



The New Jersey Biopharma Industry: A Prescription for Growth

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The New Jersey biopharma industry: A prescription for growth

EXECUTIVE SUMMARY

New Jersey has long been a critical economic engine for the United States, and the biopharmaceutical industry has been an important source of the state's growth for generations. A few key facts highlight its importance in the state: New Jersey is one of the top 10 innovation hubs in the world. It employs over 120,000 highly educated life sciences workers (of which 65,000 are biopharma). It is the operating base for over 1,000 biopharma companies, with more than 1,000 drugs in development by those companies. In 2015-2017 alone, New Jersey-headquartered biopharma companies accounted for 29% of the drugs approved by the FDA.

That said, the performance of the biopharma industry overall indicates New Jersey could be doing even better. Between 1995 and 2015, the U.S. biopharma industry grew approximately 2.3% CAGR, while New Jersey's sector grew only about 1.4%. This indicates substantial opportunities for long-term growth under the right conditions.

One of the chief reasons for the U.S. growth spurt is the substantial rise in the number of early-stage start-up companies. From 2012 to 2015, California saw 10 times as many companies founded as New Jersey, and Massachusetts four times as many¹. It may not be coincidental that New Jersey also received less federal and venture capital funding and has fewer academic-public sector research partnerships than peer states. At the same time, higher costs have made businesses reluctant to locate their operations in New Jersey.

Other states have successfully attracted biopharma companies through a mix of public, private, and non-profit levers, including targeted investment. Often thematic in execution, these investments focus on biopharma and on job creation, rather than job preservation, thereby generating a higher return on investment.

In this context, this white paper examines the health of New Jersey's biopharma industry, drawing on economic analyses, discussions with stakeholders from across the New Jersey biopharma ecosystem, and case examples of other centers of activity in the industry. The goals of the paper are to create transparency around New Jersey's strengths and opportunities, and lay out pragmatic recommendations to promote economic growth across the state through the biopharma industry. This research is informed by McKinsey analysis on biopharma in New Jersey, as well as a

¹ PitchBook, US Census Bureau County Business Patterns

recent McKinsey report (*Reseeding the Garden State's economic growth: A vision for New Jersey*) that examined New Jersey's overall economy.

Given these learnings and New Jersey's context, this paper puts forth recommendations along four levers:

1. **Direct State government support** of the industry, including targeted financial incentives, tax credits, and funding private-public and academic-commercial partnerships
2. **Promotion of life science innovation and investment** in the state, including creating a new "BioPharma Super Cluster" as a hub of life science activity, most likely in North-Central NJ.
3. **Making NJ the world leader in post-graduate and mid-career Biopharma educational and training programs** that focus on retraining for manufacturing and R&D jobs that will be critical for the next decade, and are in critical short supply (e.g., advanced drug analytics; translational research; commercialization)
4. **Strengthening New Jersey's brand**, including increased promotion and marketing of the advantages of founding or moving a company to the state.

Developing an environment for growth is crucial for improving New Jersey's economic health. The state's biopharma industry should be central to that strategy and New Jersey should build on its proven ability to ignite short-term growth and plant the seeds for long-term development.

INTRODUCTION

The state of New Jersey has played a key role in the U.S. economy since the nation's birth. Today, the Garden State ranks as the 11th in population, with approximately 9 million people². Moreover, it is the 8th largest economy in the country, with GDP exceeding \$500 billion³ and 22 Fortune 500 companies headquartered here⁴.

Recently, however, New Jersey's economy has grown more slowly than the U.S. economy as a whole. Between 2006 and 2015, the state's growth rate averaged 0.2% per year, whereas the U.S. growth averaged 1.3%.⁵

² US Census American Community Survey

³ Bureau of Economic Analysis, Bureau of Labor Statistics, Moody's Analytics

⁴ Capital IQ

⁵ Bureau of Economic Analysis, Bureau of Labor Statistics, Moody's Analytics

EXHIBIT 1: STATE RANKINGS ON METRICS IMPORTANT TO BUSINESSES

Rank among states ■ Top third ■ Middle third ■ Bottom third

Category	Metrics	State ranking						
		NJ	CA	MD	MA	NY	NC	PA
Quality and quantity of talent	Educational attainment of population	5	14	3	1	9	25	24
	Talent availability	14	1	20	8	7	10	6
	No. of universities	23	1	30	11	2	8	4
Quality of life	Pre-K – 12 education	3	46	22	1	34	26	16
	Cost of living	41	48	43	46	49	17	35
Infra-structure	Natural disaster risk	20	26	18	14	36	41	32
	Quality of roads	42	44	34	15	37	21	35
Overall business environment	Overall GDP	8	1	15	11	3	10	6
	VC funding	7	1	9	2	6	8	4
	NIH funding	23	1	5	2	3	6	4
	Regulatory environment	46	48	40	39	27	4	31
Industry environment	Sector GDP	5	1	10	3	2	4	7
	Number of biopharma startups	8	1	4	2	5	9	3
Cost of business	Value of incentives offered	7	9	42	41	29	36	31
	Labor costs	40	48	49	47	38	24	21
	Utilities costs	40	44	38	47	43	10	17
	Property costs	44	49	40	48	43	22	18
	Taxes	45	41	17	37	50	5	49

One reason for this under-par performance is the current condition of New Jersey’s life sciences industry relative to its history and relative to other states. Known as “the medicine chest of the world,” the state has been a major global hub for biopharma for more than a century. Yet in recent years, New Jersey’s biopharma industry has not kept up with other states, particularly California and Massachusetts. Even so, despite recent declines, New Jersey has maintained a leading role in pharmaceuticals, with more than half of the top 20 global pharmaceutical companies operating here⁶. However, while biotechnology has been a source of positive job growth in New Jersey, the state has struggled to grow this sector at the same rate as other leading biopharma hubs⁷. This represents a significant opportunity to attract more companies and grow revenues.

Meanwhile the biopharma industry is evolving rapidly. Scientific innovation is leading to step-changes in the standard of care for diseases with high unmet needs (e.g., Oncology, Hepatitis C). Technology and automation are impacting manufacturing processes, as well as other parts of the value chain. Clinical and commercial models have pivoted to better address an emerging focus on the value therapies deliver to patients, health systems, and payers. These shifts mean that tomorrow’s winners will look different from past winners. To be successful, New

⁶ Capital IQ

⁷ *New Jersey’s Life Sciences Industry Cluster*, NJ Department of Labor & Workforce Development, Summer 2017, Bureau of Economic Analysis, Moody’s Analytics

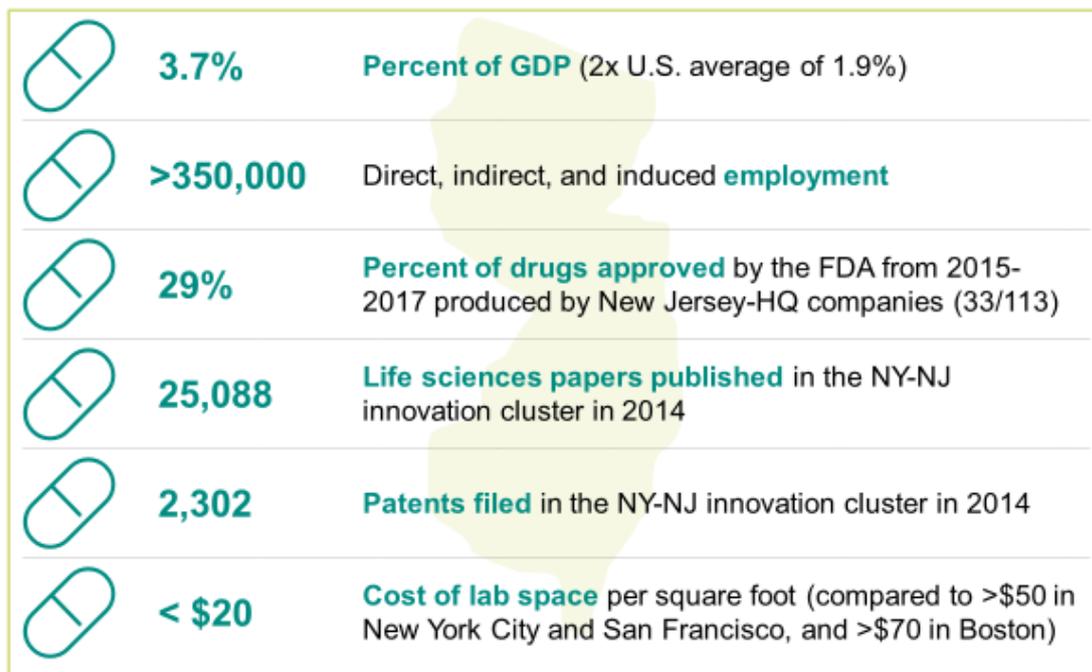
Jersey must develop new capabilities and strategies, and should carefully examine the trends and their implications for its biopharma industry.

New Jersey certainly has the means to restore its leading position in the biopharma industry. This overview lays out the key points to consider in achieving that goal.

A CLOSER LOOK AT NEW JERSEY'S BIOPHARMA INDUSTRY

New Jersey is home to approximately 1,000 pharmaceutical and biotechnology companies⁸. More than half of the 40 largest biopharma companies—primarily pharmaceutical companies—have headquarters or a major presence here⁹. Combined, the sector contributes more than \$100 billion per year to New Jersey's output. That is 3.7% of the state's GDP, twice the national average. The industry directly employs approximately 65,000 people and indirectly more than 300,000¹⁰.

EXHIBIT 2: BIOPHARMA IN NEW JERSEY



⁸ US Census County Business Patterns

⁹ Capital IQ

¹⁰ Bureau of Economic Analysis, Bureau of Labor Statistics, Moody's Analytics, *Biopharmaceutical Sector Impact on New Jersey's Economy*, PhRMA, May 2015

A center for innovation

New Jersey's concentration of biopharma makes it one of the top 10 innovation clusters in the U.S. In 2014, the cluster produced 25,000 life science publications and filed approximately 2,300 patents in 2013¹¹. In 2014, companies in New Jersey had over 1,000 drugs in development, and from 2015-2017, 33 of the 113 novel drugs approved by the FDA came from companies with Global or US headquarters in the state¹². Among the state's considerable strengths in biopharma, perhaps none shine brighter than its ability to develop transformative therapies and bring them to market. The high rate of approvals is due in no small part to New Jersey's highly educated workforce: 38.6% of adults over 25 hold a bachelor's degree or higher, and 14.9% have a graduate or professional degree, compared with an average of approximately 31.3% holding a bachelor's degree in the U.S. overall – and 11.9% with a graduate or professional degree.¹³ Additionally, New Jersey's 63 colleges and universities produce more than 20,000 life sciences graduates annually,¹⁴ an important source of talent for the industry.

Tremendous scale but stagnating growth

Despite these advantages, New Jersey's biopharma industry has not kept up with the rest of the country. From 1977 to 2015, the state's biopharma industry gross domestic product (GDP) has grown by 1.1% per year, whereas U.S. biopharma GDP grew more than 4.2 percent. New Jersey's biopharma employment growth has also stagnated, declining 0.4% per year since 1977, while employment in the industry nationally has grown 1.3%.

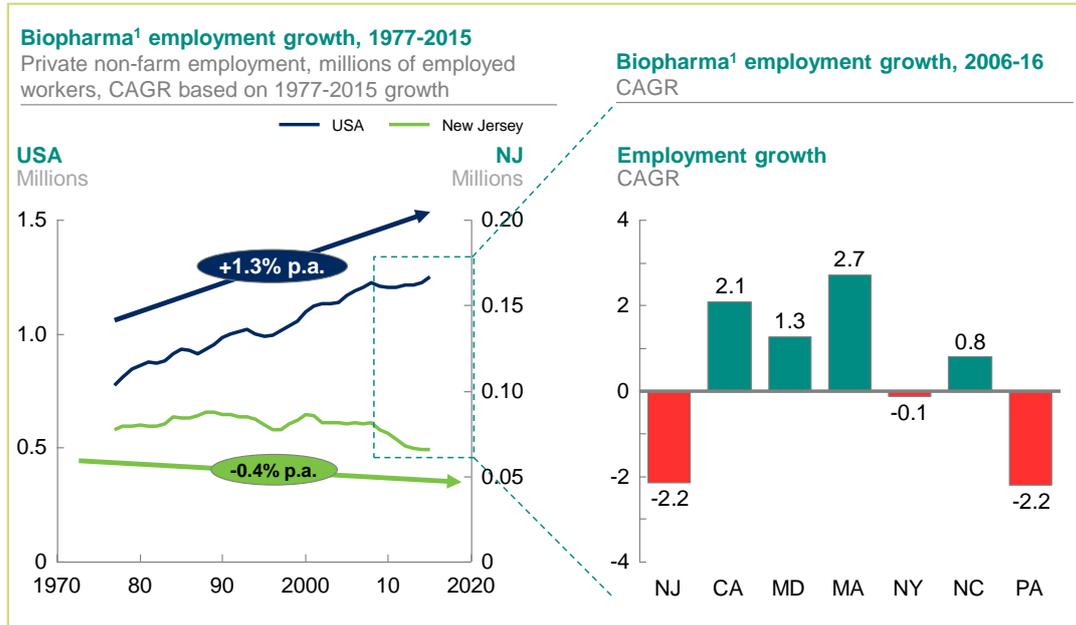
¹¹ PubMed, EvaluatePharma, Web of Science, Hoover's, US Patent and Trademark Office, Bureau of Labor Statistics

¹² Food and Drug Administration

¹³ US Census Bureau American Community Survey

¹⁴ Choose NJ

EXHIBIT 3: NEW JERSEY'S BIOPHARMA EMPLOYMENT



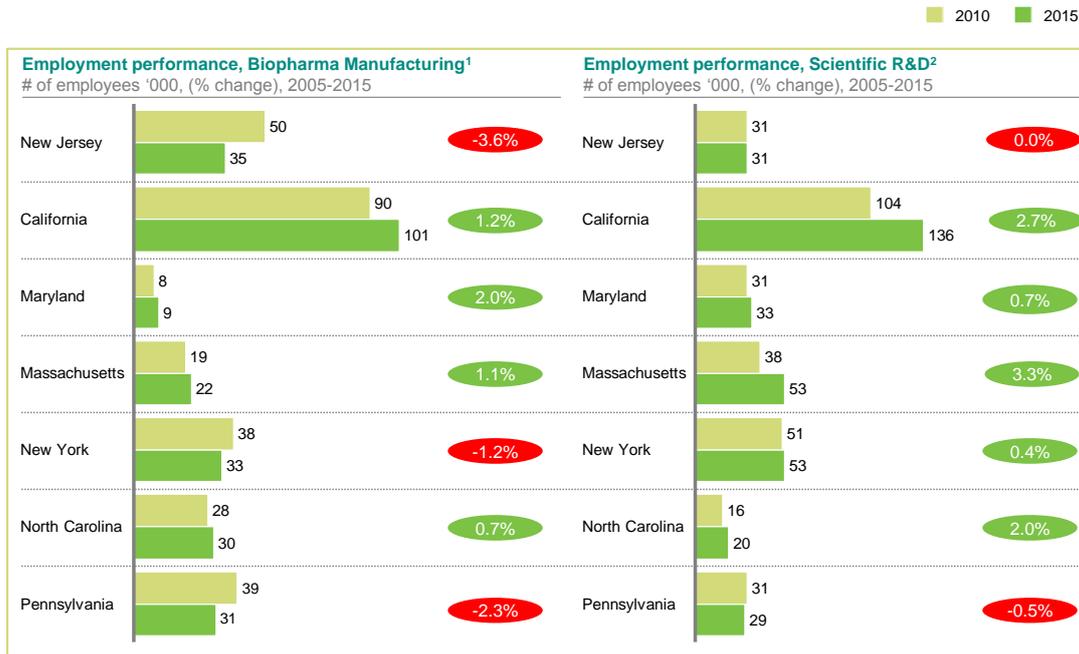
Unlike the rest of the country, biopharma employment numbers in New Jersey did not recover after the financial crisis of 2008-2009. From 2010 to 2015, it declined 2.7% per year, while U.S. employment grew 0.8% annually. Notably, New Jersey’s biopharma employment decline occurred primarily in the pharmaceutical subsector, whereas biotechnology employment grew 1.0% per year.¹⁵

Specifically, the decline in New Jersey’s biopharma employment has been mainly in manufacturing: While R&D employment was flat from 2005 to 2015, manufacturing employment declined 3.6% per year. Both New Jersey’s R&D and manufacturing employment trailed most peer states.¹⁶

¹⁵ Bureau of Economic Analysis, Bureau of Labor Statistics, Moody's Analytics

¹⁶ Bureau of Labor Statistics, Moody's Analytics

EXHIBIT 4: NEW JERSEY EMPLOYMENT IN BIOPHARMA MANUFACTURING AND R&D



Competition for start-ups and job creation

Compounding these difficulties, during the past decade, New Jersey’s biopharma industry has experienced increasing competition from other states that were also trying to raise their quotient of biopharma start-ups. For example, California and Massachusetts have, respectively, created ten and four times the number of companies compared with New Jersey (885 biopharma companies founded in California between 2012 and 2015, 430 in MA, and only 89 in NJ)¹⁷.

This trend line is reflected in the totals. Between 2012 and 2015, there were four peer states where the percentage of start-up biopharma companies exceeded the national average of 2.5%: Massachusetts (7.3%), California (3.9%), Pennsylvania (3.4%), and Maryland (3.1%). The percentage of start-ups in New Jersey, by contrast, was only 2.1¹⁸.

Winners of this competition receive material economic benefits, as underscored by employment, wages and economic output (all figures from 2014). The six states that employed more than 250,000 people in biopharma were among the 11 states with the highest GDP. Biopharma in the U.S. employed more than 850,000 people, with the average salary exceeding \$120,000, more than twice the U.S. average in the private

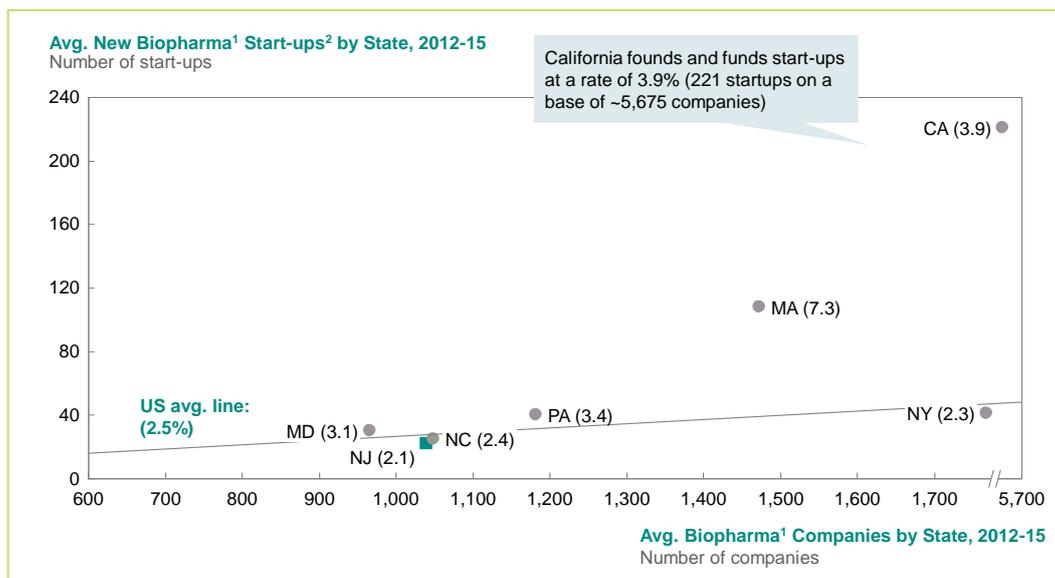
¹⁷ PitchBook, US Census County Business Patterns

¹⁸ PitchBook, US Census County Business Patterns

sector. The industry also generated over \$1.2 trillion in economic output, almost 4% of the U.S. economy, and paid more than \$67 billion in personal taxes.¹⁹

The indirect economic benefits are even more striking. For every job directly provided by biopharma companies, the industry supports 4.2 indirect and induced jobs. That means 3.6 million jobs in other U.S. sectors (e.g., wholesale trade, real estate, legal services, transportation) are created as a byproduct of direct industry employment.²⁰

EXHIBIT 5: BIOPHARMA START-UP ACTIVITY



Lagging peers in funding for the biopharma sector

Several sources of funding are critical for creating and growing companies, including public, venture capital, and academic. New Jersey lags peer states on all three.

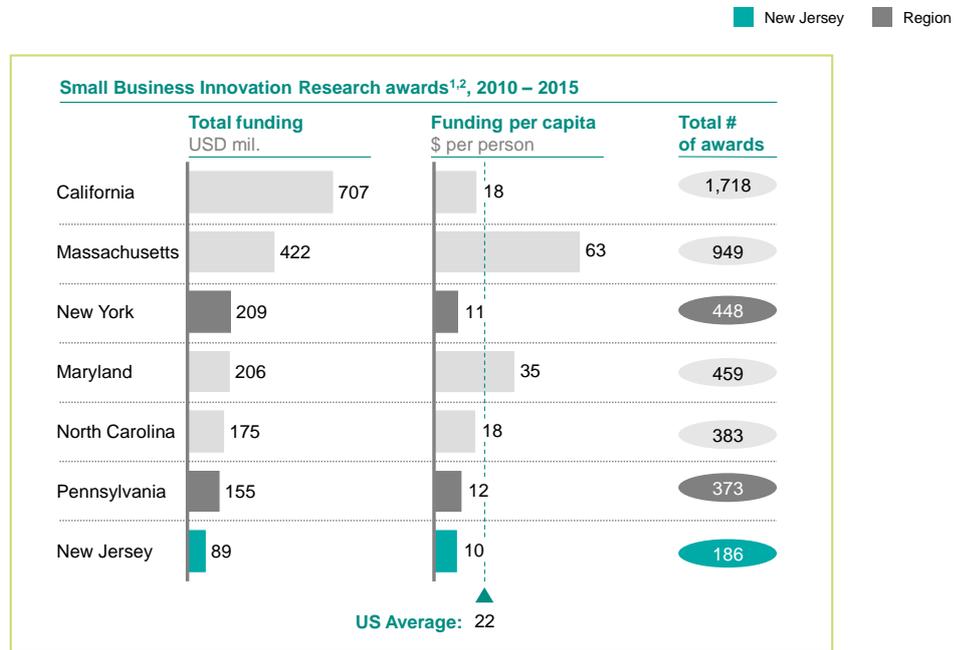
The lower start-up rate in New Jersey is reflected by the low level of public funding for advancing the biopharma sector. Moreover, the state has attracted lower amounts of federal investment for small businesses relative to peer states: between 2010 and 2015, it received only 186 Small Business Innovation Research (SBIR) awards

¹⁹ *The Economic Impact of the US Biopharmaceutical Industry: National and State Estimates*, PhRMA and Teconomy Partners LLC, May 2016

²⁰ *The Economic Impact of the US Biopharmaceutical Industry: National and State Estimates*, PhRMA and Teconomy Partners LLC, May 2016

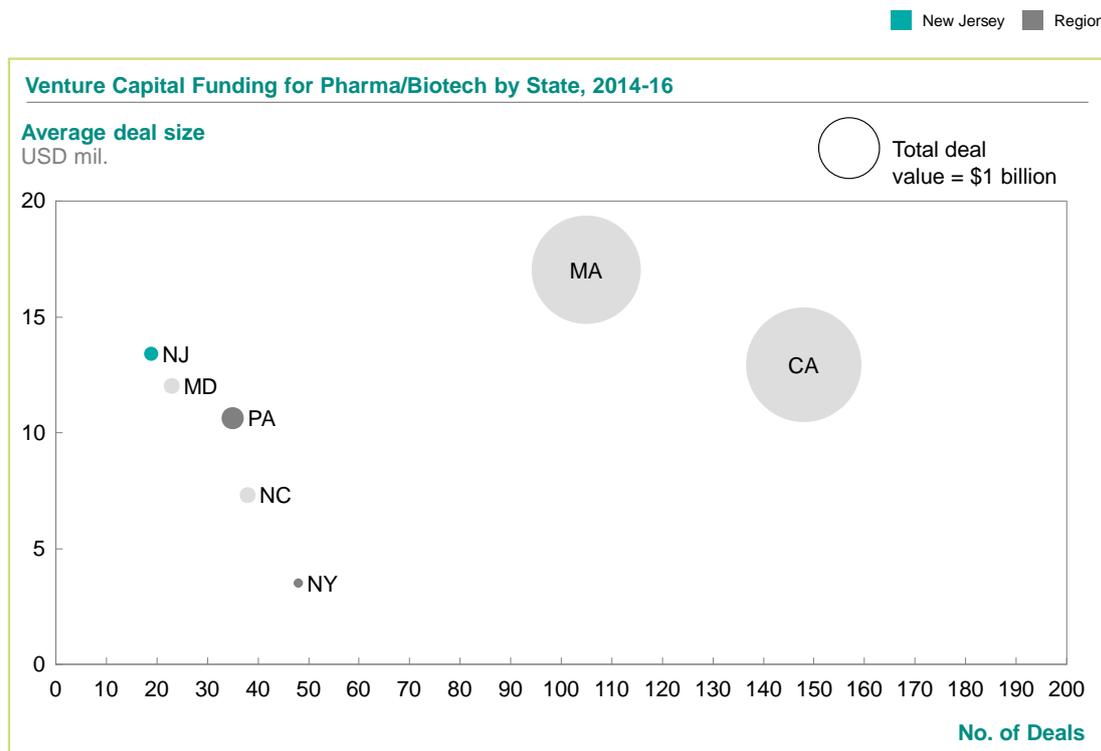
totaling \$89 million. In contrast, Massachusetts small businesses received 949 awards totaling \$422 million²¹.

EXHIBIT 6: FEDERAL INVESTMENT FOR SMALL BUSINESSES



In addition, venture capital funding investment is an area where NJ is not keeping pace with other geographies. From 2014 to 2016, California completed 148 biopharma deals, receiving venture capital funding of \$1.9Bn invested, and Massachusetts completed 105 biopharma VC deals that generated \$1.8Bn invested. In sharp contrast, 19 New Jersey deals received venture capital funding investments totaling \$255 million²². The causes and effects here are complex and related to other factors, such as fewer incubators and lower levels of funding for basic life sciences research, which are described below.

²¹ US Small Business Administration SBIR/STTR Program
²² PitchBook



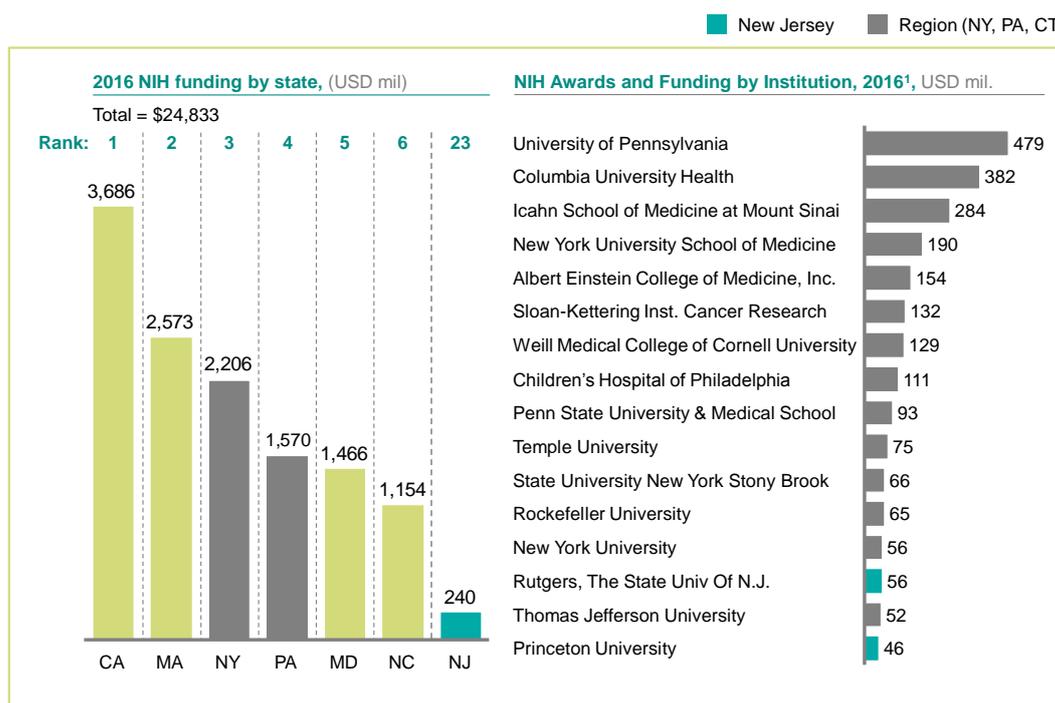
Massachusetts and California currently lead in biopharma incubators with 29 and 25 respectively, and New York has eight. New Jersey currently has only four, but is moving up the list by increasing to seven in the near-term. Today, New Jersey has 85 VC firms headquartered in the state (19 of them focused on biopharma), but attractive innovation will be needed to keep investment within state lines²³.

In addition, New Jersey’s academic and public-sector biopharma research funding lags peers. Most of the funding for academic biological research is provided by grants from the National Institutes of Health. New Jersey institutions received \$240 million in NIH funding in 2016, making it the 23rd ranked state. The entire state received less funding than 24 different individual academic institutions. Meanwhile, institutions in New York City and Philadelphia received almost \$2.5 billion in biomedical grants in 2016²⁴.

²³ PitchBook

²⁴ National Institutes of Health

EXHIBIT 8: NIH FUNDING IN STATES



Higher cost of doing business

Since the 1990s, the cost of doing business in New Jersey has increased more than most of its peers. It is more than 10% higher than the U.S. average, primarily because of the state’s high labor costs and tax rates²⁵.

Labor costs, however, are not necessarily the determining factor in business location decisions. Businesses thinking of moving to New Jersey may overlook labor costs if the state addresses other factors, such as the cost of living, infrastructure,²⁶ regulatory constraints,²⁷ and licensing requirements²⁸ – all categories in which New Jersey ranks in the bottom quartile nationally.

The state’s regulatory system is highly complex. With 565 municipalities, each with its own rules for zoning and business regulation, as well as county and state regulations, the process of getting approvals can be daunting for young companies²⁹.

At the same time, New Jersey has paid about four times more per life sciences job compared with peer states. Specifically, it has paid about \$38,400 per life sciences

²⁵ *North American Business Cost Review: 2016 edition*, Moody’s Analytics, June 2016

²⁶ “America’s Top States for Business 2016,” CNBC.com, January 2016

²⁷ “The Best and Worst States for Business 2016,” Forbes.com, November 2016

²⁸ “Small Business Friendliness Survey 2016,” Thumbtack, June 2016

²⁹ New Jersey State League of Municipalities

job, while Massachusetts has paid less than \$12,200 per life sciences job and California paid less than \$9,250 per life sciences job³⁰.

ATTRACTING BIOPHARMA COMPANIES

A large proportion of states use a variety of incentives to attract biopharma companies, especially ones that are small or in start-up mode. A holistic strategy, rather than ad hoc investment, maximizes chances of success.

Targeting through multiple mechanisms

As of 2015, 15 U.S. states offer small business innovation research matching grants to bioscience companies. Half of all states offer angel investor tax credits for investments in technology companies, including bioscience companies, and more than 70% offer research and development tax credits.³¹

As of 2017, 16 states offer small business innovation research (SBIR) matching grants and 25 states offer tax credits to angel investors who invest in technology companies, including the biosciences. Some states also invest directly in private venture capital firms that fund small biopharma companies.³²

Massachusetts, for example, supports small biopharma creation by providing matching grants for SBIR phase II and a sales tax exemption for R&D and biomanufacturing equipment. The state also invests in biopharma companies directly through the MassVentures. Likewise, California offers state sales tax exemptions for R&D and biomanufacturing equipment, as well as exemptions for biopharma companies.

New Jersey also spends significantly on incentives, but these tend to be less biopharma focused and broader in nature. Moreover, they are frequently used to preserve existing jobs in a variety of sectors, rather than create or attract new ones.

³⁰ Average incentive per job calculated using IncentivesMonitor database for deals from 2010-2016, including only deals in industry sector: life sciences. This calculation includes total jobs (new jobs and safe-guarded jobs). IncentivesMonitor – WAVTEQ (www.IncentivesMonitor.com)

³¹ *Bioscience Economic Development In The States: Legislation And Job Creation Best Practices*, Biotechnology Industry Organization, 2016

³² *Bioscience Innovation in the States: Legislation and Job Creation Through Public-Private Partnerships*, Biotechnology Innovation Organization, 2017



Jump-starting a virtuous start-up cycle

Young companies have created most of the new jobs in the U.S. From 2000 to 2011, net job creation in the country came from companies less than 11 years old.³³ The founding of biopharma start-ups follows a virtuous cycle: more companies founded leads to more companies being founded. This phenomenon allows successful states to outpace the rest once a critical mass of start-up activity is established, generally in hub cities or specially designated regions.

For example, 996 biopharma companies were founded in California between 2011 and 2015, and another 296 were founded in 2016. In Massachusetts, the number of biopharma company launches during those periods was 488 and 163 respectively. By contrast, in New Jersey, the numbers are 102 and 27.³⁴

States compete fiercely to capture a sizable portion of the sector’s employment growth. To achieve this, several have invested in incubators. Since 2000, California has more than doubled its number of biopharma incubators to more than 20.

³³ *Entrepreneurship and Job Creation in the US Life Sciences Sector*, Brookings Institute, 2014

³⁴ PitchBook

Although New Jersey presently has only four biopharma incubators, there are plans for three more, in addition to a number of other supportive developments to attract companies³⁵. These developments include:

- The RU-UMDNJ merger, which has resulted in a culture and systems that encourage entrepreneurship and company creation at Rutgers University
- NJIT's NJ Innovation Institute, which is making headway in biomanufacturing
- The Enterprise Development Center at the New Jersey Institute of Technology
- Rowan University's incubator and investment fund
- The announcement of the Seton Hall-Hackensack Meridian School of Medicine
- The Institute for Life Sciences Entrepreneurship, which is supporting start-ups
- Princeton University's BioLabs-managed incubator
- Celgene's 16,000-square foot biopharma incubator for entrepreneurs who are interested in medical research and innovation, which will open later this year
- The New Jersey Economic Development Authority's soon-to-be-opened Biotech Development Center (BDC), which will offer over 32,000 square feet of affordable lab space for post incubation and rapidly growing biopharma companies, as well as the Commercialization Center for Innovative Technologies (CCIT), one of the leading life sciences and biotechnology incubators in the region

New Jersey should also consider the type of innovator who founds new biopharma companies. Often, these are star scientists who bring therapies developed in academia to the private sector for development. These scientists frequently come from major universities and bring NIH funding. Incubators and targeted incentives have been shown to be effective in luring star scientists, again highlighting interdependencies among key factors.³⁶

In addition to luring start-ups to New Jersey, there are opportunities to bring the headquarters, clinical trials apparatus, or commercialization arms of larger companies here as well. This could include both US- and internationally-headquartered companies. While considering these options, it is important to note that states that have been successful at attracting biopharma companies have focused their incentives on the life sciences. The goal is to achieve a critical mass of infrastructure and activity that contributes to a thriving ecosystem.

³⁵ PitchBook, Press Search

³⁶ Moretti, Enrico and Daniel J. Wilson, *State Incentives for Innovation, Star Scientists and Jobs: Evidence from Biotech*, NBER Working Paper No. 19294, 2013

Category	Metric	Importance for site selection ¹				NJ rank
		Manu- facturing	R&D	Clinical trials	Corpor- ate HQ	
Quality and quantity of talent	Educational attainment of population	High	High	High	High	Top third of states
	Talent availability	High	High	High	High	Top third of states
	Number of universities	Medium	High	High	Medium	Middle third of states
Quality of life	Pre-k – 12 education	Medium	Medium	Medium	Medium	Top third of states
	Cost of living	High	High	High	High	Bottom third of states
Infra-structure	Natural disaster risk	Medium	Low	Low	Low	Middle third of states
	Quality of roads	High	Medium	Low	Medium	Bottom third of states
Overall business environment	Overall GDP	High	Medium	Medium	High	Top third of states
	VC funding	Low	High	High	Low	Top third of states
	NIH funding	Low	High	High	Medium	Middle third of states
	Regulatory environment	High	High	High	High	Bottom third of states
Industry environment	Sector GDP	High	High	High	High	Top third of states
	Number of biopharma startups	Low	Medium	Low	Medium	Top third of states
Cost of business	Value of incentives offered	High	High	Low	High	Top third of states
	Labor costs	High	High	Medium	High	Bottom third of states
	Utilities costs	High	High	Low	Medium	Bottom third of states
	Property costs	High	High	Low	High	Bottom third of states
	Taxes	High	High	High	High	Bottom third of states

Developing a robust attraction strategy

Despite the challenges it faces, New Jersey is well-equipped to attract new biopharma companies. Its location is appealing to companies looking to access major markets and sources of talent. Situated in the center of the Northeast corridor, which generates over 20% of U.S. GDP, it boasts proximity to New York City and Philadelphia, the largest and fifth-largest cities in the U.S.³⁷. The Port of New York/New Jersey is the largest in the country as measured by the value of goods flowing in and out.

To convince biopharma companies to move to New Jersey, the State must determine where and how to invest funds. Next, it must create an integrated strategy on how best to incentivize the retention and creation of jobs in the biopharma sector and its related industries.

The state can then choose from among many options to support a robust biopharma ecosystem. These options should provide benefits over three time horizons, near-, mid-, and long-term. Below is a non-exhaustive set of potential options drawn from the analysis of historical data, the options deployed by other successful states and countries, and the suggestions of CEOs and other leaders of companies based in New Jersey and elsewhere.

³⁷ *Re-seeding the Garden State's economic growth: A vision for New Jersey*, McKinsey, July 2017

As our analyses have shown, the state of the BioPharma industry in NJ is at a crossroads. Purposeful investment and a concerted public-private effort can help NJ regain its legacy of being the “medicine chest to the world” by retaining existing biopharma jobs, attracting new jobs, and sparking overall economic growth at least at the level of national biopharma growth of ~1.4% if not at the higher rate of 2-3% that some states are delivering. In the absence of that, we believe the steady decline of -1-2% will continue.

Job creation strategies must include targeted incentives, coordinated public and private effort, and structural changes that encourage founding new enterprises in New Jersey, retraining existing talent, and enticing companies from around the world to set up US operations in NJ in the near-, medium-, and long-term. We recommend 4 significant initiatives that promise to deliver the maximum impact fastest:

1. **Direct State government support** of the industry, including targeted financial incentives, tax credits, and funding private-public and academic-commercial partnerships
2. **Promotion of life science innovation and investment** in the state, including creating a new “BioPharma Super Cluster” as a hub of life science activity, most likely in North-Central NJ.
3. **Making NJ the world leader in post-graduate and mid-career Biopharma educational and training programs** that focus on retraining for manufacturing and R&D jobs that will be critical for the next decade, and are in critical short supply (e.g., advanced drug analytics; translational research; commercialization)
4. **Strengthening New Jersey’s brand**, including increased promotion and marketing of the advantages of founding or moving a company to the state.

Needless to say, additional levers such as investment in infrastructure improvement and reducing the cost to operate in NJ can also have massive impact in biopharma and overall, but experience has shown that these levers are tougher to implement quickly. We endorse these levers but have purposefully picked the above 4 which we believe provide the highest likelihood of implementation and “bang-for-the-buck.” They are also levers that span public and private efforts, and lend themselves to public-private partnerships that are critical for impact.

1. Direct State government support

Short-term levers that provide financial incentives and improve accessibility to funding will be attractive to biopharma companies. For nascent biopharma companies, access to capital is a key consideration. For established companies, tax incentives play an important role in increasing attractiveness of a given market by reducing costs.

Specific short-term actions could include:

- Increase Angel Investor Tax Credit from 10% to 25% for investment in emerging technology businesses that have 75% of employees in NJ. The program is currently capped at \$25 million. The credit could be increased without increasing the cap and without increased cost to the state budget.
- Make the Grow New Jersey Assistance Program permanent and target the program to biopharma companies. This program, which offers a 10-year tax credit for up to \$15,000 per job per year, is scheduled to sunset in June 2019.
- Improve the Technology Business Tax Certificate Transfer (Net Operating Loss, or NOL) program by eliminating the single sales factor as it applies to this program.
- Change R&D credits to give start-ups more access to capital. This could be done by making them a rebate on payroll taxes.
- Adopt a version of IRS Section 1202, an incentive program that rewards investments in companies with significant growth potential and synchronizes the timing of a capital investment and the angel investor's gain from the investment.
- Fund NJ biotechs through private-public and academic-commercial partnerships.
- Provide matching funds for SBIR programs and provide expanded assistance on grant application preparation to promote New Jersey recipients of Small Business Innovation Research (SBIR funds). Such a program will enable companies to develop stronger business and operational models, while utilizing the federal SBIR program as a vetting mechanism for promising technologies.
- Create and fund targeted workforce retraining programs for displaced pharmaceutical manufacturing workers. This will enhance New Jersey's commercialization strength and stem the "brain drain" as baby boomers begin to age out of the workforce.

In addition to the above, the state of New Jersey should consider improving infrastructure to support the industry in the long-term. These may include investment plans targeting manufacturing and heavy export zones. This is not a strength for New Jersey, and interventions may be required to bend the curve in manufacturing employment.

2. Promotion of life science innovation and investment, including creating a new BioPharma Super Cluster

Our second recommendation entails recementing New Jersey as a center of innovation in life sciences, especially after drugs and devices enter the clinic. This lever encompasses two related ideas:

- First, create a public-private effort to seed and launch new companies focused on mid- to late- stage drug development, advanced analytics/RWE/HEOR, and product launch/commercialization. These are the areas where New Jersey is a

world leader, driven by the presence of BioPharma leaders such as Johnson and Johnson, Merck, Bristol-Myers Squibb, Novartis, and Celgene, to name just a few. New Jersey has the talent, and New Jersey also has the drug substrate in the pipelines of these companies. In considering how it could create something distinctive, New Jersey might contemplate tapping the deep pipelines of large, established pharmaceutical companies headquartered in the state. Bringing together seasoned R&D executives, VC leaders, and leading academics from across the state would spark creative dialogue around how promising assets could be “rebooted” and could be a testing ground for new ways to develop assets (e.g., novel investment arrangements, heavy use of advanced analytics).

The state should encourage and incentivize creation of new companies focused on clinical research, leveraging pipelines of the larger companies as mentioned, using models such as Lilly’s CGRP and Roivant. Expanding the number of incubators through seed funding would help to build momentum and increase attractiveness for start-ups and entrepreneurs in the industry.

- Second, NJ should strongly consider launching a BioPharma Super Cluster with targeted incentives and critical mass. The state today has a very strong but loosely affiliated concentration of biopharma in North and Central NJ and diffused presence in the rest of the state. Case studies from other countries and states show that scale and focus make a difference. Israel is an example of a successfully developed ecosystem with concentrated industry activity and access to world-class research. The industry focuses on three main hubs – Tel Aviv, Jerusalem and Haifa, all within a 2-hour drive of each other. Additionally, world-class research entities are in close proximity, such as the Weizmann Institute of Science, University of Jerusalem, Tel Aviv University and the Technion – Israel Institute of Technology. In Massachusetts, the industry has benefitted from extensive investment in the Massachusetts Life Sciences Center (MLSC) from its founding until 2016, and has invested more than \$600 million in government funds. It has also secured more than \$2.3 billion in matching investments in the Massachusetts life sciences industry. These funds supported a range of investments, and programs to enhance the workforce and promote industry growth.

California’s biopharma hub in Silicon Valley is fueled by three internationally-renowned universities (UCSF, Berkeley and Stanford) and has become a global leader in stem cell research, supported by its public-private partnership with the California Institute for Regenerative Medicine (CIRM) that was created to allocate \$3 billion to stem cell initiatives.³⁸ NJ should seek inspiration from these and numerous other examples and create a BioPharma Super Cluster with incentives and infrastructure that support incubation of new companies in a concentrated area and in designated “innovation” or “free trade” zones.

³⁸ *Capital 20.20: Advancing the region through focused investment*, Upstate Revitalization Initiative, October 2015

The above ideas enforce each other and would create a self-perpetuating cycle that would further lead to strengthening academic research, attracting more NIH funding, attracting star scientists, and improving technology transfer processes.

3. Making NJ the world leader in post-graduate and mid-career BioPharma Educational and training programs

The global economy is undergoing a quantum shift in the number and types of jobs that will be required going forward, due to technological disruption. A recent McKinsey report estimated that up to 30% of the hours worked globally could be automated by 2030. This means that job loss and retraining are inescapable. NJ has already seen the disadvantages of these trends as demonstrated by the 2-3% decline in biopharma manufacturing and R&D jobs over the last decade (see Exhibit 4). But this trend can be converted to a positive via retraining and vocational education in biopharma.

This is not a new idea, but one whose time has come. The need for retraining is evident across industries, and in state-led initiatives across the U.S. that focus on improving training and promoting flexibility in the workforce. These initiatives include data and analytics-related programs and policies, such as LaunchBoard in California, a platform that provides data on progress, employment and earnings to help educators evaluate programs in terms of demand. Career search and matching tools, such as Launch My Career, funded by the U.S. Chamber of Commerce Foundation in partnership with Gallup, provides college-bound students with information on ‘hot jobs’. Numerous state-led programs also offer training and work-based learning, as well as financial aid to students. New Jersey’s own New Start Career Network and ‘65 by 25: Many Paths One Future’ initiatives, as well as supportive financing measures, are good starts but require scale.

So what areas should NJ focus on? The capabilities needed to drive a thriving industry 10 years from now will look dramatically different from today’s. New Jersey should consider how public-private partnerships and universities can transform their educational strategies and focus their programs on one or more of the jobs of the future described below:

- **Advanced analytics.** The explosion in available data and computational power has enabled a step-change in data-driven decision-making across the biopharma value chain (e.g., discovery, clinical trial optimization, real world evidence). This is creating substantial demand for data scientists and engineers.
- **Patient-centric drug development.** Patients today are more informed than ever, and competition for patient enrollment in trials is ever-increasing. Winners in the future will take a patient-centric approach to their development and commercialization plans. Here, New Jersey can rely on an enviable “deep bench” of seasoned R&D executives, an advantage enjoyed by few other locations in the world in addition to a highly concentrated, diverse population for recruitment to critical trials.

- **Convergence of drug, device, and consumer technologies.** Technology is rapidly breaking down traditional lines of demarcation between pharma, med tech, and consumer health. Robotics and “connected care” that enables real-time patient interventions will change the way biopharma companies think about the value their products deliver.
- **Value and market access.** As healthcare costs continue to climb and significantly burden society, governments, health systems, and payers are becoming increasingly value-conscious in their care decisions. As a result, biopharma companies will need leaders who are well versed in the broader health ecosystem, the priorities of diverse stakeholders, and the strategies needed to secure patient access to new medicines.

As mentioned earlier, biopharma will be a net 2-3% growth industry globally and NJ should be well placed to take more than its fair share of job creation. But this will happen only if the state and its local institutions aspire to make the state the world leader in biopharma’s jobs of the future. Doing so will not only help attract high-quality employees and employers, but will also improve the quality of research and innovation needed to support the wider ecosystem.

4. Strengthening New Jersey’s brand

Marketing outreach that promotes advantages for biopharma companies in New Jersey represents another lever. A major focus should promote New Jersey as an attractive headquarters location for international companies planning to establish U.S. operations. New Jersey’s value proposition will be especially appealing to companies entering the late development and commercialization stages of their pipeline as the state offers a high concentration of professionals with expertise in these areas. Proactive communications – to both the public and targeted audiences – can help shape the “New” New Jersey brand.

New Jersey marketing efforts should also promote the state as an ideal location to conduct clinical trials. This industry has the potential to create jobs and add millions to New Jersey’s economy. In 2013, BioNJ found that total annual investments in clinical trials by corporate and NIH sponsors totaled \$263.3 million and resulted in \$779 million in economic output.³⁹ Clinical trials investment supports 3,750 jobs on an annual basis, with GDP impact of \$337 million. Direct wages total \$142 million. Per \$1 million invested in clinical trials, 15 jobs are created; \$1.37 million is added to GDP. That base has strong potential for growth.



New Jersey has enormous potential to accelerate growth in biopharma and the state as a whole. If New Jersey commits to creating an environment that helps companies thrive and that attracts new start-ups and funding, its upside is considerable. The

³⁹ *BioNJ Economic Impact Study of Clinical Trials Activity in New Jersey*, BioNJ, 2016

recommendations herein could bring jobs and more businesses that could help energize our state economy and reestablish New Jersey as the Medicine Chest of the World.

A related set of forthcoming recommendations from the New Jersey Biotechnology Task Force that was established in 2017 should also be considered.

APPENDIX

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Exhibit sources and notes

Exhibit 1: Moody's Analytics; US Census, American Community Survey; Ipeda, NCES; US Bureau of Labor Statistics; C2ER, Emsi; FEMA; U.S. Department of Transportation; Forbes; National Institutes of Health; Pitchbook; Tax Foundation; EIA; IncentivesMonitor – WAVTEQ (www.IncentivesMonitor.com); US Census; NCES; proprietary McKinsey framework and analysis

Exhibit 2: Moody's analytics; PubMed; EvaluatePharma; Web of Science; Hoover's; US Patent and Trademark Office; US Bureau of Labor Statistics; JLL Research; NJ Department of Labor & Workforce Development, Quarterly Census of Employment and Wages, 2010-2015 Annual Averages; The Economic Impact of the Biopharmaceutical Industry: U.S. and State Estimates, Report prepared for PhRMA, May 2016

Exhibit 3: Bureau of Economic Analysis, Moody's Analytics. (1) Biopharma industries defined as the following NAICS codes: 3254 Pharmaceutical and medicine manufacturing, 3391 Medical equipment and supplies manufacturing, and 5417 Scientific research and development services

Exhibit 4: Moody's Analytics (1) Defined as NAICS codes: 3254 Pharmaceutical and medicine manufacturing and 3391 Medical equipment and supplies manufacturing; (2) Defined as NAICS code: 5417 Scientific research and development services (includes some non-healthcare R&D)

Exhibit 5: Pitchbook, US County Business Patterns (Establishment data). (1) Biopharma industry defined as the following NAICs: 3254 Pharmaceutical and medicine mfg, 3391 Medical equipment and supplies mfg, and 5417 Scientific R&D services; (2) Pharmaceutical and biotechnology companies founded in the year that have received funding. Number shown is the average number of companies founded and funded per year over the period from 2012 – 2014

Exhibit 6: SBIR/STTR Program, US Small Business Administration (SBA). (1) Small businesses are defined as having 499 employees or less; (2) SBIR provides grants in two phases. Phase 1 ('start-up') provides up to \$150,000 for six months of product exploration/feasibility. Phase 2 ('expansion') provides up to \$1M for maximum of two years. It is provided only to Phase 1 grantees to explore commercialization opportunities

Exhibit 7: Pitchbook

Exhibit 8: National Institutes of Health, 2016. (1) Not exhaustive; (2) Funding goes to both universities and companies, e.g. Soligenix

Exhibit 9: IncentivesMonitor – WAVTEQ (www.IncentivesMonitor.com). (1) Different types of incentives include: tax, grant subsidy, loan/credit, non-financial, other/not-specified; (2) Additional incentive programs in New Jersey include the Angel Tax Incentive and the Technology Business Tax Certificate Transfer (NOL).

Exhibit 10: FDI benchmarks adjusted based on case studies; proprietary McKinsey framework and analysis. (1) General importance, specific companies may have differing priorities.



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