

New York's Next Big Industry: Commercial Life Sciences

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 **PARTNERSHIP FUND**
for New York City

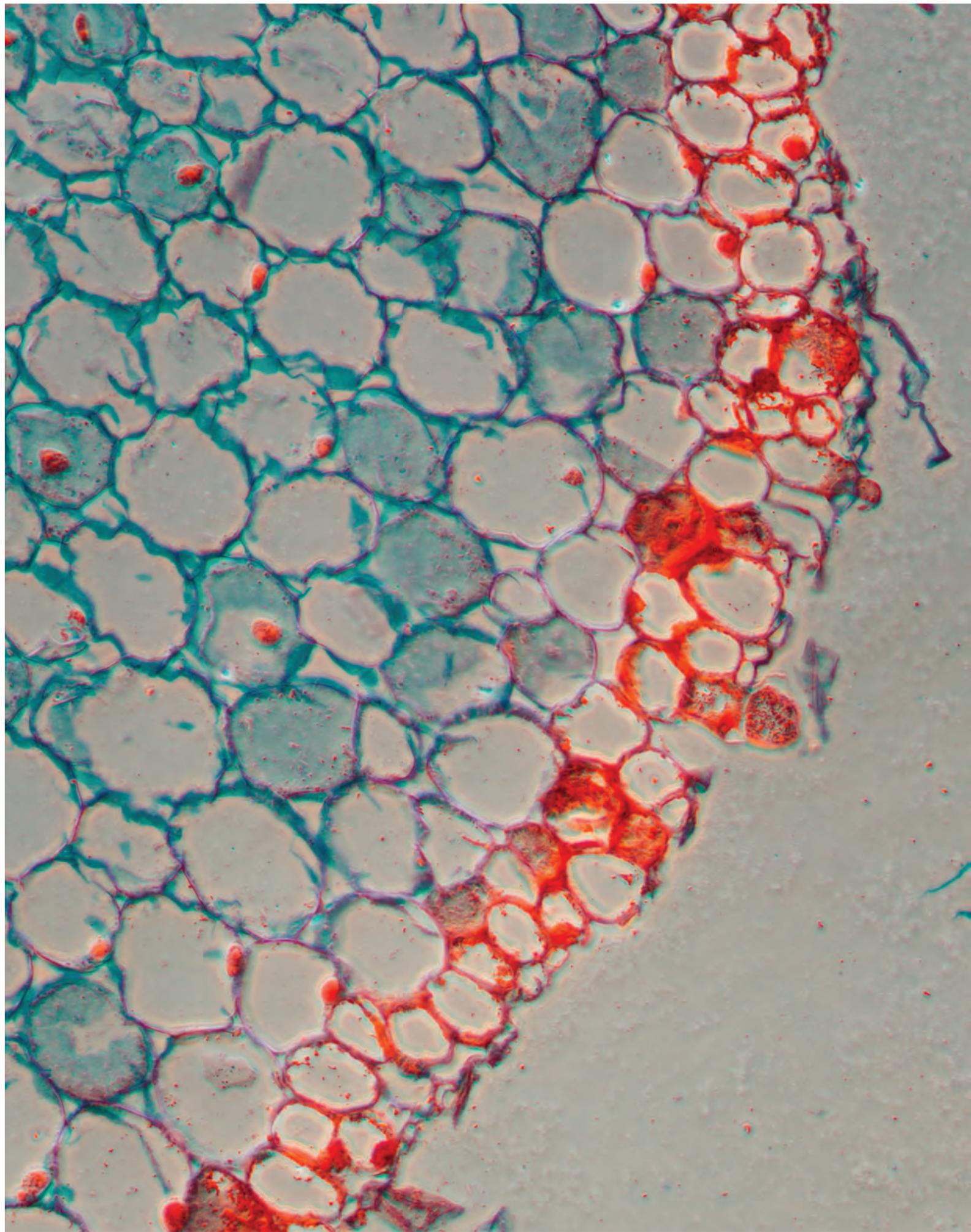
 **KPMG**



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Executive Summary

Life sciences is an industry that is entering a period of rapid growth, driven by scientific advances happening in a handful of premiere research centers around the world, including New York City. Historically, New York has been a leader in life science discoveries and patents, but has lagged thriving commercial hubs like those in Massachusetts and California when it comes to capturing life science jobs and attracting capital investment to build companies.

Today, New York has an opportunity to build a significant life sciences industry cluster, thanks to the pace and quality of the scientific and clinical work that is increasingly concentrated in the metropolitan region and to a new set of factors, including:

- Exceptional leadership and scientific talent at medical research institutions and universities across the state;
- Convergence between life sciences and information technology sectors, with New York having developed significant assets in relevant IT sectors;
- Increased interest of global pharmaceutical companies and risk capital investors in partnering with local institutions and making high profile investments here;
- Expanded real estate industry interest in development of wet lab space, incubators and accelerators dedicated to life sciences; and,
- Growing collaboration among institutions, government, and the private sector, to develop a life sciences ecosystem in New York City and State that is far stronger and more connected than in the past.

In order to fully take advantage of these assets, the Partnership Fund for New York City, with support from Dr. Susan Windham-Bannister and KPMG, identified four key areas where there is a need for investment:

- **Space:** Affordable and appropriately located commercial lab space;
- **Talent:** Development of entrepreneurial life sciences talent within the universities;
- **Capital:** Additional early stage capital willing to take high risk; and,
- **Promotion:** Overall better connectivity within and promotion of the life sciences ecosystem.

New York's life sciences assets, if aggregated and supported by strong leadership from the public and private sectors and aggressive public policy and marketing initiatives, position the region for explosive growth. This is the moment for New York State to move forward with a full-scale public-private initiative to create a world class life sciences industry cluster.

In 2015, Massachusetts generated \$1.32 of venture capital for the life sciences industry for every \$1.00 of federal NIH funding it received.

New York State generated only \$0.06 of venture capital for every \$1.00 of NIH grants.

Introduction

The life sciences industry is a rapidly growing sector of the U.S. economy, currently generating \$316 billion in annual economic output or 2 percent of the nation's GDP.^{1,2} The industry—which includes biotechnology, pharmaceuticals, medical diagnostics, genomics, bioinformatics and medical devices—pays good salaries (average of \$104,000), generates a high economic multiplier, and is a magnet for private investment capital. In 2015, life sciences companies in the U.S. attracted \$10 billion in venture capital and added a net 37,000 jobs.^{3,4}

Life sciences is expected to experience a new round of explosive growth in the near term. Advances in genomics are enabling the discovery and development of highly targeted drugs, therapies and diagnostic tests—referred to as “personalized medicine.”

New York has the talent and institutional resources to be at the forefront of this explosion of scientific advancement and commercial activity.

Fifteen years ago, a study conducted by the Partnership Fund for New York City identified why New York had failed to develop a life sciences industry cluster, despite its academic pre-eminence in the field. The key missing ingredients were found to be a shortage of commercial wet lab space, the absence of an entrepreneurial culture within New York's academic medical centers, and lack of early stage venture capital. This work helped spur development of the Alexandria Center, New York's first life sciences park on the East River medical corridor. It also encouraged transformative changes in leadership and technology transfer capacity at

academic medical institutions. Many of the deficits of earlier decades have been substantially eliminated, with support of city and state government and institutional leadership.

Today, the New York metropolitan region is attracting unprecedented interest from venture capitalists, pharmaceutical companies, real estate developers and leading life sciences entrepreneurs. A serious industry cluster is finally emerging. However, New York is facing growing competition from established centers like London, California and Massachusetts as well as from the emerging ones like Atlanta, Cleveland, Florida, Kentucky, Singapore, Texas and the Netherlands. In just the past few months, two of the city's most important institutional leaders—Dr. Marc Tessier-Lavigne of Rockefeller

University and Dr. Laurie Glimcher of Weill Cornell Medicine—have been recruited to lead Stanford University in California and the Dana Farber Cancer Institute in Boston, respectively.

In 2008, then Massachusetts Governor Deval Patrick committed \$1 billion to support the development of that state’s life sciences industry. Over seven years, the state, through the Massachusetts Life Sciences Center (MLSC), has invested or committed \$595 million, which has been matched by over \$2 billion in private and federal funds.⁵ MLSC’s Job Creation Tax Incentive Program awarded more than \$140 million to 90 life sciences companies over six years and created over 4,500 jobs at a cost of roughly \$30,000 per job.⁶ Additionally, infrastructure investments in research and manufacturing space, which account for half of MLSC’s committed resources, have created more than 4,300 jobs.⁷

The Partnership Fund determined it was time to review the status of the regional industry and New York’s competitive position. Dr. Susan Windham-Bannister, who led the development of Massachusetts’ life sciences ecosystem as CEO of MLSC, was commissioned to lead this review. KPMG provided pro bono expertise to survey the assets and status of the local industry.

Dr. Windham-Bannister’s assessment of New York focused on “innovation capacity”—the ability to translate academic life sciences research into commercial products and services.

She identified key building blocks that underpin innovation capacity: a pipeline of translational research; entrepreneurial culture; qualified workforce; enabling infrastructure; and a well-coalesced life sciences ecosystem. Cities with high innovation capacity promote the creation of viable new life sciences companies, compete more successfully for risk investment capital to grow these companies, and attract and sustain a high volume of commercial life sciences activity.

The conclusion of this review is that New York is poised to become a global commercial hub of life sciences. Realizing this objective, however, will require strategic public and private programs and investments to strengthen New York’s innovation capacity over the next several years. State and city government, institutional leadership—especially trustees of major medical research institutions—as well as the city’s investment and philanthropic communities, all have essential roles in capturing this opportunity to build a significant new industry in New York.

Status of Commercial Life Sciences in New York

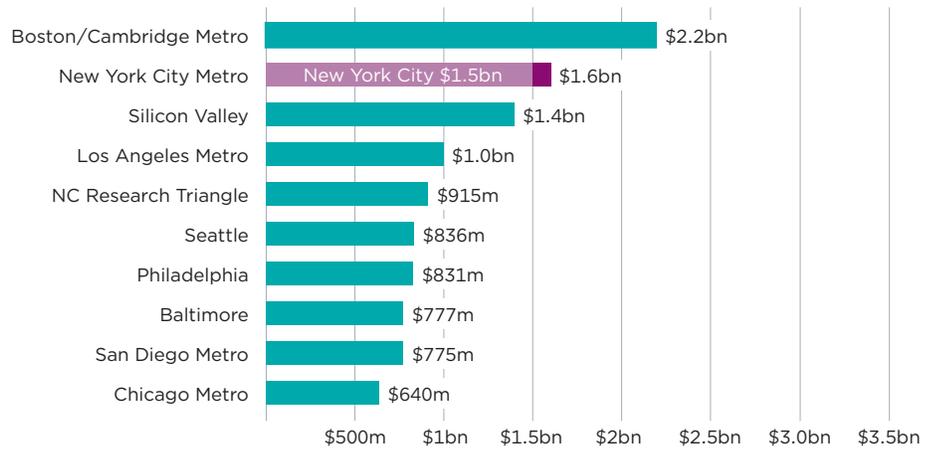
The academic medical institutions and world-class scientists of New York contribute heavily to the research and discovery that make the U.S. the world leader in life sciences. But New York still is punching far below its weight when it comes to translating public, private and philanthropic investment in scientific and clinical research into local jobs and commercial activity. New York City and New York State generate 4 percent and 8 percent of nationwide GDP, respectively, but account for just 1 percent and 5 percent of the nation’s economic output in life sciences. Many of the world’s largest biotech companies—Amgen, Progenics, and Millennium, to name a few—are built on discoveries made at New York institutions, yet their operations and employees are located elsewhere.⁸

The states of California, Massachusetts and New York rank numbers one, two and three in awards of annual research grants from the National Institutes of Health (NIH), a key measure of the quality and quantity of life sciences research. The majority (78 percent) of New York State’s NIH funding comes to the Downstate metropolitan region, which ranks second in total funding behind Boston/Cambridge and ahead of Silicon Valley.⁹ However, Boston/Cambridge and Silicon Valley each have 3.9 to 4.4 times more life sciences jobs than New York City (Exhibits 1 and 2).

New York also has been comparatively weak in attracting venture investment. In federal fiscal year 2015, for

1a NIH Support to Institutions by Geographic Cluster

Federal FY 2015



1b NIH Support to Institutions by State

Federal FY 2015



Source: NIH Data

2 Key Economic Indicators by Region

Region	Life Sciences Jobs, 2015	Life Sciences as a Percentage of GDP, 2013	Life Sciences Venture Capital Investment, 2015
Silicon Valley	63,827	6%	\$3.3 billion
San Diego County	52,139	6%	\$600 million*
Boston/Cambridge	56,080	5%	\$2.6 billion*
New York City	14,438	0.3%	\$140 million*

*Due to data availability, VC figures are for San Diego Metro, Massachusetts and Downstate New York (New York City, Westchester County, and Long Island)
Source: EMSI data, PwC MoneyTree™ Report

CASE STUDY: REGENERON PHARMACEUTICALS

Regeneron Pharmaceuticals, Inc. illustrates the potential for statewide benefits from having commercial life sciences companies incubating in New York City. Regeneron started in 1988 with a small scientific team based at Weill Cornell Medical Center and Columbia University. Fortunately, the company had leadership that was committed to New York, and they relocated to what at the time was the closest lab space to New York City that provided near term growth potential—the Landmark at Eastview in Tarrytown.

In 1993 Regeneron took over a former Sterling drug factory in Rensselaer County and has created over 1,300 manufacturing jobs at that location.^{13,14} In November 2015 Regeneron announced a \$150 million investment in its Tarrytown headquarters that is expected to create at least 300 new jobs.¹⁵

Today the company has 4,000 employees, a \$40 billion market capitalization, annual revenues of \$4.1 billion (2015) and active research and development programs in many disease areas, including ophthalmology, inflammation and cancer.^{16,17,18} By anchoring companies at their early and growth stages in New York, the state will likely capture more jobs as companies scale—an easier lift than attracting firms de novo from elsewhere.

every \$1.00 of NIH funding that Massachusetts received, its life sciences industry attracted \$1.32 of venture capital. By comparison, New York State's life sciences industry secured only \$0.06 of venture capital for every \$1.00 of NIH grants. Neighboring New Jersey did much better, with \$0.91 of venture funds for every NIH dollar (Exhibit 3).¹⁰

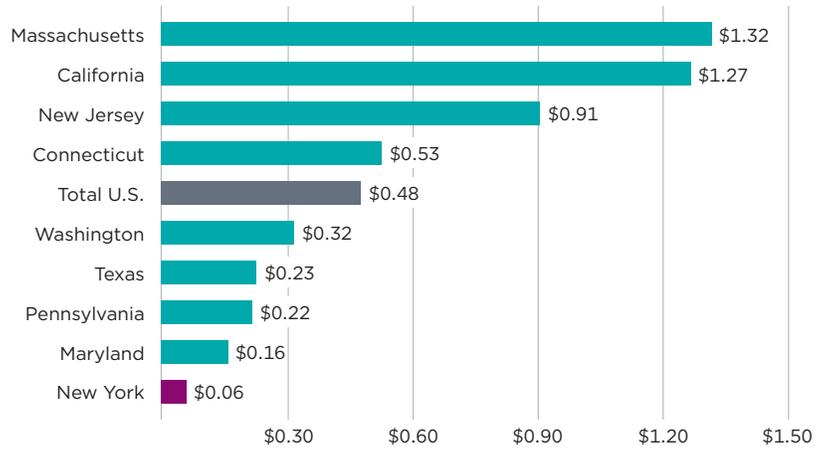
If commercial activity in Downstate New York were on a par with its NIH funding, the region would realize an additional 18,000 to 25,000 jobs and \$2.2 billion to \$3.1 billion of additional economic activity.^{11,12} Growth of

the life sciences sector would range from 62 to 89 percent, and would support thousands of additional jobs. Without its “fair share” of venture funding, New York will continue to lag other regions in life sciences job creation and economic output (Exhibit 4).

3 Ratio of Private (VC) Investments to Public (NIH) Funding

Federal FY 2015

For every \$1.00 of NIH funding, Massachusetts sees \$1.32 in venture capital funding for biotech, medical devices and equipment. By comparison, New York only sees \$0.06.



4 Key Life Sciences Economic Indicators: Ranking Among 50 States

	Life Sciences as a Percentage of GDP (2013)	Life Sciences Venture Capital Investment (Federal FY 2015)	NIH Funding (Federal FY 2015)	Number of Howard Hughes Medical Investigators (2015)	Number of National Academy of Science Members (2015)
California	6	1	1	1	1
Connecticut	11	9	16	4	9
Maryland	13	11	5	7	5
Massachusetts	3	2	2	2	2
New Jersey	1	12	23	13	4
New York	24	16	3	3	3
North Carolina	4	7	6	10	11
Pennsylvania	10	6	4	14	10
Texas	40	10	7	5	7
Washington	27	8	8	6	8

Source: EMSI data, PwC MoneyTree™ Report, NIH data, Howard Hughes Medical Institute, National Academy of Sciences

New York City Biomedical Assets

New York City boasts one of the world's largest concentrations of biomedical research institutions, world-class universities, disease-focused foundations, health care service providers and proximity to major pharmaceutical operations.

Academic Institutions

New York City's academic research institutions are well-known for high quality biomedical research and compete well for research funding. In FY 2015, over \$556 million, or 37 percent of NIH funding coming to New York State, was awarded to institutions along the "First Avenue Medical Corridor" in Manhattan, where the city's life sciences activity is centered.¹⁹

The city also has a deep pool of "next generation" scientific talent. Seven percent of all post-doctoral scientific

researchers in the U.S. are at New York City universities—second only to Boston with 10 percent.²⁰

New York's researchers are regularly recognized by prestigious national and international organizations, with a greater number of Howard Hughes Medical Institute Investigators and National Academy of Sciences members than all but California and Massachusetts (Exhibits 5 and 6).²¹

In terms of patent awards, New York is comparable to Boston, and exceeded only by the University of California Board of Regents (includes San Francisco and San Diego).²² The key difference is that academic institutions in Boston and California more often have institutional cultures that encourage their faculty (and post-doctoral students) to commercialize

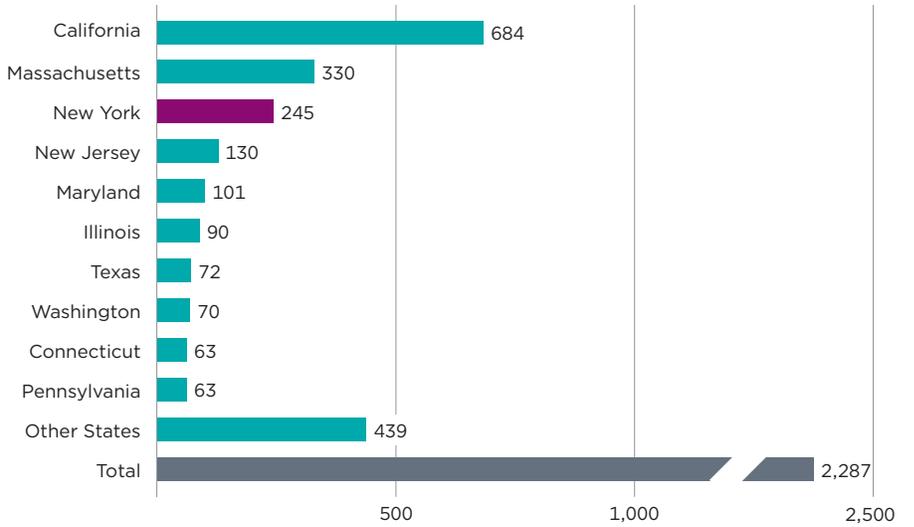
their research, while New York institutions tend to license their patents to third parties. From 2003–12 New York University, Columbia University and Mount Sinai Medical School were among the top ten earners of licensing gross income in the U.S.²³

Proximity to Pharmaceutical Companies

The New York-New Jersey metropolitan region has a high concentration of the pharmaceutical industry's global leaders, including Bayer, Bristol Myers, Johnson & Johnson, Merck, Novartis and Pfizer.²⁴ Pharma companies are potential partners with startup companies for clinical development, marketing and distribution of new drugs. "Big pharma" also contributes to the development of a skilled workforce that startup companies need for growth.

5 National Academy of Science Members

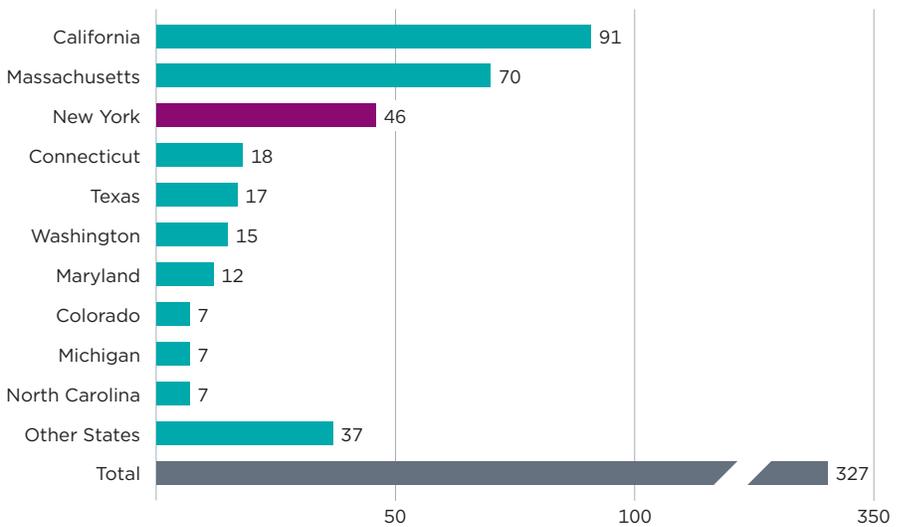
As of March 2016



Source: National Academy of Sciences

6 Howard Hughes Medical Investigators

As of March 2016



Source: Howard Hughes Medical Institute

CASE STUDY: NEW YORK GENOME CENTER

The New York Genome Center is a world-class research consortium of academic, medical and industry leaders, focusing on translating genomic research into clinical solutions for serious disease. Under a New York State grant, it has teamed with the State University of Buffalo to support a new Genomic Medicine Center in Buffalo.

The Center has been awarded several sizeable grants since it began operating in 2012. Most notably, in January 2016, after just four years of operation, the NIH awarded the Center \$40 million over four years to use genomic sequencing to study autism, designating the Center as one of four “Centers for Common Disease Genomics” in the country alongside Washington University, the Broad Institute and Baylor College of Medicine.

Located in Manhattan, the Center currently has 160 employees and expects to grow to 500 employees.

Member institutions include: Albert Einstein College of Medicine, American Museum of Natural History, Cold Spring Harbor Laboratory, Columbia University, Cornell University/Weill Cornell Medicine, Hospital for Special Surgery, The Jackson Laboratory, Memorial Sloan Kettering Cancer Center, Icahn School of Medicine at Mount Sinai, New York-Presbyterian Hospital, The New York Stem Cell Foundation, New York University, Northwell Health (formerly North Shore-LIJ), The Rockefeller University, Roswell Park Cancer Institute, Stony Brook University and IBM

In recent years, several leading pharmaceutical companies have established new hubs and research centers in New York City, attracted by the opportunity to work in closer collaboration with the city’s universities.

- **Lilly:** After acquiring ImClone Systems, Lilly chose to move those employees to the Alexandria Center in Manhattan rather than New Jersey, where the company already had operations. They subsequently designated New York City as their oncology hub.²⁵
- **Pfizer:** In 2011, Pfizer opened a Center for Therapeutic Innovation, also at the Alexandria Center, and signed a collaboration agreement with seven local academic medical centers.²⁶
- **Roche:** Following an extensive review of East Coast options, Roche relocated over 200 employees in its Translational & Clinical Research Center to New York City from Nutley, N.J.—explicitly to develop stronger links with New York City’s academic science.

New Real Estate Entrants

Since Alexandria Real Estate Equities, the world’s largest wet lab developer, opened the city’s first major commercial life sciences center on the East River in 2010, private sector interest in developing office and wet lab space has steadily grown:

- Alexandria retains an option to build a third tower on their campus at First Avenue and 29th Street and is exploring other sites in the city.

- Two groups are looking to create “plug and play” wet lab space for early stage companies. Harlem Biospace intends to expand its 2,500-square-foot co-working space, which houses 20 seed stage companies. Cambridge BioLabs, a successful accelerator program, has established a New York City subsidiary and is seeking ~30,000 square feet to set up operations here.
- BioMed Realty Trust, a major developer and operator of space in Westchester County, Cambridge, Massachusetts and elsewhere in the U.S., was recently acquired by The Blackstone Group and is actively exploring development opportunities in New York.
- Several other real estate firms are actively looking for appropriately zoned sites that can accommodate wet lab space.

Disease-Focused Foundations

Almost half of the top 35 disease-focused foundations are headquartered in the New York metropolitan region, awarding a combined \$400 million in research funding annually.²⁷ Many of these foundations have moved beyond basic research and are providing grants and investment capital to move targeted therapies through clinical trials. Most disease-focused foundations have expert advisory boards that could help investors more efficiently assess emerging technologies.

Early Stage Funding

New York City has an abundance of philanthropic and investment capital, although relatively little has been tapped for venture funding in life



Inside the New York Genome Center
Image Credit: New York Genome Center



Alexandria Center for Life Sciences opened in 2010 and will have 1 million square feet when fully constructed

Image Credit: Alexandria Center for Life Science courtesy of Alexandria Real Estate Equities, Inc..

CASE STUDY: ACORDA THERAPEUTICS

Acorda Therapeutics, known for development of a drug targeted at multiple sclerosis, was founded in 1995 by a graduate of Columbia College of Physicians and Surgeons. With just six employees, Acorda moved to Westchester in 1998 due to a lack of affordable wet lab space in New York City, and expanded in 2012 to the Ardsley Park life sciences campus. Acorda now has more than 300 employees. Acorda's decision to remain in New York State when they could not find space in the city, however, has not been the pattern. Most companies built on New York science have located outside the state.

sciences. Over a 10-year period from 2006 to 2015, only \$9 million of angel funding and \$11 million of seed funding was invested in life sciences companies in New York City (Exhibit 7), with no reported angel or seed funding for three of those years. By comparison, in Boston/Cambridge and Silicon Valley, angel and seed funding during 2006–2015 totaled \$110 million and \$184 million, respectively.²⁸

New York's "Silicon Alley" startups in other high-tech sectors have been far more successful in attracting early stage funding, even from traditional life sciences investors. In 2015, only 2 percent of venture investments in Downstate New York went to life sciences companies. In Massachusetts and Silicon Valley, life sciences received 45 percent and 12 percent of total venture dollars (Exhibit 8).²⁹

During the last twelve months, however, five new venture funds have entered the New York City market: Accelerator Corp. from Seattle; Arch Ventures from Chicago; Flagship Ventures from Boston (as part of the Early Stage Fund established by the NYC Economic Development Corporation [NYCEDC]); Deerfield (new early stage fund); and Versant Ventures from San Francisco. Venture capital funding nearly tripled from 2014 to 2015, with \$140 million flowing to life sciences companies in Downstate New York, including:

- \$17 million Series A for Lodo Therapeutics (Accelerator Corp)
- \$48 million Series A for Petra Pharma (Accelerator Corp)

- \$44 million Series A for Kallyope (Lux Capital, Polaris Partners, Illumina, Alexandria Ventures, The Column Group, Tony Evnin)
- Undisclosed for Kyras Therapeutics (Versant)
- \$2.75 million convertible note for TARA Biosciences (Harris & Harris, Partnership Fund, Alexandria Ventures)³⁰

Small but Growing Number of Successful Life Sciences Companies

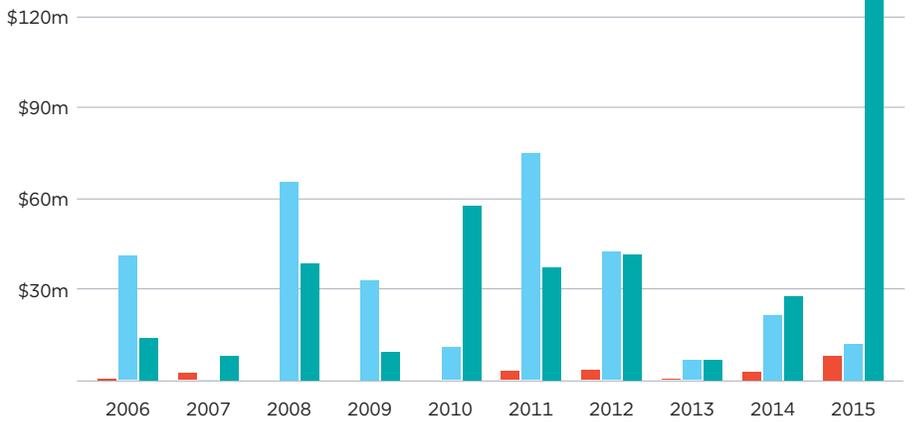
There have been several successful life sciences companies built in the metropolitan region, including Regeneron and Acorda in Westchester and, more recently, Ophthotech, Intercept Pharma and Intra-cellular Therapies in New York City.

These ventures are developing regional talent and producing successful entrepreneurs who can be angel investors for the next generation of early-stage companies.

Specialized Professionals

New York City offers a unique depth and diversity of professional services that specialize in the life sciences industry, including legal, financial, public relations, management consulting and accounting firms. These are essential support for growing companies as well as established industry players.

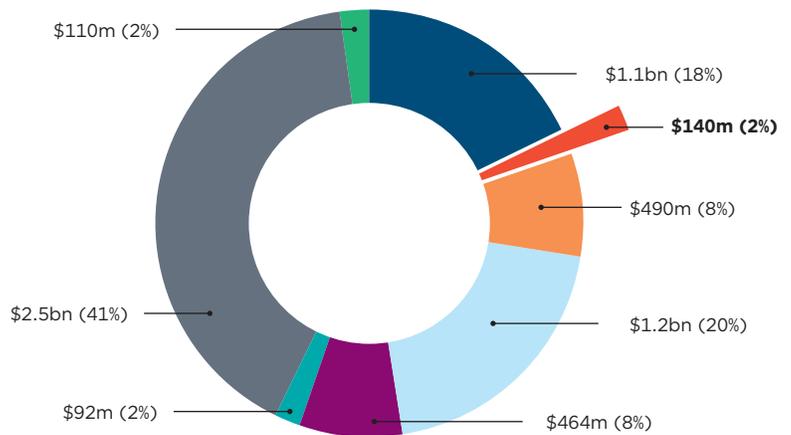
7 Venture Capital Funding for New York City Life Sciences



█ Angel and Seed
█ Series A
█ Series B-G

Source: CB Insights, KPMG analysis. Categories used include: "Biotechnologies", "Drug Development/Discovery", "Medical Devices & Equipment", "Pharmaceuticals/Drugs"; Location restricted to five boroughs

8 Downstate Venture Capital Dollars by Industry, 2015



█ Life Sciences
█ Business Products & Services
█ Consumer Products & Services
█ Financial Services
█ Healthcare Services
█ IT Services/Software
█ Other
█ Media & Entertainment

Source: PwC MoneyTree™ Report

Life Sciences Development Timeline

The pace of activity in New York is accelerating, especially during the past 12-18 months.



The Partnership and nine academic medical centers launch the NY Structural Biology Center

1999

Launch of NY Stem Cell Foundation

2005

Groundbreaking of Alexandria Center

2007

1992

New York State, New York City and Columbia University open the Audubon Center, the city's first biotech incubator, in Washington Heights



2001

Partnership Fund releases "Market Demand Study for Commercial Biotechnology, Biomedical and Bioinformatics Facilities in New York City"

2004

New York City, New York State and SUNY Downstate open a biotech incubator in Central Brooklyn





Partnership Fund's BioAccelerate program launches, increasing commercial spinouts from the New York City academic sector

Jan. Pfizer opens Global Center for Therapeutic Innovation at Alexandria Center
Aug. Partnership Fund starts Riverside Chats hosted by Memorial Sloan-Kettering

Sept. New York Genome Center opens
Oct. Tri-Institutional Therapeutics Discovery Institute launched
Nov. Harlem BioSpace opens

Mar. Arch and Flagship Ventures selected for NYCEDC Early Stage Life Sciences Fund

Apr. Collectis moves into the Alexandria Center

Jul. Deerfield Management raises \$550 million Healthcare Innovations Venture Fund

Aug. Versant Ventures opens New York City office

Dec. Kallyope announces \$44 million Series A Financing

2009

2011

2013

2015

2010

Mar. New York City Council and Partnership Fund's NYC Emerging Technologies Summit launches



Dec. Alexandria Center East Tower opens with Lilly's Imclone as anchor tenant

2012

Oct. Intercept Pharma IPO
Nov. NYCEDC's Entrepreneurship Lab (eLab) program launched



2014

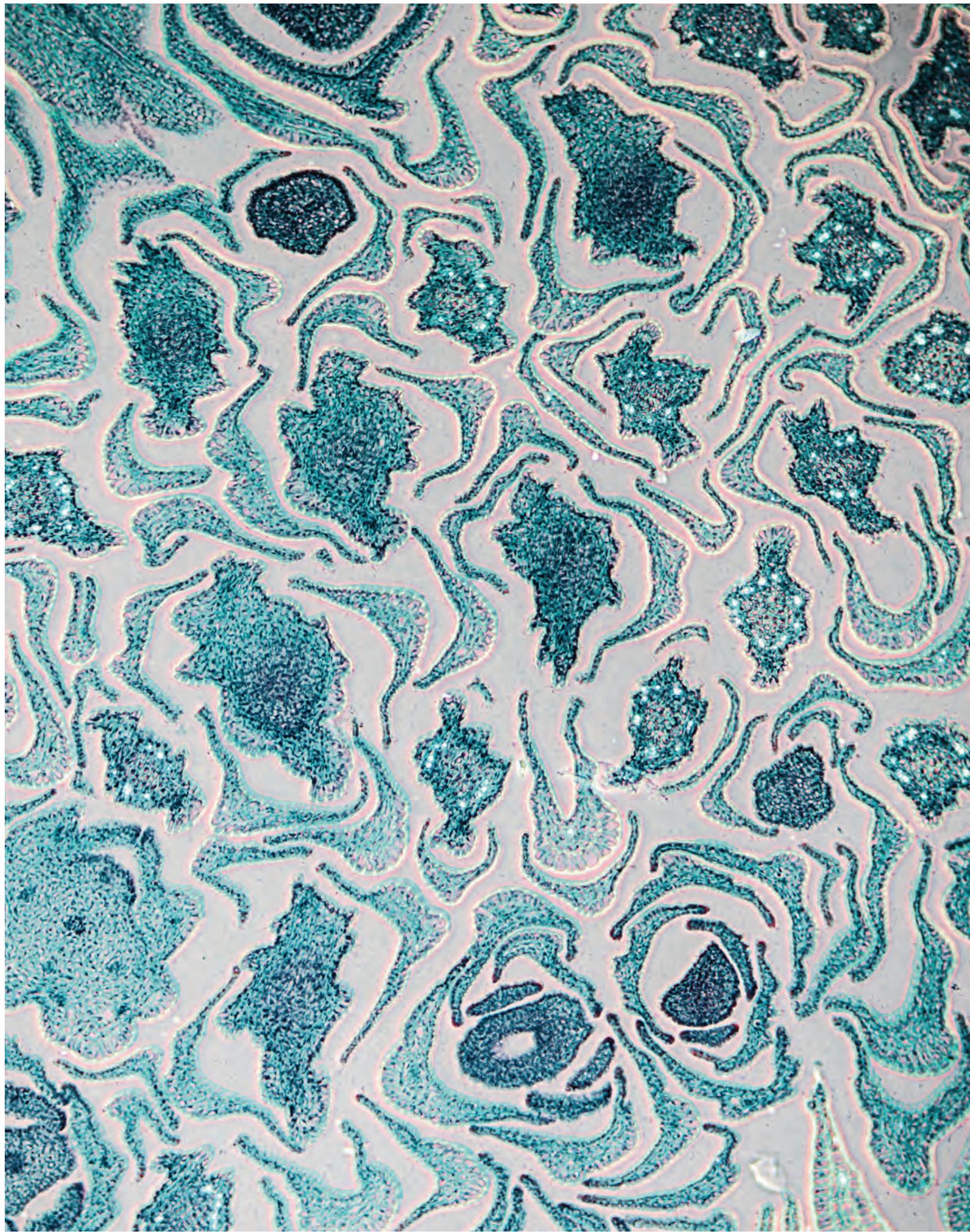
Jan. Roche relocates to Alexandria Center West Tower from New Jersey
Jul. Accelerator Corp. moves into Alexandria Center West Tower



Aug. Intra-Cellular Therapies moves into Alexandria Center West Tower

2016

Jan. NIH names New York Genome Center one of the four national centers and awards \$40 million
 Petra Pharma announces \$48 million Series A financing
 Lodo Therapeutics announces \$17 million Series A financing
Jun. 15,000 SF incubator opens at Alexandria Center



Key Findings

As the timeline illustrates, New York's innovation capacity has accelerated rapidly in the past six years, but much remains to be done. To establish a leading industry cluster and create a critical mass of life sciences companies and jobs, New York must focus on four key areas:

- 1. Space:** affordable and appropriately located wet lab space to accommodate companies both when they spin out of the university and then as they grow;
- 2. Talent:** resources within the universities to support promising scientists who want to start companies and to identify talent to build those companies;
- 3. Capital:** additional early-stage capital prepared to take high risk;
- 4. Promotion:** better connectivity between the various stakeholders and a program to market New York's assets.

The Partnership Fund estimates that the New York Metropolitan Region's life sciences industry could double in terms of jobs and economic output over the next decade if the right investments are made by the private and public sectors. New York could then take its rightful place as a leading global center for commercial life sciences.

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Finding No 1

The lack of appropriate, affordable wet lab space remains a key barrier to life sciences development. There is unprecedented interest from the real estate industry in developing life sciences facilities, but the city's restrictive zoning and permitting requirements, and high costs, are barriers to market-rate development.

“We need places to put our new companies. Right now this is a real problem. And location is important. We have to be able to put companies where the commute won't be overly taxing. A lot of the talent that we will need to recruit is in New Jersey; some is in Westchester (Tarrytown). As long as you have incubating space on Manhattan Island then we may be able to access that talent via commuter transportation.”

New York VC



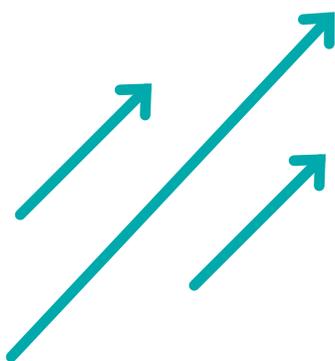
- The explosive growth of life sciences in Cambridge, Massachusetts was possible because MIT and the City of Cambridge supported the conversion of derelict industrial buildings into low cost commercial lab space. New York still has older industrial and publicly-owned buildings that could be re-developed into wet lab space at a substantially lower cost and more quickly than new construction.
- To the extent that government is prepared to provide public incentives, the pace of private investment can be accelerated and a wider range of early stage companies can be accommodated. Both the city (through the NYCEDC) and the state (through STARTUP-NY and Regional Economic Development Council [REDC] and Empire State Development [ESD] grants) have resources and interest in encouraging private development of affordable space for life sciences.
- City government is well positioned to address the real estate challenges, by establishing an inventory of properties appropriate for conversion to life sciences and assisting private developers with zoning and permitting issues.
- NYCEDC could establish a “One Stop Shop” to centralize information around the existing City and State licensing, permitting and regulatory requirements relevant to life sciences companies. The goal is to reduce the time and cost to develop wet lab space, a process that can take 12–18 months longer in New York City than in competitor markets.

“It’s really costing us a lot of money to get through the process of starting an incubator here because it’s very hard to figure out what type of permit we need. It’s very different than anything else we’ve had to go through in other communities. And because it’s so complicated you can’t do it without professional advisors—that’s what makes it so expensive.”

Accelerator Investor

Finding No 2

Life sciences entrepreneurs and venture capitalists are still not convinced that startups and their short-term growth needs can be accommodated here.



- Coordinated efforts to meet short term needs for “plug and play” wet lab space should be a focus of NYCEDC and ESD. Early stage companies need flexible lease terms and pre-built space so they can begin operations quickly and avoid a large investment to build out space that they will soon outgrow. New York City offers few options when it comes to pre-built modular lab/office suites that are conveniently located and provide shared equipment and support services. Affordability, at a maximum of \$70–80 per square foot for built-out space, is critical.
- State and city government in emerging competitor locations such as Atlanta, Cleveland, Florida and Texas offer lower-cost options and subsidy packages to attract startups, in some cases pirating them from New York institutions. Neighboring New Jersey and Pennsylvania offer deep incentive programs that are applicable to life sciences companies as well as a robust network of incubators.³¹ Cambridge BioLabs launched its “plug and play” space with \$10 million in grants from the state of Massachusetts and needs similar support here.
- New York’s high costs of living and doing business, including personal and business taxes, and the lack of a robust, refundable research tax credit put the region at serious disadvantage as companies mature and scale.

Finding

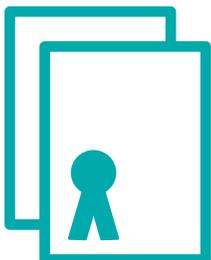
No 3

While New York institutions have recruited many academic leaders and trustees who want to build stronger “cultures of entrepreneurship” within their institutions, the funding and infrastructure to support this cultural transformation is far from adequate.

“Many of our faculty don’t know enough about how to start companies. They are not full-time employees of the hospital, just affiliates and on the faculty of the medical school.”

Director, Tech Transfer Office (TTO)

- Academic researchers in New York City who want to commercialize their research by starting a company do not have easy access to facilities, venture capital, or the business management experience required. In contrast to California and Massachusetts, scientists at New York institutions cannot just “walk down the hallway at their university and ask a colleague” since so few of them have started companies. The existing New York incubators (Columbia Audubon, Harlem Biospace and SUNY Downstate) mostly rent space to companies that are already established and can sign a lease, not to scientists with an idea.³²
- To reinforce an entrepreneurial culture, New York needs more accelerator programs that provide funding and access to investors, mentors and relevant services, as well as incubation space. The accelerator model taps private sector expertise and offers scientists a portfolio of resources such as front- and back-office space to help them launch a company, as well as access to potential funders and experienced life science business mentors.
- Trustees and senior university leadership must be fully engaged with cultural transformation that fosters entrepreneurship. Questions to ask include:
 - How many CEOs or Board Trustees have backgrounds in entrepreneurship?
 - Are entrepreneurial-related metrics (number of spin out companies, etc.) provided to the Board on a regular basis?
 - Are there resources that support entrepreneurship on campus, such as an incubator with wet lab space or biomedical Entrepreneur-in-Residence program?
 - What are the institutional barriers to faculty/post docs/students participating in spin outs from their labs?
 - Are the licensing offices incentivized to maximize licensing revenue at the expense of supporting spin out companies?
 - Are there programs to connect faculty/students with alumni or trustees who are successful entrepreneurs (events, internships, etc.)?



Finding No 4

New York has a relatively small pool of experienced mid- and senior-level talent who can manage and grow startup life sciences companies. To the extent that this talent already is in New York, it is not readily identifiable and accessible to investors, scientists, or entrepreneurs.

- The accelerator model is one vehicle to identify and engage experienced mid- and senior-level talent who are skilled in science translation, company formation, and management and operations of startups. It would help identify and coalesce talent that is already in the New York Metro region, as well as those contemplating coming to New York.
- Funding internships at young life sciences companies has been an effective way to increase the talent pipeline, give students direct exposure to entrepreneurship and add diversity to the life sciences sector.
 - The Massachusetts Life Sciences Center funds an internship program that provides incentives for companies to select students from community colleges to fill available internship slots. This program has increased the demographic distribution of internship recipients by gender and ethnicity with a roughly 10 percent increase in the number of non-Caucasian students taking part between 2010 and 2013.

“I don’t know if I can find the talented management team to run the companies that I form in New York City. It’s a ‘craft’ that often is taught through mentorship from serial entrepreneurs. I could fire a scatter gun in New York and wouldn’t hit someone like this. I could a fire a small pistol and hit ten of them in Boston.”

Corporate VC



“Right now there is the distraction of ‘easy money’ in New York for early stage tech companies doing app development. Everyone is focused on tech startups—if you are building an app, people will almost throw money at you. Why take on the risk of products that have a harder road of development when you can invest in products with a shorter development time, easier path to market and lower risk profile?”

New York VC



Finding No 5

New York City has a relative abundance of investment capital, but not enough is focused on high-risk, early stage activity. The success of “Silicon Alley” has drawn seed and early stage capital to media, e-commerce, health IT and other tech sectors, exacerbating the funding gap for life sciences entrepreneurs.

- Early-stage venture funds from around the country have begun to open offices in New York City, but tend to characterize their decision to do so as an “experiment,” “toe in the water,” “new frontier” or “an exploratory effort.”
- New York needs a “side car” fund to help de-risk early stage companies for larger subsequent investments by venture capitalists and to support the emerging startup ecosystem. This would offer a vehicle to engage high-net-worth individuals, especially those serving as trustees at biomedical research institutions, in the creation of such a fund, as well as a network of angel investors.
- The Partnership Fund is prepared to organize a side car fund assuming this is matched by government and institutional commitments to the larger cluster development initiative.

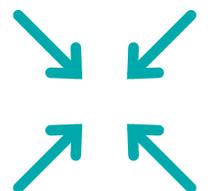
Finding No 6

The emergence of personalized medicine and the convergence of life sciences with other technology sectors create a significant opportunity for New York. With its competitive strengths in genomics and high tech, New York is strongly positioned to take a leadership role in the next wave of life sciences innovation.³³

“Recent breakthroughs in genetics and immunology have led to a renaissance in the life sciences community, a rewriting of the medical textbooks, and new options for patients. The bar has been raised for what is expected for new medicines for patients, clinicians, providers and payors, and informs how our science can be focused on rapid development of breakthrough medicines.”

Pharma Executive

- A number of advances in genomics and genome mapping are creating an explosion of innovation in therapeutics, treatments and diagnostics, such as personalized/precision medicine, specialty drugs, gene-targeted therapies and testing for the genetic abnormalities associated with orphan diseases.
 - With its expertise in biology, oncology, genomics and IT, New York is well positioned to capitalize on these growth opportunities, provided it can support the local scientists who want to start local companies.
- In addition, the “convergence” of information technology, biology and chemistry is enabling the discovery of new treatments for complex or rare diseases, more efficient ways of conducting clinical trials, and lower cost of drug development. For example:
 - Computational biology is being used to create accurate models of the human brain, assist in modeling biological systems and help sequence the human genome, contributing to the advance of the growing field of personalized medicine.
 - Medical device companies are using information technology to develop the next generation of “smart” devices and sensors that monitor and send patient data to healthcare providers.
 - The synergies between New York’s established enterprise technology companies and life sciences entrepreneurs can be exploited to strengthen the cluster, as is happening for example, through the partnership between IBM Watson and the New York Genome Center.



“If we see that New York has figured out a way to engage and support serial entrepreneurs who are knowledgeable about selecting good science and forming companies, we definitely will put money there.”

Boston VC

Finding No 7



New York has an opportunity to become the East Coast leader in life sciences. Massachusetts is reaching the end of its decade-long, \$1 billion life sciences initiative. Its success has created intense local competition for talent and real estate, driving up costs and creating opportunities for other markets like New York.

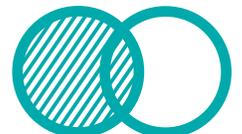
- New York City and State need to send strong signals of their intention to become a dominant player in commercial life sciences, through a combination of incentives and marketing initiatives.
- A set-aside allocation of a meaningful amount of New York State Excelsior Jobs Program Tax and investment credits for the life sciences sector would be an immediate way to demonstrate this commitment.
- A focus on life sciences for the state’s STARTUP-NY program, that offers ten years of zero taxes to companies that locate on designated sites and partner with local colleges, would demonstrate the focus on building this cluster. Importantly, START-UP NY also eliminates state personal income taxes for employees, allowing New York City to compete with places like Massachusetts, where the rate is about 30 percent lower.
- A new research and development refundable tax credit for early stage life sciences companies would be the most dramatic illustration of New York’s commitment to life sciences and attraction for entrepreneurs and investors who want to maximize the funds they have to invest in development of their companies.
- The jobs created by these tax credits would likely provide opportunities for New Yorkers with a range of educational backgrounds. As an example, in Massachusetts, 71 percent of the new hires at life sciences companies who received tax incentives in 2010 had a Bachelor’s degree or less; 15 percent had an education level of high school or less.³⁴

Finding No 8

New York has tremendous institutional and human assets in life sciences, but they are highly fragmented, often competitive, and seldom realize the benefits of collective action. New York needs to aggregate and promote these assets in a collective marketing and development effort.

- A visible public-private life sciences initiative (with dedicated staff) would provide the catalyst for an ecosystem that drives the continued development of the local cluster. It would provide new market entrants with access to resources, talent, mentors, and colleagues. It could help “demystify” the process of building a company in a very complex business, legal and regulatory environment.
- Promotion and marketing are essential to the development of a high performing cluster and attraction of the resources required to drive it forward. New York institutions have strong individual brands, but a super-brand and a true ecosystem are a pre-condition for capturing the economic benefits that match its stature and investment in research and discovery.
- The Governor’s network of REDCs offers a forum for planning and executing on a statewide strategy to support development of a vibrant life sciences cluster with access to the relevant resources of every region of the state. The New York City REDC has indicated its willingness to provide leadership in mobilizing an inter-regional program to advance the policy and funding priorities required to build the state’s innovation capacity in order to make New York a leader in commercial life sciences.

“Our ecosystem is ‘fledgling’ at best. We have pockets and pieces, different organizations hold gatherings, summits and events, but no one has really pulled everyone together. Someone referred to it as ‘blobs of mercury’ that haven’t run together. There really isn’t a focal point for leadership and ownership by someone or some organization that has the right gravitas. One of the new academic leaders is trying hard to connect people, but that is not, and shouldn’t be, his full-time job.”



Appendix

Life Sciences Economic Impact

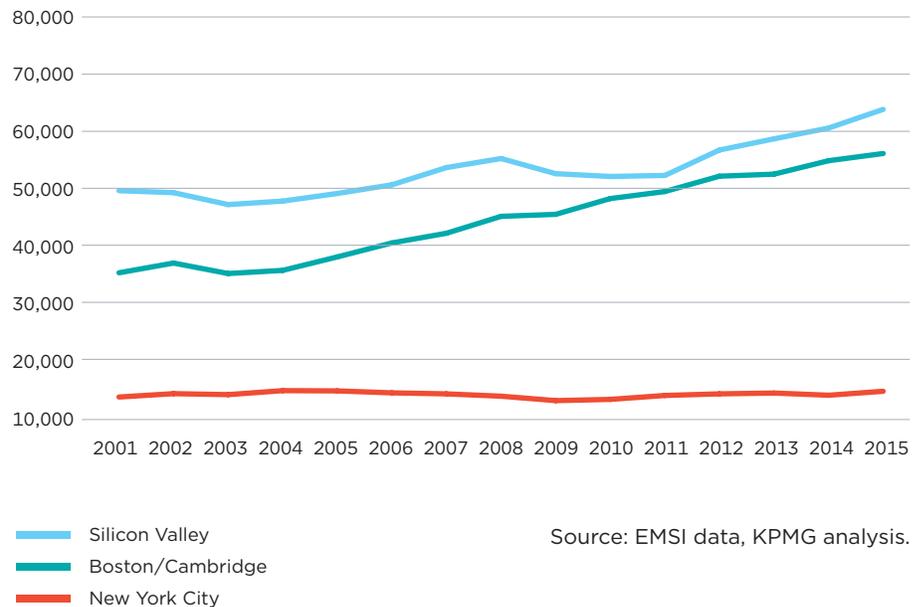
The U.S. life sciences industry—which includes biotechnology, pharmaceuticals, medical diagnostics, genomics, bioinformatics and medical devices—is growing faster than the overall economy, has above average salaries, an above average economic multiplier and attracts a significant share of investment capital.

- The life sciences sector represents a much smaller piece of New York City’s economy than in comparative metro areas. The sector is poised for strong growth across the country and New York City is well situated to capture some of this growth.
 - In New York City, life sciences accounts for 0.3 percent of GCP (\$2.2 billion).³⁵ The sector accounts for 5–6 percent in both Silicon Valley and Boston/Cambridge.³⁶ Life sciences generates 2 percent (\$316 billion) of the nation’s GDP.³⁷
 - U.S. sales are projected to grow 4 percent/annum to \$555 billion by 2019.³⁸ Growth of global biotech drug sales are expected to grow at even faster rates, 9 percent/annum from an estimated \$289 billion in 2014 to \$445 billion by 2019.³⁹
- Over the next decade, life sciences employment in the U.S. is projected to grow 11 percent (compared to 12 percent overall projected employment growth).⁴⁰ New York City currently has approximately one-fourth as many life sciences jobs as its competitor regions.
 - Life sciences employs over 1.5 million people in the U.S., and is projected to surpass 1.7 million jobs by 2024.⁴¹
 - The regions/areas with the highest number of life sciences jobs are Silicon Valley (64,000), Boston/Cambridge (56,000) and San Diego (52,000).
 - By comparison, New York City has 14,000 life sciences jobs. Based on the current trajectory, life sciences jobs will increase 6 percent in New York state and 11 percent in New York City over the next decade.⁴²
 - In Boston/Cambridge, thanks largely to a \$1 billion state investment, life sciences jobs grew 60 percent from 2003–2015, while job growth for the state overall during that same period was only 9 percent (Exhibit 9).⁴³

9 Total Life Sciences Employment in Selected Regions

2001-2015

Boston/Cambridge includes Suffolk & Middlesex counties, New York City includes 5 boroughs only, and Silicon Valley includes San Francisco, San Mateo & Santa Clara counties



- In New York City, the average life sciences salary is \$90,000, slightly higher than the average city salary of \$84,000.⁴⁴ The average life sciences salary in the U.S. is \$104,000.
- The typical life sciences job supports approximately four other jobs across the country.^{45,46}
 - At the state level, the job multiplier for Massachusetts is 3.3, while it is 4.6 in California.⁴⁷
 - The economic multiplier of a life sciences job in New York State is 3.8.⁴⁸
- Over 17 percent of all U.S. venture investment was targeted at life sciences in 2015.⁴⁹ Life sciences venture funding reached an all-time high in 2015 with \$10 billion, up nearly 50 percent from 2013.⁵⁰
 - Nationwide, life sciences received the second highest amount of venture funding, behind software which received 40 percent (\$24 billion).⁵¹
 - In Downstate New York, life sciences received the eighth highest amount of venture funding, out of 16 categories.
- Much of the life sciences industry has been built on research spun out from universities, many of whom receive competitively awarded funding from the NIH.
 - In federal FY 2015, New York City's research community received \$1.5 billion in funding from the NIH trailing only Boston/Cambridge at \$2.2 billion and ahead of Silicon Valley at \$1.4 billion.⁵² The degree to which an area is able to attract investment dollars relative to that NIH funding is a good proxy to measure the vibrancy of their commercial life sciences sector.
 - In federal FY 2015, for every \$1.00 of NIH funding that Massachusetts, California and New Jersey received, approximately \$1.32, \$1.27 and \$0.91 of life sciences venture funding was invested in those states, respectively. The national figure was \$0.48.
 - In New York, it was \$0.06.⁵³

Comparative Incentive Programs for Life Sciences in the United States

NEW YORK CITY & STATE

New York City and State government offer incentives to attract life sciences companies focused on encouraging capital expenditures and job creation. Those offered by New York State include the Excelsior Jobs Program and a Research & Development Tax Credit. At the city level, there is a Biotech Tax Credit.

NYC Biotech Tax Credit⁵⁴

The NYC Biotech tax credit is available to emerging technology companies focused on biotechnology with annual sales of \$10 million or less. The size of the credit depends on amounts paid or incurred for certain facilities, operations, and employee training in New York City. The maximum credit a company can receive is \$250,000 per year. To claim the tax credit, a company must:

1. Have 100 full-time employees or less, with at least 75 percent in New York City
2. Spend at least 6 percent of net sales on research and development
3. Have gross revenues less than or equal to \$20 million

The NYC Biotech Tax Credit is as-of-right.

NYC Early-Stage Life Sciences Funding Initiative⁵⁵

The NYC Early-Stage Life Sciences Funding Initiative is run by the NYCEDC with support from VC firms in the city. The funding partnership will deploy a minimum of \$150 million of early-stage funding, and seeks to launch 15 to 20 life sciences startups with 2,000 permanent private sector jobs by 2020.

Excelsior Jobs Program⁵⁶

The Excelsior Jobs Program provides job creation and investment incentives to firms in targeted industries such as biotechnology, pharmaceutical, high tech,

clean-technology, green technology, financial services, agriculture and manufacturing. Firms in these industries that create and maintain new jobs or make significant financial investment are eligible to apply for up to four new tax credits:

1. Excelsior Jobs Tax Credit: A credit of 6.85 percent of wages per new job.
2. Excelsior Investment Tax Credit: Valued at 2 percent of qualified investments.
3. Excelsior Research and Development Tax Credit: A credit of 50 percent of the Federal Research and Development credit up to three percent of research expenditures in New York State.
4. The Excelsior Real Property Tax Credit: Available to firms locating in certain distressed areas and to firms in targeted industries that meet higher employment and investment thresholds.

In order to receive Excelsior tax credits, each organization is required to submit an application through the Regional Economic Development Council process.

Qualified Emerging Technology Company Certification and Capital Tax Credit⁵⁷

The Qualified Emerging Technology Company Certification and Capital Tax Credit is available to investors in emerging technology companies in New York State with annual sales of \$10 million or less. The size of the credit depends on the amount invested in emerging technology companies. This credit is available as-of-right.

Qualified Emerging Technology Company Employment Credit⁵⁸

The Qualified Emerging Technology Company Employment Credit is available to emerging technology companies in New York State with annual sales of \$10 million or

less. Companies receive \$1,000 for each additional employee on their payroll compared to when they began receiving the credit. Companies can receive the credit for up to three consecutive years. This credit is available as-of-right.

Research & Development Tax Credit (New York State)⁵⁹

The Research & Development Tax Credit is available to people or businesses who invest in R&D buildings and tangible personal property. The size of the credit depends on the amount invested in R&D. This credit is available as-of-right.

NYC Life Science Innovation Showcase⁶⁰

An annual forum at which academic entrepreneurs showcase their work to venture capitalists, angel investors and biopharma development executives. Co-hosted by the Alexandria Center, the New York Academic Consortium and the Partnership Fund for New York City.

NEW JERSEY⁶¹

Life sciences and health companies may qualify for tax breaks by creating as few as 25 full-time jobs (10 for new technology startups and manufacturing businesses).

Grow New Jersey Assistance Program (Grow NJ)

Provides tax credits ranging from \$500 to \$5,000 per job, per year, over ten years, with numerous bonus credits each ranging from \$250 to \$3,000 per job, per year if the project meets certain requirements, such as location in an urban area or high job creation levels. Maximum awards can reach as high as \$15,000 per job, per year, and projects can earn up to \$300 million over 10 years.

In order to take advantage of the Grow New Jersey Assistance Program, each organization is required to submit an application through the New Jersey Economic Development Authority.

Technology Business Tax Certificate Transfer Program

Allows New Jersey-based technology and biotechnology companies to sell their New Jersey net operating tax losses and R&D tax credits to unrelated profitable corporations.

Businesses can monetize their losses to fund their business growth and operations.

Angel Investor Tax Credit Program

Provides refundable tax credits against New Jersey corporation business or gross income tax for 10 percent of a qualified investment in emerging technology business with 75 percent of their employees in New Jersey that conducts research, manufacturing or technology commercialization. Both out-of-state and foreign investors are eligible for the program.

Founders and Funders

Provides emerging tech and life sciences companies in New Jersey with access to angel and venture capital investors. At events held semi-annually, early-stage companies meet with venture investors in 10 minute, one-on-one sessions to discuss strategy, business models and funding opportunities.

INDIANA⁶²

In 2013, the State of Indiana appropriated \$25 million to start the industry-led Indiana Biosciences Research Institute (IBRI). Eli Lilly also made an initial grant of \$10 million. The Institute invests in entrepreneurial research focused on metabolic disease and poor nutrition. IBRI is led by a team of executives and support staff focused on building a research institute with 150 to 200 scientists organized into research teams around 8–12 principal investigators—known as Indiana Research Fellows. The teams will partner with industry and universities on research projects and consist of experts across a spectrum of competencies, including bioengineering, bioinformatics, nanotechnology and agriculture.

KENTUCKY⁶³

The Kentucky SBIR-STTR Matching Funds Program is funded by the state. These matching funds are to be used for new and additional work tasks that are complementary to a company's existing Federal SBIR-STTR Award. Companies from Kentucky and those willing to move to Kentucky can apply.

SBIR-STTR Matching Fund Program

Provides matching funds up to \$150,000 for Phase I and up to \$500,000 for Phase II (up to two years). Recipient is required to relocate the business to Kentucky within 90 days of the agreement and must maintain its Kentucky-based status for five years after receipt of the final disbursement of funds and at least 51 percent of the company's property and payroll must be in Kentucky. At least 51 percent of the matching funds grant amount must be spent in Kentucky.

CPRIT Funding Opportunities

Under the guidance of its governing body, the Oversight Committee, CPRIT accepts applications and awards grants for promising cancer research, product development and prevention programs. Academic institutions, organizations and companies are eligible to apply. All CPRIT-funded research must be conducted in Texas by Texas-based scientists and reflect CPRIT's mission to attract and expand the state's research capabilities and create high-quality new jobs in Texas.

MASSACHUSETTS⁶⁴

Massachusetts Life Sciences Center

The Massachusetts Life Sciences Center (MLSC) is an investment agency that supports life sciences innovation, research, development and commercialization. The MLSC is charged with implementing a \$1-billion, state-funded investment initiative. These investments create jobs and support advances that improve health and well-being. The MLSC offers the nation's most comprehensive set of incentives and collaborative programs targeted to the life sciences ecosystem. These programs propel the growth that has made Massachusetts the global leader in life sciences. The MLSC creates new models for collaboration and partners with organizations, both public and private, around the world to promote innovation in the life sciences (Exhibit 10).

PENNSYLVANIA⁶⁵

In 2013, Pennsylvania created a venture-related initiative funded from the selling of credits against the state's insurance premium to further fund bioscience and other

startups through the State's Ben Franklin Technology Partners program and the Life Sciences Greenhouses.

Ben Franklin Technology Partners

Ben Franklin Technology Partners (Ben Franklin) is a seed stage capital provider for the region's technology sectors, investing over \$175 million in more than 1,750 regional technology companies. Ben Franklin has also launched university/industry partnerships that accelerate scientific discoveries to commercialization, and has seeded regional initiatives that strengthen the entrepreneurial community.

Ben Franklin Technology Partners is an initiative of the Pennsylvania Department of Community and Economic Development. In addition to its numerous investment partners, Ben Franklin receives funding from the Ben Franklin Technology Development Authority.

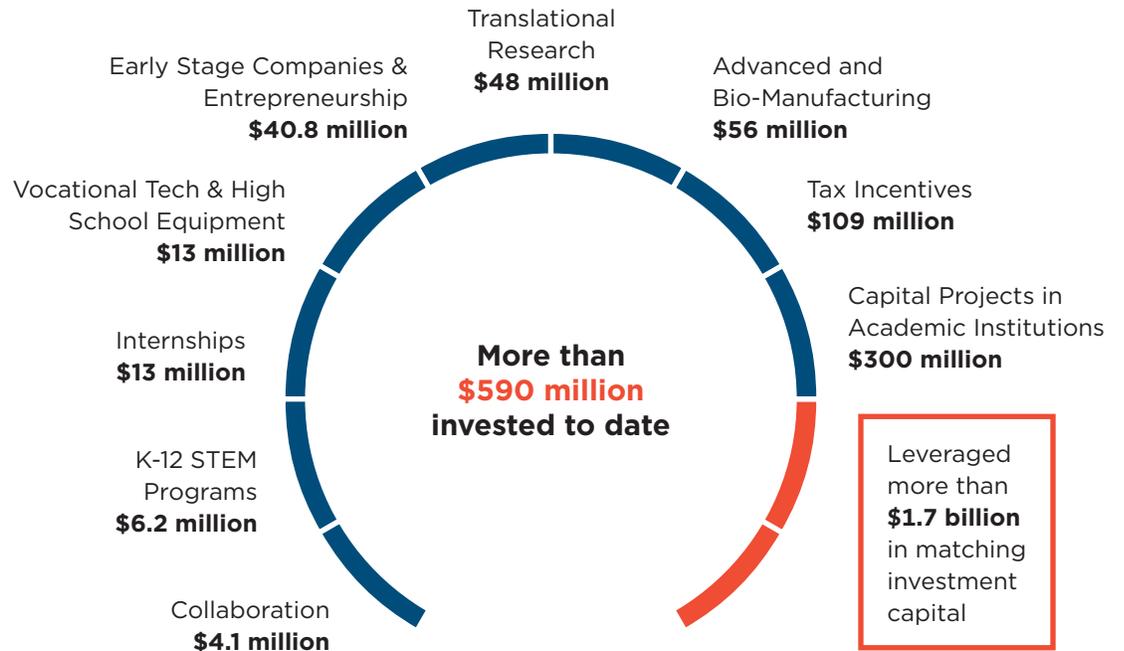
Life Sciences Greenhouses

There are three Life Sciences Greenhouses in Pennsylvania: Biotechnology Greenhouse of Southeastern Pennsylvania, the Life Sciences Greenhouse of Central Pennsylvania and the Pittsburgh Life Sciences Greenhouse. These Greenhouses provide mentoring, investment, and partnerships for entrepreneurs throughout their company's life cycle. The Life Sciences Greenhouses were initially funded with \$90 million from Pennsylvania's settlement with the tobacco industry in 2002.

TEXAS⁶⁶

The Cancer Prevention and Research Institute of Texas (CPRIT) was established in 2007 by issuing \$3 billion in bonds to fund groundbreaking cancer research and prevention programs and services in Texas. CPRIT's goal is to expedite innovation in cancer research and product development, and to enhance access to evidence-based prevention programs throughout the state.

10 MLSC Breakdown of Investments to Date



Source: Massachusetts Life Sciences Center

Endnotes

1. There is no standard definition of the “life sciences” sector, but for the purposes of this report, the Partnership defines life sciences using the following sectors’ NAICS codes:

NAICS	Description
325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing
325414	Biological Product (except Diagnostic) Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334517	Irradiation Apparatus Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliance and Supplies Manufacturing
339114	Dental Equipment and Supplies Manufacturing
339115	Ophthalmic Goods Manufacturing
339116	Dental Laboratories
541711	Research and Development in Biotechnology
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
621511	Medical Laboratories
621512	Diagnostic Imaging Centers

2. Economic Modeling Specialists Incorporated (EMSI)
3. PwC MoneyTree™
4. EMSI
5. <http://www.masslifesciences.com/wp-content/uploads/2015-Annual-Report.pdf>
6. <http://www.masslifesciences.com/wp-content/uploads/2016-Tax-Incentive-Launch-Release-FINAL-1-14-16.pdf>; <http://www.masslifesciences.com/programs/tax/>
7. <http://www.masslifesciences.com/wp-content/uploads/2015-Annual-Report.pdf>
8. New York City boasts a long history of research in the life sciences sector, with many major drug discoveries and biotech advances originating at Columbia University, NYU, Rockefeller University, Weill Cornell Medical, and other New York universities, as well as Albert Einstein, Hospital for Special Surgery, Memorial Sloan-Kettering Cancer, and Mount Sinai medical centers
9. National Institutes of Health (NIH)
10. PwCMoneyTree™; National Institutes of Health (NIH)
11. If Downstate New York were to match Massachusetts in terms of venture capital funding, it would create nearly 9,000 life sciences jobs in the city, causing the sector to grow by 62 percent. It would also create an additional 18,000 jobs in other sectors. If Downstate New York were to match Silicon Valley in venture funding, the city would add nearly 13,000 life sciences jobs, causing the sector to nearly double (89 percent increase). It would also create over 12,000 jobs in other sectors. In terms of GCP, these scenarios would increase the sector’s contributions from \$2.2 billion to \$3.4 billion and \$3.8 billion, respectively. Additionally, these jobs would create an additional \$975 million to \$1.3 billion in GCP in other sectors.
12. Detailed explanation: Downstate New York received \$140 million in life sciences VC funding in 2015. This was significantly less than Massachusetts, which received \$2.58 billion. To match the funding received by Massachusetts’ life sciences sector, Downstate New York would need to receive an additional \$2.44 billion in venture funding. Using EMSI’s economic multipliers, the Partnership modeled the impact this additional \$2.44 billion of venture funding would have on the city’s life sciences sector. EMSI’s input-output

tool allows one to estimate how added sales in specific sectors impact the broader economy in terms of added jobs. Although venture capital funding is not precisely the same thing as sales revenue, companies are likely to utilize the two revenue sources in a similar fashion, namely by reinvesting it into the business. The Partnership did not assume the new VC funding would be distributed across the life sciences sub-sectors proportionally based on New York City's current jobs. Instead, the Partnership assumed the added funding would make New York City's VC funding proportional to Massachusetts' jobs. More simply, the Partnership assumed much of the funding would flow into sectors where New York has traditionally lagged Massachusetts, such as Research and Development in Biotechnology and Pharmaceutical Preparation Manufacturing. If New York City received an additional \$2.44 billion in life sciences VC funding to match Massachusetts' total, it would create 8,925 life sciences jobs in the city. Additionally, this new life sciences activity would create 9,378 jobs in other sectors. If New York City received an additional \$3.16 billion in life sciences VC funding to match Silicon Valley's total, it would create 12,885 life sciences jobs in the city. Additionally, this new life sciences activity would create 12,382 jobs in other sectors.

13. <http://www.regeneron.com/history>
14. <http://newsroom.regeneron.com/secfiling.cfm?filingID=1532176-16-45&CIK=872589>
15. <https://www.governor.ny.gov/news/governor-cuomo-announces-new-regeneron-expansion-will-create-more-300-jobs>
16. <http://www.regeneron.com/history>
17. <http://newsroom.regeneron.com/secfiling.cfm?filingID=1532176-16-45&CIK=872589>
18. <http://finance.yahoo.com/q?s=REGN>
19. National Institutes for Health (NIH) data
20. Association of American Medical Colleges
21. HHMI.org; nasonline.org
22. USPTO data, KPMG analysis. "Life Sciences" patent classes include Chemistry/Pharmacology/Organic Compounds, Surgery, Dentistry, MedTech/Devices, and Prosthetics
23. University Start-Ups: Critical for Improving Technology Transfer, Brookings Institute, 2013
24. TopPharma, xConomy
25. <https://www.lilly.com/research-development/RDLocations.aspx>
26. <http://press.pfizer.com/press-release/pfizer-announces-seven-new-york-citys-top-research-hospitals-join-global-centers-thera>
27. GEN, <http://www.genengnews.com/insight-and-intelligence/top-35-grant-giving-disease-foundations-2015-edition/77900452/?page=1>; accessed 10/21/15
28. CB Insights, KPMG analysis. Categories used include: "Biotechnologies", "Drug Development/Discover", "Medical Devices & Equipment", "Pharmaceuticals/Drugs"; Locations restricted to five boroughs only (for New York City), "Boston" and "Cambridge" only (for Boston/Cambridge), and "Silicon Valley" only (for Silicon Valley).
29. PwC MoneyTree™
30. PwC MoneyTree™
31. Grow New Jersey Assistance Program; Technology Business Tax Certificate Transfer Program; Angel Investor Tax Credit Program; Founders and Funders – details can be found at <http://www.choosenj.com/Life-Sciences-Incentives.aspx>. New Jersey-based incubators include the Commercialization Center for Innovative Technologies, the Waterfront Technology Center at Camden, the South Jersey Technology Park at Rowan University and the Enterprise Development Center at New Jersey Institute of Technology. Details can be found here: <http://www.choosenj.com/incubators.aspx>.
32. The Accelerator Corp. provides access to their own management talent and services, but their goal is to start five to six companies over the next four to five years, which will be an important addition to New York, but more is needed.

33. P. Sharp, et al, "The Third Revolution: The Convergence of the Life Sciences, Physical Sciences and Engineering, MIT, 2011
34. The Boston Foundation, Life Sciences Innovation as a Catalyst for Economic Development https://www.tbf.org/~ /media/TBFOrg/Files/Reports/LifeSciences_%C6%92.pdf
35. Gross City Product
36. EMSI
37. EMSI
38. <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-2015-life-sciences-report-united-states.pdf>
39. <https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Life-Sciences-Health-Care/gx-lshc-2016-life-sciences-outlook.pdf>
40. EMSI
41. EMSI
42. EMSI
43. EMSI
44. EMSI
45. An economic multiplier is a measure of the follow-on impact that one occurrence has on another. This can be measured in terms of number of direct or indirect jobs created (sometimes called a "jobs multiplier"), the aggregate wage(s) added to the labor pool (a "wages multiplier"), or the overall impact on gross domestic (or city, state, etc.) product (a "GDP multiplier"). These multipliers can inform economists and policy-makers on the expected impact of contemplated future actions.
46. <https://www.bio.org/sites/default/files/Battelle-BIO-2014-Industry.pdf>. Note: The Partnership uses a narrower definition of life sciences than Battelle, which includes the industries related to agriculture and distribution. Multipliers were estimated to reflect the Partnership's definition using job multipliers and employment figures from Battelle.
47. https://www.bio.org/sites/default/files/SP_Massachusetts.pdf; https://www.bio.org/sites/default/files/SP_California.pdf
48. https://www.bio.org/sites/default/files/SP_New_York.pdf
49. PwC MoneyTree™
50. PwC MoneyTree™
51. PwC MoneyTree™
52. National Institutes of Health (NIH)
53. PwC MoneyTree™ Report; National Institutes of Health (NIH)
54. <https://www1.nyc.gov/nycbusiness/description/nyc-biotech-tax-credit>
55. <http://www.nycedc.com/LifeSciencesFund>
56. <http://esd.ny.gov/businessprograms/Excelsior.html>
57. https://www.tax.ny.gov/pit/credits/qetc_capital.htm
58. http://esd.ny.gov/businessprograms/data/taxes_incentives/qetcs.pdf
59. http://www.nyfirst.ny.gov/resourcecenter/Agency-Programs/Tax_Finance/TaxCredits.html
60. <https://alexandriaevents.cvent.com/events/nyc-life-science-innovation-showcase/registration-ea33e40dcc9245919bdac588e2cfeeed.aspx>
61. <http://www.choosenj.com/Life-Sciences-Incentives.aspx>
62. <http://www.indianabiosciences.org/pages/Home/default.aspx>
63. <http://www.kstc.com/>
64. <http://www.masslifesciences.com/>
65. <http://www.sep.benfranklin.org/>; <http://palifesciencesgreenhouseinitiative.com/>
66. <http://www.cprit.state.tx.us/>

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Acknowledgments

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Susan R. Windham-Bannister, Ph.D., is President and CEO of Biomedical Growth Strategies LLC. From 2008–15 she was the founding President and CEO of Massachusetts' \$1 billion Life Sciences Initiative, which is widely credited with propelling Massachusetts to its current position as the global leader in life sciences innovation.

Partnership Fund for New York City

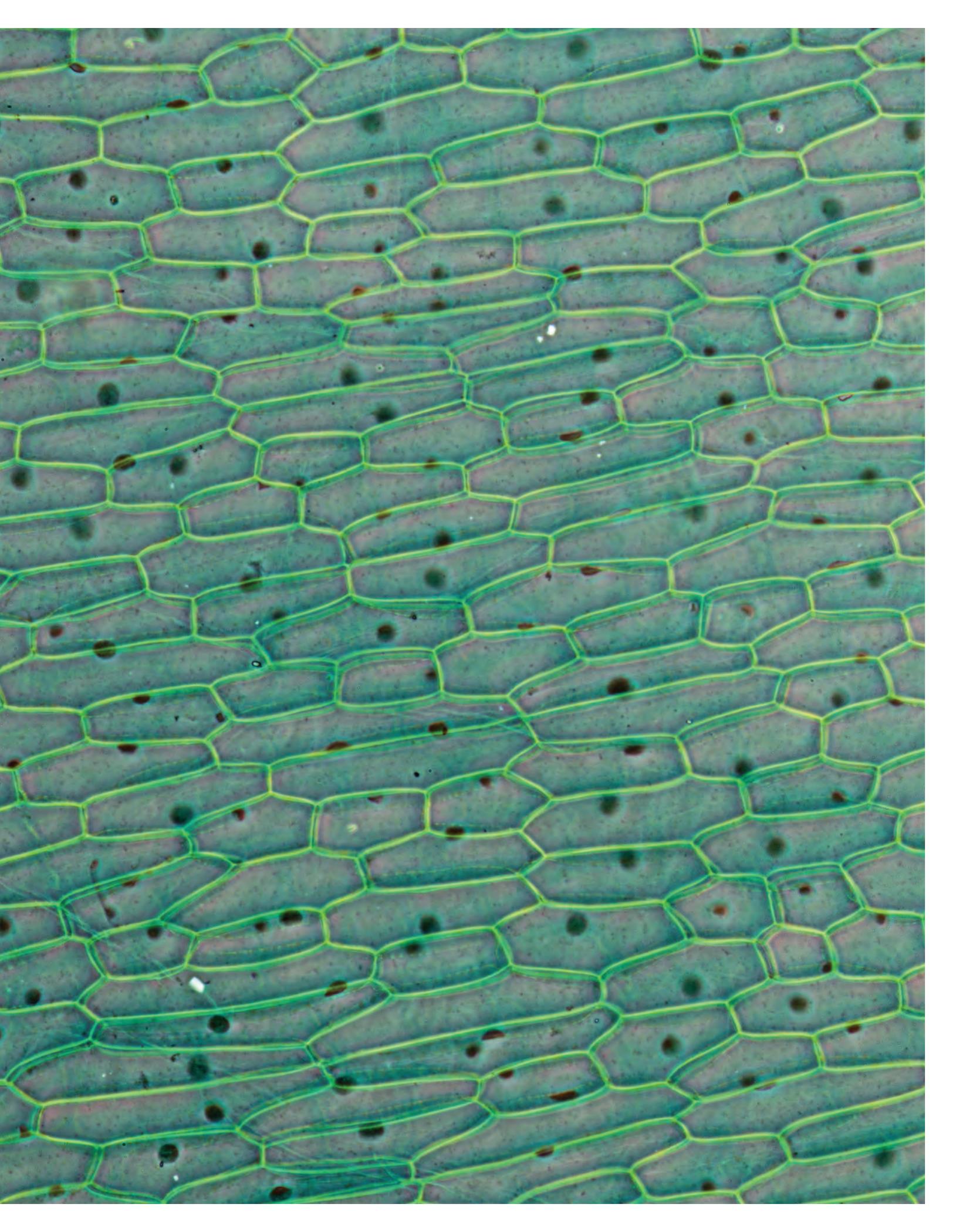
Founded in 1996 by Henry R. Kravis and Jerry I. Speyer, and capitalized by the Partnership's global leaders of business and finance, the Fund's mission is to mobilize our investors' resources to create jobs and build a stronger, more diversified economy. Since inception, the Fund has invested in excess of \$144 million. As an evergreen fund, realized gains are continuously reinvested.

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