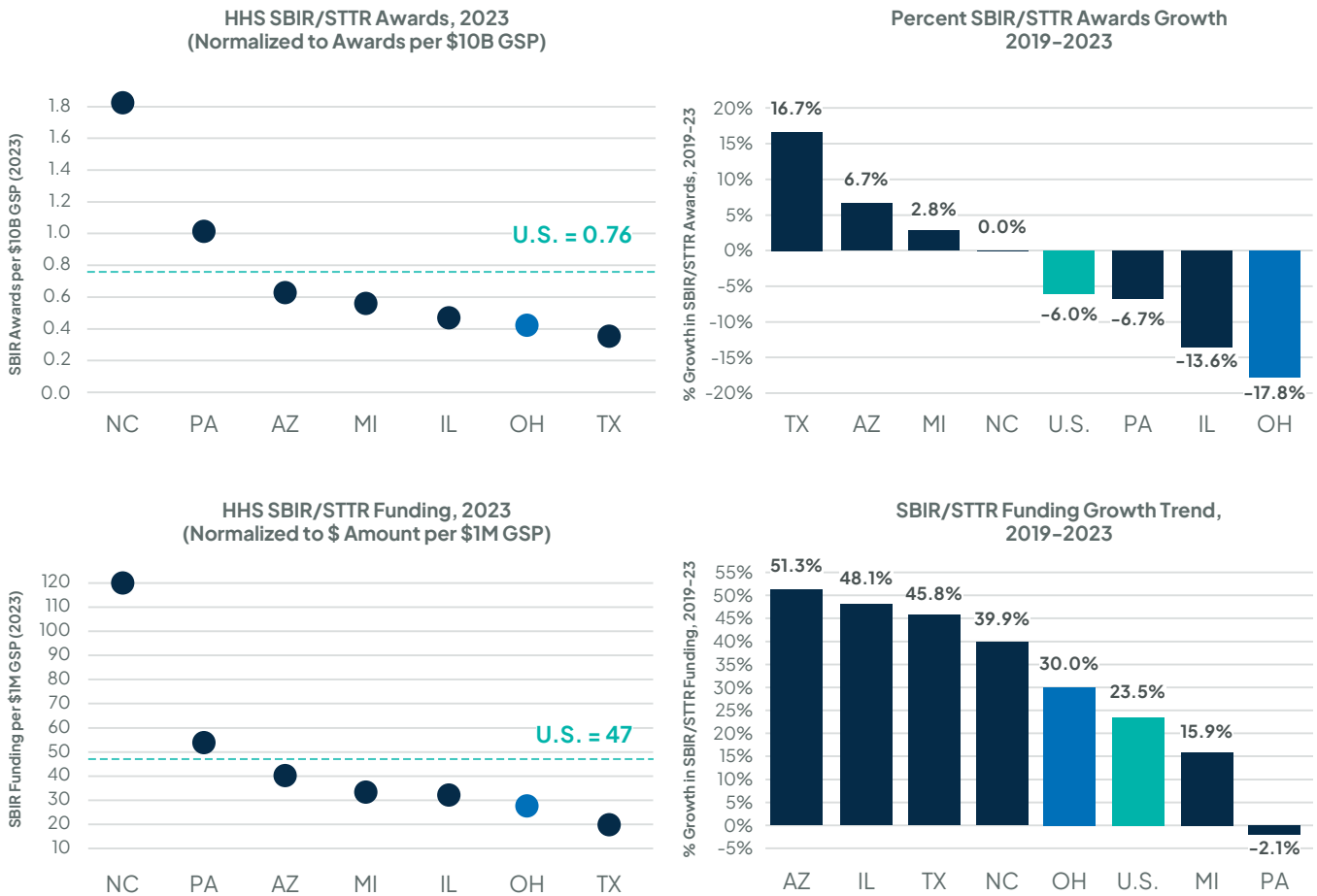


Source: TEconomy Partners' analysis of NIH RePORTER data.

On a normalized, per GSP basis, Ohio lags the nation and nearly all comparison states in award levels (Figure 20). The state has seen a significant decline in the number of SBIR/STTR awards since 2019 (-18%), behind all comparison states. It is important to note that 33 states have some form of SBIR/STTR matching program; currently, Ohio does not.

Shifting to funding levels reveals a similar situation where Ohio is behind most all comparison states and the national average in its level of SBIR/STTR award funding per \$1 million in GSP. And while the state has seen growth in funding since 2019, it has not kept pace with most of the benchmark states.

Figure 20. Life Science-related HHS SBIR/STTR Awards and Funding Relative to Size of State Economy and Growth Since 2019



Source: TEconomy Partners' analysis of NIH RePORTER data; GSP data from BEA.

Ohio's Challenges: Federal SBIR/STTR Awards to Life Sciences Companies

Whether in terms of sheer levels, recent growth, or normalized on a per GSP basis, Ohio is lagging behind nearly all of the comparison states and U.S. averages in HHS-funded SBIR and STTR awards to its small innovative life sciences companies.

OLS has recognized this challenge and is actively working to establish a matching grants program for SBIR and STTR grant recipients. These types of matching efforts have been successful in 33 other states and support small innovative company efforts to enhance their impact, encourage businesses to develop and remain within the state, to de-risk projects aimed at commercial readiness, and to attract further private investments.

Clinical Trials Activity

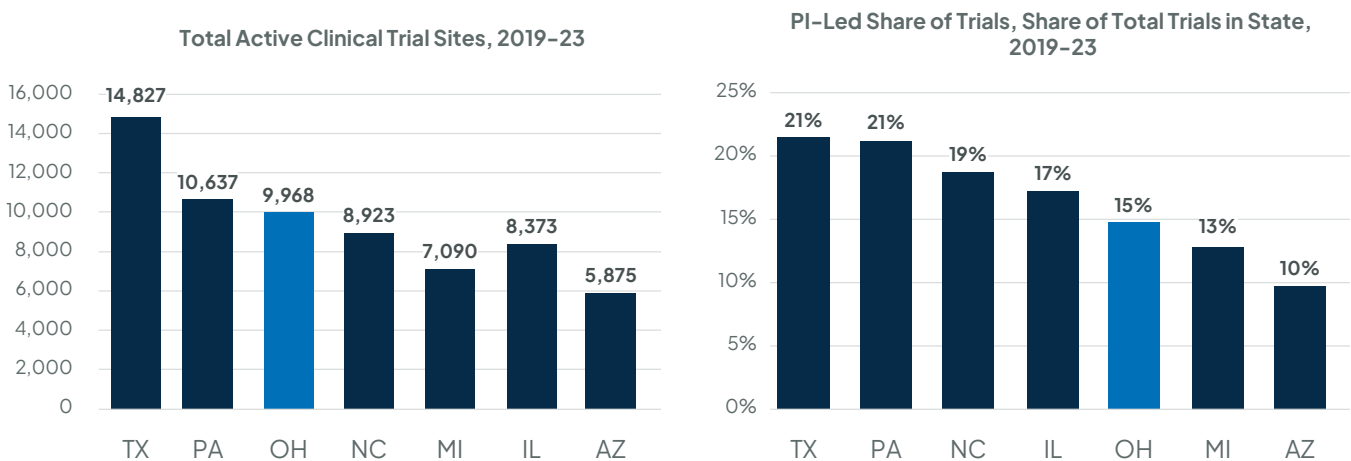
Clinical testing represents a unique context and challenge for life sciences innovation. Strict FDA regulatory oversight of investigational therapeutics as well as novel and life-sustaining types of medical devices require testing in human subjects to demonstrate safety and efficacy. Ohio, with its outsized hospitals and healthcare services sector and recognized clinical excellence, serves as a major hub for clinical trials activity. The state has hosted at least one trial site for nearly 10,000 active and unique clinical trials during the 2019 through 2023 period—a level that places Ohio among the upper tier of the comparison states (Figure 21).

Across nearly 10,000 clinical trials with at least one site in Ohio since 2019, nearly 1,500 or 15% were led by an Ohio Principal Investigator—an indicator of locally rooted innovations.

In addition to serving as a major host for clinical trials sites, Ohio’s institutions are often acting as the lead sponsor and Principal Investigator (PI)—a key indicator of locally rooted innovations advancing to the clinical research and translational stage. Across the 9,968 trials with at least one site in Ohio since 2019, nearly 1,500 or 15% were led by an Ohio PI. This significant share of state-rooted innovation spans the following leading institutions, with their respective counts of PI-led trials from 2019-23 in parentheses:

- Cleveland Clinic (281)
- Cincinnati Children’s Hospital (265)
- Ohio State University (263)
- Ohio State Comprehensive Cancer Center (160)
- Case Comprehensive Cancer Center (106)
- University of Cincinnati (100)

Figure 21. Clinical Trials Sites and In-State, PI-Led Share of Trials, Ohio and Comparison States, 2019–23



Source: TEconomy Partners’ analysis of clinicaltrials.gov database.

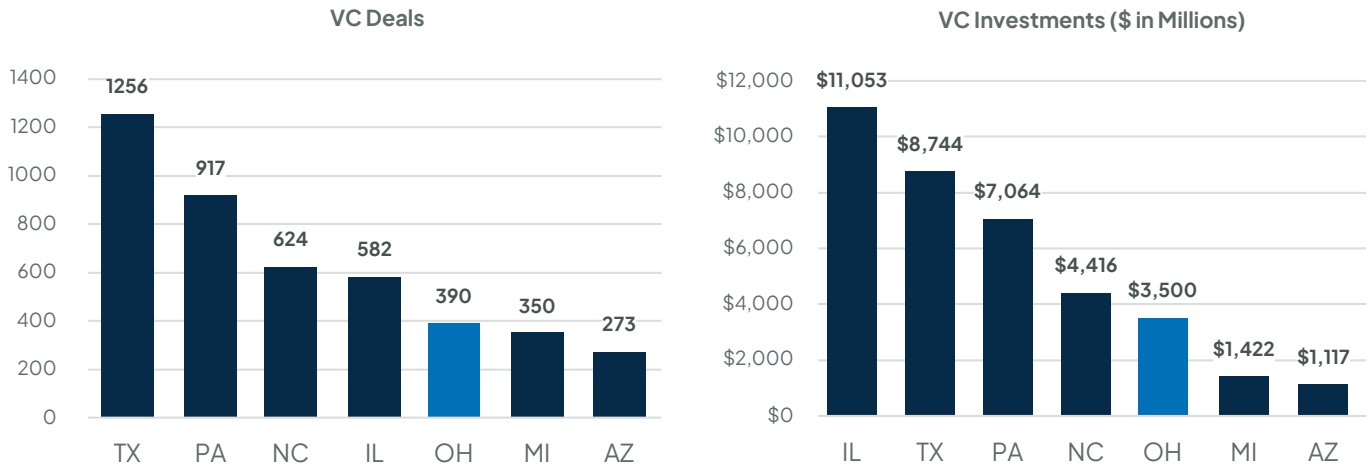
GROWTH CAPITAL

Venture Capital Funding to Life Sciences Companies

Access to capital is especially vital for R&D-intensive life sciences companies facing long time horizons to guide innovations through to commercial outcomes and steady revenues. In particular, seed- and early-stage companies require funding, often in multiple tranches or rounds to sustain their product development as well as to conduct the rigorous pre-clinical and clinical testing required to meet industry regulations.

From 2019 through 2023, Ohio life sciences firms received \$3.5 billion in cumulative investments across 390 individual deals (Figure 22). Among the comparison states Ohio is among the lower tier, ranking 5th in both measures of investment activity in emerging, high-growth potential companies.

Figure 22. Life Science-Related VC Deals and Investment, Cumulative Totals, 2019–23



Source: TEconomy Partners' analysis of PitchBook Data.

The leading recipients of VC investments in Ohio's life sciences industry are shown in Table 13. Most of these firms have received more than one round of funding to reach the investment totals that span \$50 million or more since 2019. As the deal range spans a relatively wide, 5-year period, the current operating status of these companies can vary. For example, Olive AI, a fast-rising digital health company with the leading value of VC funding during this period, wound down its operations in 2023, selling off key components. Ohio-based companies receiving VC funding span numerous innovation areas of the life sciences, from gene therapy development to drug delivery and drug development for oncology, to varied health IT and telehealth platforms, the breadth of technology areas among recipient firms is impressive.

Table 13. Leading Ohio Life Sciences Companies in VC Investments, 2019–23

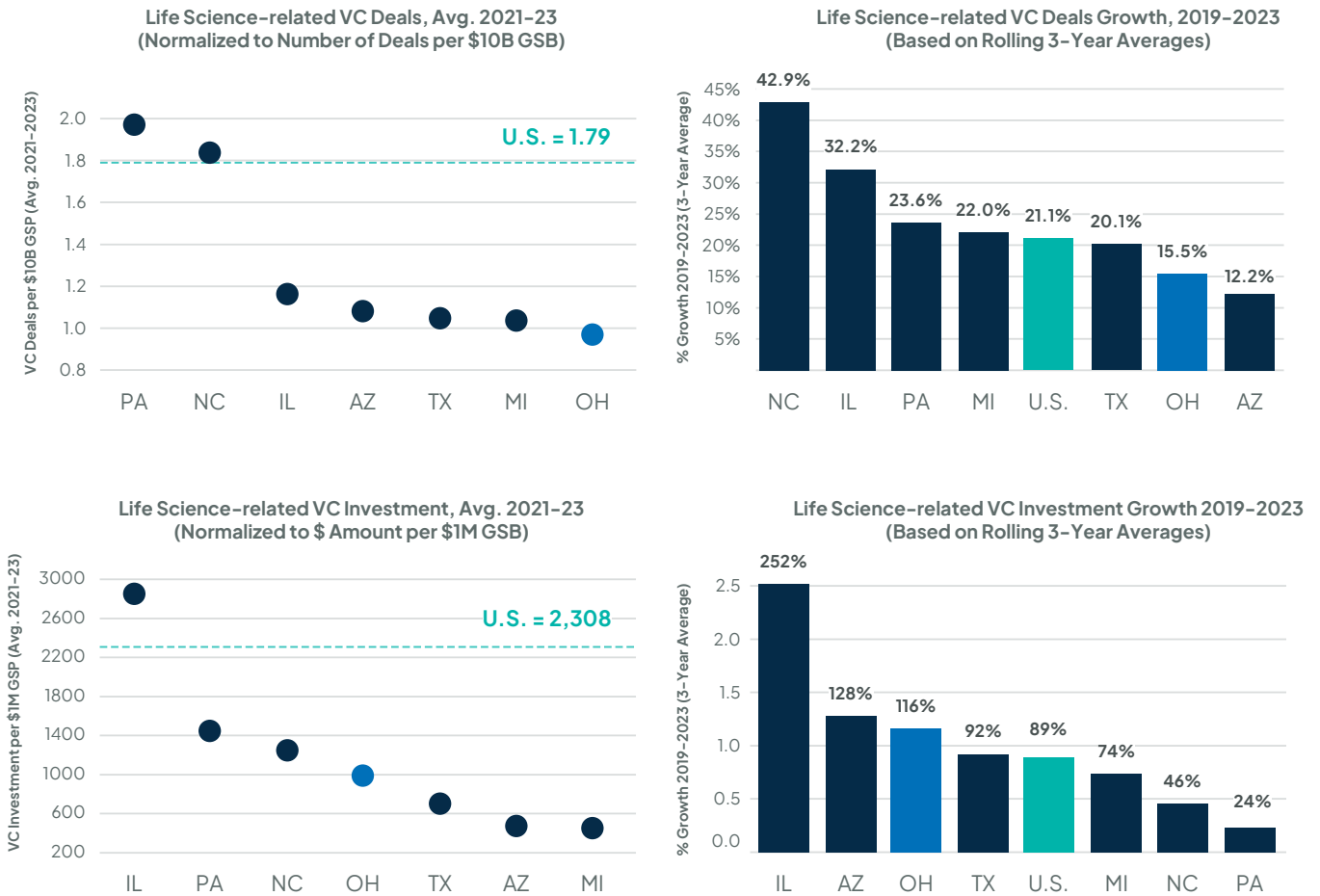
Company Name	Description	Deal Years	Total Deals	Total Investment (in millions)
Olive	process automation software for healthcare	2020–2021	4	\$784
AmplifyBio	biotechnology R&D platform	2021–2023	3	\$350
Forge Biologics	gene therapy development	2020–2022	3	\$250
Enable Injections	developer of drug delivery devices	2022	1	\$215
Beam	dental hygiene data platform	2019, 2021, 2023	3	\$176
American Nitrile	manufacturer of nitrile gloves	2021–2022	3	\$173
Kurome Therapeutics	cancer drug development	2020–2021, 2023	3	\$79
CinRx Pharma	biotech consulting and investment	2020	1	\$67
Sermonix Pharmaceuticals	cancer drug development	2019, 2021	2	\$66
AndHealth	telehealth platform	2022	1	\$57
Circulo	healthcare and insurance data platform	2021	1	\$50

Source: TEconomy Partners’ analysis of PitchBook Data.

Ohio’s volume of VC deal flow and funding in life sciences companies has expanded in recent years. Recognizing the relatively erratic nature and trends in year-to-year VC investment activity, an approach is taken to smooth the trend analysis—namely, this growth analysis utilizes rolling 3-year averages to assess growth trends. This approach finds Ohio growing by nearly 16% in growth of VC deal activity, and by 116% in growth of VC investment levels over the 2019 to 2023 period (Figure 23). This represents above-average growth in funding levels, outpacing the U.S. and most comparison states. However, it represents relatively slower growth in deal activity.

When considering Ohio’s volume of life science-related VC deal flow and funding, normalized relative to GSP, the state is significantly below national averages. In deal activity, Ohio ranks last among the benchmark states. In funding levels, Ohio is among the middle tier of states. While not included in the comparison set, it is important to recognize that life sciences VC funding is highly concentrated in coastal states, particularly in leading global hubs in Massachusetts and California. This extremely high concentration in funding tends to skew national average levels upward. Still, Ohio sits well behind Illinois, Pennsylvania, and North Carolina on a per GSP basis, and significantly behind these states and Texas in terms of sheer funding levels.

Figure 23. Life Science–related VC Deals and Investment Relative to Size of State Economy and Growth Since 2019



Source: TEconomy Partners’ analysis of PitchBook Data; GSP data from BEA.

Ohio’s Challenges: Life Sciences VC Funding

When considering Ohio’s volume of life science-related VC deal flow and funding, normalized relative to GSP, the state is significantly below the national averages. In deal activity, Ohio ranks last among the benchmark states. In funding levels, Ohio is among the middle tier of states.

Summarizing Ohio’s Innovation Ecosystem Performance for Life Sciences Development

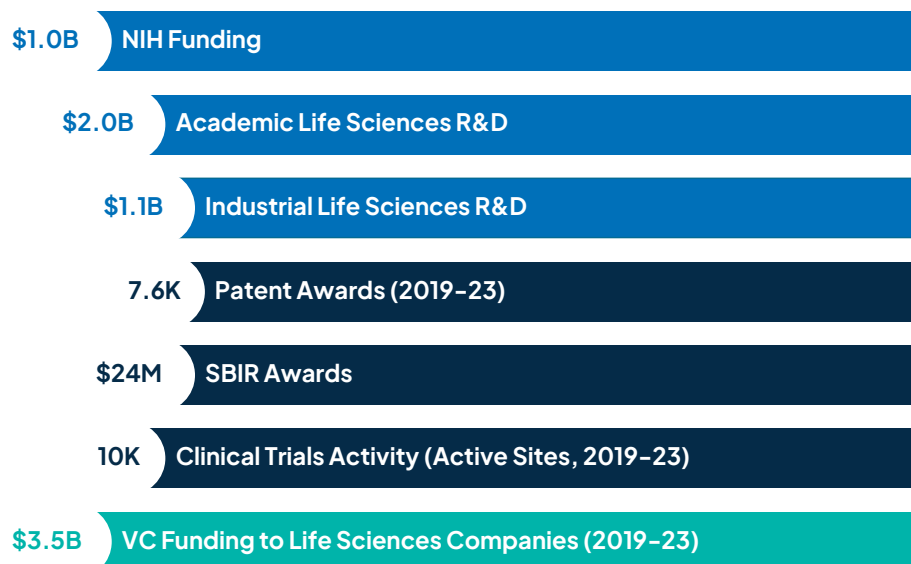
Considered all together, Ohio’s innovation ecosystem represents a significant base of research, innovation, and funding activity (Figure 24). **In terms of areas of strength for Ohio and where the state stands out relative to national and benchmark states, key findings and takeaways include:**

- In life sciences academic R&D, with a base of \$2 billion in activity in the latest year, Ohio has above-average levels of research expenditures. Ohio has seen rapid growth in university R&D since 2019, outpacing the national average and all six comparison states.
- In innovation activities, Ohio is well above the national average in its patenting activity in life science-related technologies relative to its GSP. The state has a relatively high level of clinical trials site activity.
- In growth capital, Ohio has seen above-average growth in VC investments in life sciences companies.

In terms of identified challenges for Ohio, key findings include:

- Capital/Funding: relative to U.S. averages, Ohio is well below in VC deal activity and funding levels; the state lags national averages in SBIR/STTR award and funding levels.
- Industry R&D and NIH Funding: Ohio is lagging in relative levels and growth of both industrial R&D and NIH funding relative to the nation and key comparison states.
- Limited Wet Lab Space: a study commissioned by OLS and its regional partners has found demand well outstripping the supply of available wet lab space in Greater Columbus, and OLS members and stakeholders point to broader challenges accessing wet lab space across the state for private life sciences firms.

Figure 24. Summarizing Ohio’s Innovation Ecosystem for Life Sciences Development



Note: Data represent totals for latest year available, generally 2023; exceptions are for clinical trials activity and VC funding levels, which both represent cumulative totals for the full 2019–23 period.

Source: TEconomy Partners’ analyses.







IV. Conclusion

Ohio's life sciences industry has grown at a significant, double-digit pace in recent years, and its sizable employment and establishment base is generating an estimated \$66 billion in annual economic impacts for the state.

The industry is clearly an economic engine for Ohio, consistently outpacing the overall private sector and generating high-quality jobs that pay nearly \$105,000 per year, on average. Ohio workers in life science-related occupations earn more, on average, for entry-level job opportunities compared with the overall economy—and in most cases, significantly more. Entry-level workers in life science-related roles earn an estimated 48% more, on average, in Ohio compared with their entry-level counterparts in all occupations—approximately \$44,000 per year versus nearly \$30,000 for all occupations. The state has distinct strengths in life sciences-related distribution and has outpaced national growth in rapidly growing subsectors of the life sciences including research, testing, and medical laboratories and pharmaceutical manufacturing. Ohio life sciences firms and research institutions are advancing significant innovations in medical devices, pharmaceuticals, and in emerging areas such as biopolymers as evidenced by strong patent activity. The state's research universities are growing life sciences R&D at a rapid, leading pace, fueling discovery in agricultural biosciences, bio-based industrial products, and biomedical innovations.

This context of Ohio's recent growth and its robust baseline of activity across its life sciences industry and associated innovation ecosystem signal a strong and exciting future for the state's life sciences cluster. This future and continued success, however, are not guaranteed. Several areas of "Ohio's Challenges" have been identified throughout this report and assessment. They are summarized and presented in Figure 25 below, along with a high-level directional assessment of each major area included in this report. OLS and its industry stakeholders and ecosystem partners must continue to monitor and address these areas to ensure the vibrant and competitive future for which Ohio is well-positioned in the life sciences.

Figure 25. Summarizing Ohio’s Position, Performance Across Life Sciences Industry and Innovation Ecosystem Elements

Industry or Ecosystem Element	OH Position, Performance	Ohio’s Strengths	Ohio’s Challenges
Industry Position, Performance		<ul style="list-style-type: none"> Ohio firms have increased employment by double-digits since 2019, well outpacing limited overall private sector growth. Ohio outpacing the nation in growth of two industry subsectors—research, testing, & med labs; pharmaceuticals. The state has a specialized employment concentration in life science-related distribution. 	<ul style="list-style-type: none"> Ohio slightly behind national pace of industry employment growth and middle of pack among comparison states in employment size, growth, and relative concentration.
Research and Development		<ul style="list-style-type: none"> Ohio has above-average levels of university life sciences R&D expenditures. Rapid growth in university R&D outpacing national average and all comparison states. 	<ul style="list-style-type: none"> Lagging in relative levels and growth of both industrial R&D and NIH funding relative to nation, comparison states.
Innovation		<ul style="list-style-type: none"> Among leading states and well above-average in life science-related patent awards and growth. Relatively high level of clinical trials site activity. 	<ul style="list-style-type: none"> Lagging national averages and nearly all comparison states in SBIR/STTR award and funding levels.
Growth Capital		<ul style="list-style-type: none"> Ohio has seen above-average growth in life science-related VC investments. 	<ul style="list-style-type: none"> Relative to U.S. averages, Ohio well below in VC deal activity and funding levels. Middle of the comparison states in VC investment levels.

Source: TEconomy Partners’ analyses.

Appendix: Data & Methodology

The following presents the life sciences industry definition utilized in this report based on the detailed North American Industry Classification System (NAICS) codes that make up the five major subsectors of the overall industry.

Defining the Life Sciences Industry

Table A1. Life Sciences Industry Definition

Life Sciences Subsector	NAICS Code	NAICS Description
Agricultural Feedstock & Industrial Biosciences	311221	Wet Corn Milling
	311224	Soybean and Other Oilseed Processing
	325193	Ethyl Alcohol Manufacturing
	325311	Nitrogenous Fertilizer Manufacturing
	325312	Phosphatic Fertilizer Manufacturing
	325314	Fertilizer (Mixing Only) Manufacturing
	325315	Compost Manufacturing
	325320	Pesticide and Other Agricultural Chemical Manufacturing
Pharmaceuticals	325411	Medicinal and Botanical Manufacturing
	325412	Pharmaceutical Preparation Manufacturing
	325413	In-Vitro Diagnostic Substance Manufacturing
	325414	Biological Product (except Diagnostic) Manufacturing
Medical Devices & Equipment	334510	Electromedical and Electrotherapeutic 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

Life Sciences Subsector	NAICS Code	NAICS Description
Research, Testing, & 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
Life Science-related Distribution	423450*	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
	424210*	Drugs and Druggists' Sundries Merchant Wholesalers
	424910*	Farm Supplies Merchant Wholesalers

*: Includes only the portion of these industries engaged in relevant life science activities.

Economic Impact Approach and Methodology

Using the information on the size and composition of Ohio's life sciences industry, TEconomy prepared an analysis of the economic impact of the industry on the State of Ohio's economy using the IMPLAN input/output model. IMPLAN, one of the most widely used models in the nation, can be used to analyze the impacts of companies, projects, or entire industries. An input/output (I-O) analysis examines the relationships among businesses and among businesses and final consumers. I-O analysis is based on the use of multipliers, which describe the response of an economy to a change in demand or production. Multipliers measure the effects on an economy from a source of economic activity, in this case, the jobs and activities of companies in the life sciences industry in Ohio.

The economic activity generated in a state is greater than the simple total of spending associated with the event or activity being studied. As money is earned, it is, in turn, spent, earned, and re-spent by other businesses and workers in the regional economy through successive cycles of spending, earning, and spending. However, the spending in each successive cycle is less than in the preceding cycle because a certain portion of spending "leaks" out of the economy in each round of spending. Leakages occur through purchases of goods or services from outside of the region and federal taxation. The IMPLAN multipliers used in this analysis capture the effects of these multiple rounds of spending.

This report measures the economic impact of the life sciences industry by focusing on four measures of economic impact:

- **Employment.** The total number of full- and part-time jobs in all industries.
- **Output.** The total value of production or sales in all industries.
- **Labor Income.** Total labor income including wages and salaries, benefits, and self-reported income earned by the workers holding the jobs created; and
- **State and Local Government Revenues.** The fiscal revenues accruing to both state and local governments in Ohio as a result of the direct and multiplier impacts associated with the Ohio life sciences industry.

Four measures of the economic activity and impact of the jobs supported by the life sciences industry are included as follows:

- **Direct effects.** The change in economic activity being analyzed—in this case, the business activities of the life sciences industry. For this analysis, TEconomy used the employment data from the Ohio industry analysis and the IMPLAN model to estimate business activity based on these activities.
- **Indirect effects.** The changes in inter-industry purchases, for example, the purchase of raw materials by a life sciences manufacturer, in response to the change in demand from the directly affected industries.
- **Induced effects.** The changes in spending from households as income and population increase due to changes in production; and
- **Total effects.** The combined total of direct, indirect, and induced effects.

Ohio Life Sciences Industry: Detailed Regional Economic Impact Tables

Central Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	18,041	\$2,520.5	\$6,637.9	\$13,114.1	\$152.1	\$169.5	\$590.5
Indirect Effects	28,835	\$2,036.3	\$3,398.9	\$6,229.2	\$107.0	\$120.6	\$401.2
Induced Effects	20,002	\$1,071.1	\$2,090.9	\$3,461.5	\$94.5	\$104.2	\$224.2
Total Impacts	66,878	\$5,627.9	\$12,127.7	\$22,804.8	\$353.6	\$394.3	\$1,215.8
Multiplier	3.71	2.23	1.83	1.74			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Lake to River Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	800	\$65.4	\$138.6	\$422.0	\$6.3	\$10.4	\$16.0
Indirect Effects	1,025	\$53.8	\$95.2	\$184.0	\$2.6	\$4.2	\$11.9
Induced Effects	508	\$22.9	\$44.8	\$78.4	\$1.9	\$3.0	\$5.4
Total Impacts	2,333	\$142.1	\$278.7	\$684.4	\$10.8	\$17.6	\$33.3
Multiplier	2.92	2.17	2.01	1.62			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Northeast Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	20,016	\$2,149.6	\$3,863.8	\$9,576.8	\$132.7	\$150.9	\$459.2
Indirect Effects	24,161	\$1,653.2	\$2,654.5	\$4,858.8	\$77.5	\$86.9	\$335.1
Induced Effects	16,813	\$867.4	\$1,668.5	\$2,796.7	\$78.2	\$85.8	\$188.9
Total Impacts	60,991	\$4,670.2	\$8,186.8	\$17,232.3	\$288.4	\$323.6	\$983.2
Multiplier	3.05	2.17	2.12	1.80			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Northwest Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	4,112	\$376.9	\$866.2	\$3,317.9	\$39.3	\$56.3	\$90.3
Indirect Effects	6,865	\$478.6	\$888.6	\$1,654.3	\$24.0	\$32.9	\$100.6
Induced Effects	3,260	\$149.0	\$299.4	\$516.3	\$13.8	\$18.5	\$33.4
Total Impacts	14,237	\$1,004.5	\$2,054.2	\$5,488.5	\$77.2	\$107.6	\$224.3
Multiplier	3.46	2.67	2.37	1.65			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Southeast Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	1,446	\$140.7	\$287.0	\$736.0	\$7.1	\$12.7	\$32.5
Indirect Effects	1,204	\$58.9	\$122.8	\$246.3	\$3.9	\$5.8	\$13.3
Induced Effects	713	\$31.6	\$66.8	\$113.6	\$3.0	\$4.4	\$7.3
Total Impacts	3,363	\$231.3	\$476.6	\$1,096.0	\$14.1	\$23.0	\$53.1
Multiplier	2.33	1.64	1.66	1.49			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

Southwest Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	12,600	\$1,692.7	\$3,695.7	\$7,415.7	\$97.3	\$109.9	\$364.8
Indirect Effects	14,385	\$936.5	\$1,645.0	\$2,911.9	\$39.2	\$47.1	\$180.6
Induced Effects	10,849	\$572.7	\$1,135.9	\$1,877.2	\$47.6	\$56.8	\$118.3
Total Impacts	37,834	\$3,201.9	\$6,476.5	\$12,204.8	\$184.1	\$213.8	\$663.7
Multiplier	3.00	1.89	1.75	1.65			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

West Ohio

Impact Type	Employment	\$Millions					
		Labor Income	Value Added	Output	Local/ County Tax Revenues	State Tax Revenues	Federal Tax Revenues
Direct Effects	6,756	\$668.6	\$1,391.7	\$3,808.6	\$49.0	\$66.6	\$146.3
Indirect Effects	8,827	\$504.8	\$957.2	\$1,880.1	\$23.2	\$31.1	\$104.0
Induced Effects	5,087	\$241.9	\$487.3	\$828.9	\$22.1	\$28.0	\$52.4
Total Impacts	20,670	\$1,415.3	\$2,836.1	\$6,517.6	\$94.3	\$125.8	\$302.8
Multiplier	3.06	2.12	2.04	1.71			

Source: TEconomy Partners analysis using employment data developed by TEconomy and IMPLAN State of Ohio model.

