# Appendix A:
## Press Releases and Speeches

# GOVERNOR PATRICK ANNOUNCES MASSACHUSETTS' NEW LIFE SCIENCES INITIATIVE

## Investment package, industry and public- private higher education collaboration and state stem cell bank make Massachusetts global leader

BOSTON - Tuesday, May 8, 2007- Governor Deval Patrick today announced his plan to make Massachusetts the global leader in life sciences, unveiling for the first time ever a comprehensive, collaborative Massachusetts Life Science Strategy.

The plan, outlined during a speech at the BIO 2007 convention, includes a 10 year, $1 billion investment package that will both enhance the state's already nationally recognized assets in the fields of medicine and science and fill gaps in federal funding to ensure the state's ability to support life science progress from the idea stage through the production stage. The Patrick Administration's strategy brings together industry, academic research hospitals, and public and private colleges and universities to coordinate these efforts, spur new research, strengthen investments, create new jobs and produce new therapies for a better quality of life.

"There is no place in the world with as much talent in life sciences and biotech as here in Massachusetts," said Governor Patrick. "Now is the time for us to invest in that talent and bring together the resources of our unparalleled research universities, teaching hospitals, and industry to work towards a common goal - to grow ideas into products to create cures and jobs."

Key to the Governor's Life Science Initiative is new legislation that will strengthen the Massachusetts Life Science Center and charge it with the execution of a life science mission focused on science and economic development, strategic investments at critical stages of the development cycle, and collaboration with the private sector to create innovation infrastructure critical to both researchers and companies. The Governor also announced his commitment to making targeted investments in companies that encourage life science economic development in the Commonwealth.

"I commend the Governor for reaching our to all sectors of our life science cluster in order to craft a stem cell/life science package that recognizes the unique institutional assets and intellectual firepower in our region," said Steven Hyman, Professor of Neurobiology at Harvard Medical Schooland Chairman of the Massachusetts. "The Governor allocates state resources in effective ways to enhance our traditional strengths, buttress areas that need attention, and encourage powerful collaborations between our leading edge institutions."

Today's announcement at the BIO 2007 Convention highlighted the following:

A $1 billion investment package that includes funds to:

- **Bridge the NIH funding gap** - A competitive grant program during the current downturn in federal support to sustain key programs in the state. Our collective success during the 1998 - 2003 period when the NIH budget doubled from $14 billion to $28 billion only solidified Massachusetts' dominance in the area of biomedical research. However, the subsequent four years of flat funding since 2003 has caused a 13 percent loss of funding power by NIH and a 35 percent reduction in support for clinical trials. The Patrick administration will make surgical investments during the downturn to sustain key programs here in Massachusetts in order that our position is sustained to once again capture large percentages of new funding when it materializes.

- **Create the Massachusetts Stem Cell Bank** - A first A first in the nation centralized repository of new stem cell lines available to all sectors, public and private, of research enterprise. Boston University, Brigham & Women's, Children's Hospital, Harvard University, Massachusetts General Hospital, the Massachusetts Institute of Technology, Partners HealthCare and the University of Massachusetts have already agreed to participate in the Bank when it is completed.

- **Establish Massachusetts Life Science Fellowship Grants** - Grant packages for research institutions in Massachusetts to attract and retain the rising stars of life sciences research in the Commonwealth, and ensure Massachusetts is competitive with other states and nations.

- **Establish Massachusetts Life Science Innovation Centers** - Center-based research facilities that streamline technology transfer, development time and funding opportunity.

"As the president of the University of Massachusetts, the leading public academic research institution in the Commonwealth, I applaud Governor Patrick for making such a strong commitment to the life sciences, particularly stem cell research and RNAi-related research and development," said University of Massachusetts President Jack M. Wilson. "The announcement today is an important step in developing a world-class life sciences strategy for the Commonwealth that will foster scientific innovation, including unlocking the mysteries of debilitating diseases, and spur economic growth. The University of Massachusetts is proud to be able to play an important role in this strategy and I truly believe this proposal is far-reaching, comprehensive and of sufficient scope and scale to enable Massachusetts to continue and expand its national and global leadership in biotechnology and the life sciences."

"It is clear to me that scientific innovation and cutting-edge research help set Massachusetts apart in the eyes of the life sciences and greater scientific community. Today's announcement of this significant, new state funding is an important signal that the opportunities to do cutting-edge research in this state are

expanding. I am proud that RNAi is already changing the scientific landscape, offering new tools in the effort to better human health; my colleagues at the UMass Medical School and I see great promise in our continued work with RNAi and RNAi Therapeutics. Support of this type from the government, academic institutions and society allows us to further advance science and to conduct important basic, clinical and translational research," Nobel Laureate Craig Mello, Ph.D. of the University of Massachusetts Medical School said.

"The future of life sciences is here in Massachusetts." Governor Patrick said. "We have the talent. We have the entrepreneurial spirit. Now let's seize the future."

# 05.08.07 - Governor Announces Life Sciences Initiative

### Governor Deval L. Patrick

### Life Sciences Initiative Announcement

### May 8, 2007

### As Delivered

Senate President Murray reiterated her long commitment to support stem cell research on the very day she assumed her new role as President of the Senate. And under Speaker DiMasi's leadership Massachusetts passed one of the most important pieces of Life Sciences legislation in the nation just two years ago. Today we will build upon that foundation.

I'm delighted also to be joined by my friends and partners in today's initiative, Dr Peter Slavin, CEO of Massachusetts General Hospital, Jack Wilson, president of the University of Massachusetts, Josh Boger, CEO of Vertex in Cambridge and chairman elect of BIO, and Jonathan Kraft of the Kraft group.

These gentleman represent others among the teaching hospitals and research universities and biotech companies and business community generally, whose willingness to care about and in their own ways invest in science and healing has been key in our success to date and will be key to our leadership tomorrow. And I also want to welcome former senate president Robert Travaglini. Where are you Trav?

His vision helped to position this commonwealth to assume global leadership in the life sciences, and that is a profound legacy to have left this generation and the next.

This is an important time for the life sciences all over the world. Its ideas and innovations can change lives, and can generate billions of dollars in new products, good jobs at good wages, and robust sustainable economic growth.

This industry capitalizes on the best that Massachusetts has to offer, and serves the best of what Massachusetts is about. Within this small state we have a extraordinary confluence of research universities, teaching hospitals, brain power, venture capital, and a long tradition of entrepreneurialism that has helped defined this economy as being fueled by innovation. We are quite simply the largest life sciences super-cluster on the planet, and that is a thing to be very proud of.

And that concentration of expertise and talent annually brings home a disproportionate share, over $2 billion dollars a year of funding from the national institute of health. That is why we have made your work

central to our economic vision for this commonwealth. That confluence of strength is the foundation of our economy for tomorrow. One out of every seven jobs in the Massachusetts economy is in the life sciences cluster. Companies were started in Massachusetts by graduates of our universities, researchers in our research hospitals and academic medical centers go on to create breakthrough cures, but thousands of jobs. Storied companies like Genzyme, Biogen, Vertex and now, Bristol Myers Squibb, start here or move here because of the unique combinations of strengths here in this Commonwealth.

Dr. Craig Mello who has joined us here I am very proud to have by my side and is one excellent example of the work and the strength of the talent here in Massachusetts. He and his team at UMASS Medical School in Worcester just brought home a Nobel prize for their work on RNAi, a gene silencing technique that holds the promise against diabetes cancer and HIV AIDS, we are very proud of you doctor, and your team and of your work.

But the point is also this, Dr. Mello is a part of a community of tens of thousands of people working to advance the life sciences industry and the future of healing and that is a point worth emphasizing. For us, the success of the biotech industry is more than a commercial matter. Each family can speak about a mother or father who suffered from Lupus or Cancer or some other disease. All of us have known relatives and friends who live with debilitating illnesses like Alzheimer's and diabetes. Every day we meet people with spinal injuries or HIV/AIDS whose families are looking for a reason to hope. You cannot be in the company of someone you love, powerless to help them, without appreciating the vital importance of stem cell research and other biomedical breakthroughs. In many ways, the health of this industry and the health of our society are closely linked. That is why we will not rest on our laurels. Right now our competitor states and foreign nations are investing billions of dollars to attract researchers, institutions and industries. At the same time, federal funding through the National Institutes of Health, of which Massachusetts has received a disproportionate share, is flat and likely to diminish in the short term. Politics, especially around stem cell research, impairs the innovation and calculated risk-taking that make breakthroughs possible. It is essential now that the Commonwealth step up to maintain and extend our global leadership in the life sciences. That is why I am proud to announce today the Massachusetts Life Science Initiative, a 10 year - $1billion dollar investment that will create new partnerships between state government, industry, academic medical centers and public and private higher education, and accelerate our statewide life sciences growth into high gear. We want Massachusetts to provide the global platform for bringing your innovations from the drawing board to the market, from inspiration to commercialization, and from ideas to cures. We know that begins with new ideas and innovation. Our rate of innovation in recent years has been triple that of the national average and I have no intention of letting it slip. We will close the funding gaps left by depleted NIH support with grants to sustain existing research and support new explorations. This funding for promising research in areas such as stem cells and on RNAi will allow us to build on our existing strengths and bypass the impact of national politics. To increase our intellectual capital, we will offer Massachusetts Life Science Fellowship Grants to young, emerging talent. We

recognize the value of attracting and retaining the best and brightest minds to our life sciences sector, and want to help them and you build careers here in Massachusetts. It is these young talented men and women who go on to start the next Genzyme and the next Biogen and the next vertex, and create thousands of new jobs in our communities.  Our next step is the creation of an Innovation Infrastructure, one that provides the necessary support for life sciences research and development. Playing to our world leadership in stem cell research, we will create the Massachusetts Stem Cell Bank. This is unique endeavor, to be hosted at the University of Massachusetts, will be the world's largest catalog of stem cell lines widely available to researchers, and cut through the administrative tasks associated with storing, handling, and shipping stem cell lines. Beth Israel Deaconess, Brigham & Women's, Children's Hospital, Harvard, MGH, MIT, Partners HealthCare and UMass have already agreed to donate their stem cell lines to the Stem Cell Bank - keeping with and emphasizing the spirit of collaboration that has characterized our work here in Massachusetts and will be our secret weapon going forward. Researchers all over the world will have access stem cell lines that are truly made in Massachusetts. Together we are dedicated to making Massachusetts the foremost capitol of stem cell research on the planet.

In that same spirit, the state will invest in Innovation Centers to provide industry and the academic community access to cutting-edge facilities and technology. By creating central locations for resources and research, we can enhance technology transfer, cut development time, and improve our workforce deployment. These centers will serve as regional economic hubs throughout the entire Commonwealth, spawning new companies and new jobs in the cities and towns around them.

We will also partner with the private sector to purchase equipment and instruments for those innovation centers and for private facilities, right now, equipment worth millions of dollars sits idle in our own labs in Massachusetts because the federal government has prohibited its use on stem cell research. This must end, and it will end here in Massachusetts.

Life sciences in this commonwealth will be defined by innovation and cures, not ideology and short term political gain. Finally, when an idea is ready to become reality, we will make targeted investments to guide it to the marketplace. I know that all too often, breakthroughs fall into the so-called "valley of death," the investment gap between early stages of academic research and industry development. We will provide grants to translate Massachusetts discoveries into real health applications, support partnerships to move new ideas towards market supported development, and fund efforts to create new tools like stem cell lines to be made available at low cost.

We will also develop support programs for improved outreach, grant matching, and loans for life science projects qualifying for federal SBIR/STTR programs. Today, Massachusetts companies lead the nation in per capita awards under these programs. We will build on that existing creativity and entrepreneurship. Every new direct job created in the life sciences brings with it two additional jobs in support services for

suppliers, vendors, and construction and we want to pay attention to that fact.

In addition, we will develop a tax incentive program for life science companies that directly rewards job creation in Massachusetts. My administration will compete for every single job available, every single one. Using our sales team, we will aggressively seek to recruit emerging ones.

And that job creation strategy is not complete without extensive workforce training. We will focus on training that meets the skills employers are asking for. I want to make sure that the Commonwealth partners with you, your employees and with higher education to make sure that we close the skills gap and spread opportunity to all regions of this great state.

This is the vision we have for the life sciences in Massachusetts. I thank all of you for coming here at a time of great opportunity, but also of great urgency for your industry and for society. In past years the work of our academic community, and groups like the Massachusetts Life Science Collaborative have helped move this industry to a place of world leadership. But sustaining that leadership requires a bold new approach. State government now has the opportunity to be an active partner in meeting that challenge. In Massachusetts, we intend to seize it.

I look forward to working with all of you.

# ON HEELS OF LIFE SCIENCES INITIATIVE, GOVERNOR PATRICK ANNOUNCES ORGANOGENESIS TO EXPAND IN MASSACHUSETTS

## World's first profitable regenerative medicine company to grow in Massachusetts due to state's newly unveiled life science initiative

CANTON - Thursday, May 31, 2007 - Governor Deval Patrick announced today, with the support of Senate President Therese Murray and alongside House Speaker Salvatore F. DiMasi, Organogenesis' CEO Geoff MacKay and dozens of Organogenesis employees that the Massachusetts-based company, which was once planning to expand its operations outside of the state, has decided instead to stay and grow in Massachusetts. Organogenesis, the world's first profitable regenerative medicine company, made the commitment to stay in the Commonwealth as a result of Governor Patrick's $1 billion life science initiative, which was announced at this year's international BIO 2007 convention in Boston.
"I am pleased that Organogenesis has decided to stay and expand upon its success here in Massachusetts, and proud of our team for working so hard and so well to make this partnership work," said Governor Patrick.

"Regenerative medicine, which was both invented and pioneered in Massachusetts, is the most exciting and prominent frontier in healthcare. The success of this new field is directly dependent on positive governmental policies, and Governor Patrick has taken the necessary steps in this direction with an unprecedented commitment to both industry and academic institutions," said Organogenesis CEO Geoff MacKay.

"This is exactly the kind of positive and immediate response that we had hoped to see after we announced the Commonwealth's commitment to help expand this segment of our innovative economy," said Murray. "I am thrilled that Organogenesis will continue to headquarter here and provide new jobs."

"The decision by Organogenesis to keep their home in Massachusetts is yet another sign of good things to come for our thriving life science industry," said DiMasi. "Today's announcement shows the climate for doing business in Massachusetts is improving and that we must continue to do all we can to help companies keep jobs here, expand here and move here."

Canton-based Organogenesis is the world's leading regenerative medicine company and delivers living cell therapy "on demand" to medical clinics. Regenerative medicine is the process of creating living, functional cells and tissues, to repair or replace organ function lost due to disease, damage or even the natural aging process. Organogenesis' signature product, Apligraf®, is the first bio-engineered cell therapy to have received FDA approval, and is used by doctors successfully in treating patients in the US and other markets across the world. Currently a patient is treated with an Apligraf® living cell therapy

every 10 minutes in the United States. This constitutes over two-thirds of all living cell therapies applied to patients worldwide.

Organogenesis had been planning to expand its operations outside of Massachusetts, seeking a business climate that would be more favorable toward regenerative medicine. As a direct result of Governor Patrick's Life Sciences Initiative, however, Organogenesis has decided to maintain its headquarters in Massachusetts. The company also will initiate an aggressive expansion of its global head office, research, development and manufacturing facilities within the state. Organogenesis will add 300 new highly skilled jobs, thereby doubling its existing employee base and expanding its facilities to 250,000 square feet.

The Governor's plan, unveiled on May 8 during a speech at the BIO 2007 convention, includes a 10-year, $1 billion investment package that will both enhance the Commonwealth's already nationally recognized assets in the fields of medicine and science, and fill gaps in federal funding to ensure the state's ability to support life science progress from the idea stage through the production and commercialization stages. Key to the Governor's Life Science Initiative is new legislation that will strengthen the Massachusetts Life Science Center and charge it with the execution of a life science mission focused on science and economic development, strategic investments at critical stages of the development cycle, and collaboration with the private sector to create innovation infrastructure critical to both researchers and companies.

"The reality is that the regenerative medicine field is highly competitive. Without government ensuring a positive business climate, the innovation, the jobs and ultimately life altering therapies like those involving stem cells, will move to other parts of the world," said MacKay. "The Governor's plan will solidify this state as the place where all this great science is translated into therapies benefiting patients."

The Massachusetts Office of Business Development worked closely with Organogenesis to create a $12.9 million incentive package that includes grants as well as support for when the company identifies its expansion site. In addition, the state has facilitated $5 million in low-interest loans for growth initiatives. The proposed Life Sciences Initiatives also levels the tax playing field for all regenerative medicine companies when compared to nearby states.

# GOVERNOR PATRICK FILES PLAN TO MAKE MASSACHUSETTS A GLOBAL LEADER IN LIFE SCIENCES

## Package includes capital and investment funds, tax incentives, expansion of Massachusetts Life Sciences Center

BOSTON - Thursday, July 19, 2007 - Joined by legislative leaders at a special Joint Session of the Legislature, Governor Deval Patrick today filed legislation providing for a major investment in and expansion of the Life Sciences industry in Massachusetts. The legislation is a comprehensive plan to make Massachusetts the global leader in the life sciences industry.

"We want Massachusetts to provide the global platform for bringing innovation from the drawing board to the market, from inspiration to commercialization, and from ideas to cure," Governor Patrick said. "We look forward to working with the Legislature on speedy passage and to bringing to life our vision for expanding the Commonwealth's global leadership in the life sciences."

The plan is a significant milestone in moving forward on the administration's 10-year, $1 billion investment package that will both enhance the Commonwealth's already nationally recognized assets in the fields of medicine and science, and fill gaps in federal funding to strengthen the state's capacity to support life science progress from the idea stage through the production and commercialization stages.

"I have always been in support of a Life Sciences initiative that would keep Massachusetts competitive with the rest of the country, and I look forward to examining the details of the Administration's proposal as we move forward," said Senate President Therese Murray.

"This is an ambitious plan put forward by Governor Patrick and we certainly embrace the concepts," said House Speaker Salvatore F. DiMasi. "The Commonwealth must continue to be a partner with the life sciences industry and make sure we provide whatever assistance we can to ensure the industry's future growth here. As with any proposal of this magnitude, we must always keep costs and affordability in mind."

The legislation, which was outlined during a speech at the BIO 2007 convention in May, includes $500 million in capital funds that will allow for the creation and construction of the Massachusetts Stem Cell Bank and an RNAi center that will highlight and build on the work of Nobel Laureate Craig Mello, Ph.D of the University of Massachusetts Medical School. The Bank will be the world's largest repository of new stem cell lines available to all sectors, both public and private, of the life sciences sector.

The bill also includes $15 million for the Massachusetts Life Sciences Investment Fund to finance basic research, small business innovation grants, life science fellowships and workforce training. The fund will be overseen by a strengthened Life Sciences Center Board, which, under the legislation, would be expanded to include two new members and would be chaired by the Secretary of Housing and Economic

Development. Under Governor Patrick's legislation, the center would have the authority to build capital projects, award grants, and expend funds consistent with the plan outlined by the Governor. The board will be required to establish a formal process to determine how capital projects are spent.

The legislation also establishes a 10-person Advisory Committee to the Life Sciences Center Board from members of the Massachusetts Life Sciences Collaborative.

To encourage job creation and growth in the field, the legislation also creates tax incentives for certified life science sector projects. Among the credits are a redeemable 10 percent 10-year carry-forward Life Sciences Investment Incentive Tax Credit and a provision that allows projects to receive an additional 2 percent tax credit if they locate in Economic Opportunity Areas. The legislation includes a clawback provision to ensure that companies meet their job creation goals. The bill also creates a sales tax pass through for bricks and mortar purchases associated with the development of life sciences projects and creates a 100 percent refundable FDA User Fee Credit.

The bill imposes a yearly project evaluation and provides for decertification in the event that a company fails to achieve the projected return on investment mandated as part of the project certification.

"This is the future of life sciences here in Massachusetts," said Governor Patrick. "We have the talent, we have the entrepreneurial spirit. Now let's execute the vision."

# 10.30.07 - Governor Gives Testimony on Behalf of Life Sciences Bill

## Governor Deval L. Patrick

## Testimony Before Joint Committee on Economic Development and Emerging Technologies on Behalf of Life Sciences Legislation

## October 30, 2007

## As Delivered

Chairman Bosley, Chairman Hart, Members of the Committee.

Thank you for your attention to this bill and for today's public hearing.

I am here today to testify in strong support of H4234, An Act Providing for the Investment in and Expansion of the Life Sciences Industry in the Commonwealth. As you know, this bill is a collaborative effort among leaders from all aspects of the Massachusetts Life Sciences sector (many of whom are here today), working together with Senate President, the Speaker of the House and members of my administration. I want to thank everyone for that collaboration and acknowledge the unusually broad base of support for the measures proposed.

As you know, Massachusetts is world-renowned as a Life Sciences Supercluster. We have an unrivaled concentration of biopharmaceutical, biotechnology, and medical device expertise, of academic medical centers, hospitals, research institutions, and patient advocate group; and of venture capital. Our Life Sciences sector has led the world in creating life-saving medicines and therapies and innovative stem cell research that will save lives, ease suffering and reduce long-term health care costs. Our preeminence in early-stage research attracts world class talent.

The sector is an important feature of our economy as well. Growth has outpaced other industries and has provided a broad range of job opportunities at all income and skill levels. According to a study conducted by the Milken Institute, every direct job in life sciences (scientists, technicians, lab assistants, bio-manufacturing engineers) creates 3.6 indirect jobs (suppliers, vendors, support services, utilities, construction, real estate, transportation, among others). The Life Sciences is a powerful economic engine for this Commonwealth.

But regional, national and global competition is fierce. At the BIO 2007 convention in Boston, dozens of competitor states and nations aggressively targeted our talent and companies. As we gather here today, our competitors are actively luring our state's best and brightest researchers, doctors and entrepreneurs.

California and New Jersey are investing hundreds of millions in the Life Sciences, North Carolina is providing lucrative tax benefits to lure our companies, and Florida has invested hundreds of millions so that Life Sciences can expand in their state. China and Ireland - two nations with a proven record of well-coordinated competitive strategies -- have joined the global sweepstakes for talent as well. For Massachusetts -- a state dependent on intellectual capital and research -- the threat is real and the stakes are high.

In addition to the direct threats from competitor states and nations, we also face the threat of flat NIH research funding - a critical source of research funding that has declined, especially for stem cell research.

In addition, the Bush Administration's prohibition on the use of federal funds for embryonic stem cell research combined with the Romney Administration's restrictions on stem cell research have made us vulnerable to efforts by other states and foreign countries to lure Massachusetts researchers and companies with offers of new funds, new facilities, and robust research incentives free of political restrictions.

All of these are ways in which the world is changing. If we do nothing, we lose.

Recognizing these challenges, and unwilling to accept defeat, the Senate President, the Speaker and I announced the bill before you at the BIO 2007 International Convention in May. You will hear from the experts who follow me details about each element of the bill. But in brief summary, the bill contains measure to: 1) develop stronger public/private partnerships around funding and investment strategies to create new jobs, spur innovative research, strengthen investments in higher education and workforce training, 2) make targeted investments at stages of the development and commercialization cycle, particularly those where venture capital has not been available, that result in robust job creation, and 3) create Regional Innovation Centers that attract researchers and companies and grow cures and jobs.

Today, you will hear from many industry leaders, researchers, and medical experts, as well as those affected by curable diseases, about the many benefits we will derive from the implementation of the Massachusetts Life Sciences Initiative. These benefits include the creation of life saving medical therapies and cures, attraction and retention of world-class researchers and life science companies, as well as new employment opportunities for people at all wage levels.

In terms of job creation, estimates by nationally known and respected economic forecasting firms attest to the potential for up to 250,000 new direct and indirect jobs as a result of the programmatic elements of the plan.

As far as research talent is concerned, passage of the bill will help us attract and retain world-class talent,

such as Nobel Laureate Dr. Craig Mello, whose cutting edge research in RNAi is supported by our bill, or MacArthur prize winner Dr. Kevin Eggan, director of the Harvard Stem Cell Institute, whose stem cell work is also supported by and leveraged through this bill. Both are here today to offer testimony as well.

You fully appreciate that we cannot rest on our laurels and we have not done so. Just last week - and thanks in large part to your efforts - the Life Science Center approved a grant-making process that will make available $12 million toward stem cell research and other Life Science initiatives. In addition, it approved the first phase of the development of a stem cell bank and registry at the University of Massachusetts Medical School.

As you know, Bristol-Myers Squibb has chosen to open a major operation at Devens, and Genzyme has many facilities in Massachusetts, including a manufacturing facility in Cambridge and operations in Westborough. Avant Immunotherapeutics has located a facility in Fall River on the South Coast. Other companies have agreed to stay here because of our demonstrated commitment to cultivate and support this industry, and to join the global competition for investment and talent.

But not everyone is convinced that we mean it. One large company - Project Magellan - was prepared to invest hundreds of millions of dollars in over 700,000 square feet of lab and office space creating over 400 new, well-paying jobs. But our inaction on this proposal over many months caused them to abandon those plans here and focus instead on other states.

For the sake of our economy, for the sake of healing, for the sake of our future - and because you hate to lose as much as I do - I urge the Committee to take swift and favorable action on this bill. Thank you for your consideration.

# COMMONWEALTH'S TRADE MISSION TRIP TO CHINA TO FOCUS ON ECONOMIC DEVELOPMENT IN LIFE SCIENCES AND CLEAN ENERGY

## COMMONWEALTH'S TRADE MISSION TRIP TO CHINA TO FOCUS ON ECONOMIC DEVELOPMENT IN LIFE SCIENCES AND CLEAN ENERGY

BOSTON-Wednesday, November 28, 2007-The Patrick Administration today announced details for the Commonwealth's trade mission to China. Governor Deval Patrick will travel with a team of business executives, academic leaders and senior government officials next week to continue his work building trust and credibility in the growing relationship between Massachusetts and China.

The visit will include a number of meetings with Chinese government officials and business leaders to strengthen innovation and collaboration around clean energy, life sciences, education and transportation. The delegation will visit Beijing and Shanghai for the 7-day trade mission, departing Boston on Friday, Nov. 30 and arriving in China on Dec. 1, and departing China on Dec. 7 to Boston.

"Massachusetts is already a national leader in alternative energy technology and the life sciences, and in providing high-quality education at every level. But we can't compete by looking inward. To move Massachusetts forward, we have to look outward to new markets," said Governor Patrick.

This visit will be the first in a series of steps Governor Patrick takes to strengthen the Massachusetts-China relationship. The agenda will include meetings in Beijing and Shanghai with representatives from Chinese companies and universities focused on China's academic, research and development and commercial achievements.

Members of the delegation include: Secretary Dan O'Connell, Housing and Economic Development; Secretary Bernard Cohen, Transportation; Greg Watson, Senior Advisor for Clean Energy Technology; Thomas J. Kinton, Jr., CEO, Massachusetts Port Authority; Mitchell Adams, Executive Director, Massachusetts Technology Collaborative; Jack Wilson, President, University of Massachusetts; Dr. Craig Mello, Professor, University of Massachusetts Medical School, 2006 Nobel Laureate; Dr. Victor Zue, Co-Director, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology; Anthony Saich, Faculty Chair of Asia Programs, Harvard University; Josh Boger, Chair, Biotechnology Industry Organization and CEO, Vertex Pharmaceuticals; and Thomas J. Sommer, President, Massachusetts Medical Device Industry Council. Representatives from Massachusetts life science and clean energy companies - many with a presence in China - will also participate in portions of the trip (list attached).

As key partners in the Commonwealth's mission agenda and the Administration's overall economic development agenda, Massport and the Massachusetts Technology Collaborative will fund the trip. The estimated cost of the trip is roughly $200,000.

"China is the largest market in the world and the country is experiencing unprecedented economic growth and dramatic changes," said Dan O'Connell, Secretary of Housing and Economic Development. "Their spirit of entrepreneurship and innovation combined with continuously developing partnerships with the Commonwealth's many academic institutions and companies lay the foundation for long term business collaboration that will have a positive and lasting effect on Massachusetts."

China is a growing source of economic activity, and the Chinese government has called for prioritization of science and technology. Massachusetts generated $1.3 billion in manufactured goods exports to China in 2006. China wants to shift its image as a country focused on low-wage manufacturing to one of sophisticated research, development and innovation. This dynamic will shape China's relationship to Massachusetts on this trade mission and in its continued relationship with the Commonwealth.

Life Sciences in China

China's life sciences sector has many possibilities for our companies and institutions. Already, a broad range of the Commonwealth's medical centers, research institutes and life sciences companies are developing a presence in China. By traveling to China and expressing a sincere interest in cross-national development, the Commonwealth can deepen its involvement there.

China is a key location for market growth in the life sciences sector, for both consumer market expansion and as a location for research and development. The landscape for life sciences products has changed rapidly in the last several years, with the Chinese government's involvement increasing in effectiveness and sophistication.

"I look forward to working with the Governor and other business and academic leaders as we embark on this important mission. Massachusetts companies have an opportunity ahead to broaden their business activities in China and to bring their innovations into a new market," said Joshua Boger, Ph.D., President and CEO of Vertex Pharmaceuticals of Cambridge, and Chairman of the Biotechnology Industry Organization. "In the coming years, China's presence in the global life sciences community is expected to grow significantly as it both strengthens and expands its own capabilities and also works to establish relationships with U.S.-based firms."

Current economic growth projections for China generally far exceed most other industrialized countries. This market expansion is both general and specific to life sciences industries (all dollar figures in USD):

- 44% GDP Growth projection between 2004 and 2010.
- Total health care growth projection to move from $34 billion in total health care spending in 2000 to $150 billion in 2010, a compound annual growth rate (CAGR) of 16%.
- Projections in the pharmaceutical industry show growth from $18 billion to $70 billion in 2010, accounting for a 17% CAGR.

- In the medical devices market, a growth of $3.2 billion to $14.8 billion is projected between 2000 and 2010, a CAGR of 19%.

- Projections also estimate that China will be the 5th largest pharmaceutical market by 2010 and the 3rd largest market for medical devices by 2010.

Clean Energy in China

China's clean energy development has grown rapidly in recent years - a trend that is expected to continue as the country strives to generate 20 percent of its energy from renewable sources by 2020. There will be a unique window of opportunity in the coming years for clean energy technologies developed in Massachusetts to be in China.

Massachusetts' highly skilled workforce, leading universities, venture capital community and entrepreneurial environment make the Commonwealth an attractive site for Chinese investors to look for opportunities around clean energy.

"The Governor's trade mission will highlight how Massachusetts' innovative clean energy companies can help China meet two of its greatest challenges - cleaner energy sources and cleaner, more efficient industrial production," said Annie Johnson, Executive Director of the New England Clean Energy Council. "We will build partnerships that will assist these companies to gain a foothold and expand in China's enormous, fast growing energy market. Access to such vast, new markets is vital - both for these companies to attain their growth potential and to enhance Massachusetts' position as a global leader in energy innovation."

Massachusetts' clean energy cluster of more than 550 companies represents a healthy, growing ecosystem of small and medium-sized companies that present myriad opportunities for joint ventures, partnerships, technology licenses and co-investment to exploit market opportunities both in China and the US.

**Massachusetts China Partnership Official Delegation**

Members of the Official Government Delegation:

- Governor Deval L. Patrick, Commonwealth of Massachusetts

- Secretary Daniel O'Connell, Housing and Economic Development

- Secretary Bernard Cohen, Transportation and Public Works

- Gregory Clarke Watson, Senior Advisor for Clean Energy Technology

- Tom Kinton, Jr., Chief Executive Officer, Massachusetts Port Authority

- Mitch Adams, Executive Director, Massachusetts Technology Collaborative

- Jack Wilson, President, University of Massachusetts

- Dr. Craig Mello, Professor, University of Massachusetts Medical School, 2006 Nobel Laureate

Members of the Official Non Government Delegation:

- Dr. Victor Zue, Co-Director, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology
- Anthony Saich, Faculty Chair of Asia Programs, Harvard University
- Joshua Boger, Chair, Biotechnology Industry Organization and Chief Executive Officer, Vertex Pharmaceuticals
- Tom Sommer, President, Massachusetts Medical Device Industry Council

**Massachusetts China Partnership COMPANY Representatives**

Representatives from Massachusetts companies who do business in China will participate in portions of the trade mission. Some of these representatives are already based in China.

Massachusetts Life Science Industry Representatives:

- Gunther Winkler, Vice President of Strategic Initiatives, Biogen Idec
- Marc D. Beer, President and Chief Executive Officer, ViaCell, Inc.
- Thomas Taylor, Vice President Global Marketing & Business Development, Healthcare, Nypro
- Jerry Chung, Vice President, Nypro Beijing
- Geoffrey MacKay, President and Chief Executive Officer, Organogenesis
- James Qun Xue, Director of Genzyme China
- Michael Glynn, Senior Vice President, Genzyme Asia Pacifica, Canada and South Africa
- Jeffrey J. Elton, Senior Vice President of Strategy and Global Chief Operating Officer, Novartis Institutes for BioMedical Research
- En Li, Vice President and Head of Research, Novartis Institutes for BioMedical Research Shanghai

Massachusetts Clean Energy Industry Representatives:

- Bruce N. Anderson, Chief Executive Officer, Wilson Turbopower
- Mitchell Tyson, Chief Executive Officer, Advanced Electron Beams

- Leo Casey, Vice President and Chief Technology Officer, Satcon Corporation
- Elbert Leo McDaniel III, Vice President of Sales and Marketing, Satcon Power Systems
- Dennis John Duffy, Vice President of Government and Regulatory Affairs, Energy Management Incorporated / Cape Wind
- Hal M. Thrasher, Director of New Business Ventures, Rohm & Haas Electronic Materials
- Robert J. Ferguson, Vice President, Business Unit Director, Circuit Board Technologies, Rohm & Haas Electronic Materials

# GOVERNOR PATRICK AND EMD SERONO ANNOUNCE $50 MILLION BILLERICA EXPANSION

## New Center of Excellence in Life Sciences Research Will Create 100 New Jobs

BOSTON - Wednesday, April 16, 2008 - Governor Deval Patrick today announced life sciences company EMD Serono, Inc., and Merck Serono - both affiliates of Merck KGaA of Germany - will invest $50 million to expand its Billerica facility, creating at least 100 new jobs.

The announcement comes a week after the Governor delivered a major speech outlining his economic plan to create a culture of opportunity focused on restrained spending and long- and short-term investments, while preparing for the impacts of a softening national economy.

"I am delighted that EMD Serono has decided to expand in Billerica. The region's tremendous talent and resources will now be at Serono's disposal in their work to improve the quality of life for people living with serious diseases," said Governor Patrick. "Today's announcement exemplifies the value of the Life Sciences Initiative in encouraging economic development and job growth throughout Massachusetts."

"This announcement reflects Merck KGaA's strong commitment to expand EMD Serono and anchor our US operations in Massachusetts," said Elmar Schnee, President of Merck Serono. "We recognize the significant value of augmenting our research capabilities in Boston - a region with tremendous life-sciences influence not only across the US, but globally as well."

EMD Serono is a leader in the United States biopharmaceutical arena, which focuses on fertility treatments and neurodegenerative diseases and integrates cutting-edge science with patient support systems. The $50 million investment will support the construction of a Center of Excellence in discovery, which will accommodate approximately 200 scientists specializing in cancer and fertility research, and approximately 50 technical operations employee specializing in process development and protein production.

The new site's proximity to the company's Billerica protein production facility, which manufactures products for early stage clinical testing, will allow for collaborative interactions and support the rapid transition from research to manufacturing.

Construction on the new Billerica site will take approximately two years, beginning early next year. The total square footage of the Billerica Campus will be approximately 210,000 square feet, including more than 160,000 square feet of lab space. The expansion in Billerica will also create additional commercial space opportunities in Rockland, as the company strengthens its leadership position in its current therapeutic areas of neurodegenerative diseases and endocrinology, and builds the necessary infrastructure to support an increase in U.S. clinical trials and commercial growth.

"I would like to thank Governor Patrick for his unwavering commitment to strengthening Massachusetts' reputation as a global leader in science and medicine," said Fereydoun Firouz, CEO and President of EMD Serono, Inc. "The partnership and commitment of Governor Patrick, Senate President Murray, and Speaker of the House DiMasi to make the Life Sciences Initiative a reality will help ensure that Massachusetts' existing life sciences companies stay and thrive in the state, and that new life sciences companies come to Massachusetts to further enhance our position at the forefront of healthcare."

Today's announcement comes on the heels of the release of encouraging information about the professional, scientific and business services sectors as a whole. The Executive Office of Labor and Workforce Development reported earlier today that monthly survey estimates show that 2,900 new jobs were added in Massachusetts in March, the largest monthly increase since November of last year and the sixth consecutive monthly increase in jobs. Of the 2,900 jobs, 1,000 came from the professional, scientific and business services.

# 04.16.08 - Life Sciences Expansion in Billerica

## Governor Deval L. Patrick

## EMD Serono Expansion Remarks

## April 16, 2008

## As Delivered

From 25 years here in the Commonwealth we know just how exciting the efforts and the promise of EMD Serono will be both in terms of advancing healing and growing our economy. With this further investment of $50 million you add another 100 jobs in Massachusetts and another 100 opportunities for Massachusetts people to apply their talent and build better futures for themselves, their families, and for all of us.

So on behalf of my colleagues in government and all of the people in Massachusetts thank you for choosing the Commonwealth and maybe you do not hear that often enough. Let me tell you, thank you for choosing us.

There was a great team who were a part of making this work for you and I want to acknowledge them and thank them because they do it over and over and over again for companies all across the commonwealth. We want you to know at EMD Serono and all of those in the industry that you are welcome here in Massachusetts.

I am proud to say that today's announcement is the third in two weeks about a life sciences company that has chosen to grow business and locate jobs here. It is happening all across the Commonwealth.

Indeed, we are not anymore 49th in the nation, Fereydoun, for job creation. We moved last year to 15th in the nation. This morning we published job numbers showing that in the face of weakening national economic statistics, Massachusetts added upwards of 3,000 new jobs in February and March alone. We are on the move.

Our Life Sciences Initiative, that $1 billion, 10 year investment to accelerate our world leadership in this sector as contributed to that good news which Fereydoun said. The world knows that as a Commonwealth we are serious about you, about this industry, about its possibilities for healing and for its opportunity for economic expansion.

The Life Sciences initiative has indeed passed out of both the House and the Senate. It is a better bill now that it was when it went in. It has been improved by the collaboration of the members of the house and the senate and the industry and EMD Serono has been a part of that and I want to thank you all.

Senator Marzilli, Rep Green, Rep Atkins, who is here, and all of the members who have contributed to making this bill as strong as it is. I look forward to signing it very soon indeed.

We will continue because this in an industry that has great promise for all of us on a host of levels. We want you to know whether you are here in the presence of those us making these announcements, or within our sounds of our voice and images in Rockland and elsewhere, that you are welcome here. We value you. We look forward to continuing this partnership and we wish you every success. Thank you for having us here.

# Governor Patrick Signs Groundbreaking Life Sciences Legislation

## Governor, Senate President, Speaker Head to BIO International Convention with Cutting-Edge Life Sciences Law in Hand

BOSTON- Monday June 16, 2008 - Governor Deval Patrick, joined by Senate President Therese Murray and Speaker of the House Salvatore F. DiMasi, signed pioneering legislation today at the Joslin Diabetes Center that will secure Massachusetts' position as a global leader in life sciences, unveiling for the first time the comprehensive, innovative Massachusetts Life Sciences Law.
"With this initiative we take our rightful place as a global leader in the life sciences," said Governor Patrick. "There is no place in the world with as great a concentration of life sciences talent, resources and vision as Massachusetts. With these resources - and the collaboration and support of the industry, academia, business and government - we are on our way to helping find new cures for diseases, creating new jobs, and positioning ourselves for long-term economic growth."

The 10-year $1 billion investment package is the result of a year-long collaboration between the Governor, the Legislature, academia, life sciences industry leaders and patient advocacy groups.

"Here in Massachusetts we have all the components to support a strong life sciences industry," President Murray said. "With our world-class medical centers and universities, and an educated workforce, the addition of this life sciences package makes Massachusetts the ideal choice for researchers and biotech companies to grow and conduct groundbreaking and potentially lifesaving work that will push treatment and medical discoveries to a whole new level."

"Today, we take a bold step to again solidify our position as the world leader in life sciences and biotechnology and our already-thriving life sciences cluster is now the envy of the world," said Speaker DiMasi. "But more importantly, we are together investing in the cures of tomorrow so we can eradicate diseases that ravage our nearest and dearest, from cancer to Alzheimer's. I am pleased with the great law we have today and the partnership with Governor Patrick, Senate President Murray and all the legislators that brought it to fruition."

The new law will enhance the state's already nationally recognized strengths in the fields of medicine and science and fill gaps in federal funding to ensure the state's ability to support life sciences innovations from idea to product. By bringing together businesses, research hospitals, and public and private colleges and universities, the law will lead to new jobs and the discovery of novel therapies that will change the way people live in the Commonwealth and throughout the world.

"We're honored to host Governor Patrick and other legislative leaders for the signing of the historic Life Sciences Bill," said Ranch C. Kimball, President and CEO of Joslin Diabetes Center. "As the world's largest diabetes research and clinical care organization, the global diabetes community counts on us for

breakthroughs. We support Massachusetts' commitment to life sciences leadership, which is so vital to our efforts to improve the lives of people with diabetes and provide the greatest hope for a cure."

Aimed at capturing the best life sciences talent worldwide, the package includes:

- **$500m in Capital Funding to be spent over a 10 year period;** $299.5m for targeted infrastructure projects and the balance - $200m in unrestricted funds for investment in public infrastructure projects, at the discretion of the MA Life Sciences Center (MLSC).
- **$25m each year for 10 years for the MA Life Sciences Investment Fund,** held at the MLSC, for loans, grants, fellowships, and investments to stimulate increased research and development in the life sciences sector.
- **$25m each year for 10 years in tax incentives to be awarded to certified life sciences projects.**

The law also:

- **Creates the MLSC Life Sciences Investment Program** to expand employment in the life sciences sector in MA and to promote health-related innovations by supporting research and development, manufacturing and commercialization in life sciences.
- **Creates 5 Regional Technology and Innovation Centers** tobe identified from among existing life science regional centers.
- **Adds an 18 member advisory board** to be appointed by the Governor, including 10 members of the Massachusetts Life Sciences Collaborative, 5 chancellors of the UMass system, and 3 patient advocates. The Secretary of Labor & Workforce Development and 5 directors of Regional Technology Innovation Centers shall all be non-voting members.
- **Creates four additional funds to be administered by the MLSC**:
  - Dr. Craig C. Mello Small Business Equity Investment Fund;
  - Judah Folkman Higher Education Grant Fund for grants to graduate school students;
  - MA Small Business Matching Grant Fund; and the
  - MA Life Sciences Education Fund for vocational and technical school equipment purchases.

"The Life Science Initiative creates a climate which will attract and retain successful biotech companies to commit expansion plans within Massachusetts," Geoff MacKay, President and CEO of Organogenesis. "Organogenesis is implementing a major expansion to 250,000 square feet and 600 high tech jobs, and the Governor's Life Science Initiative is the driving factor guiding our selection of Massachusetts over competing options. The Life Science Initiative has given Organogenesis Inc. the business confidence to grow in Massachusetts and expand our R&D labs, manufacturing facility and global head office."

"The Juvenile Diabetes Research Foundation is very pleased that the Life Science Initiative has been passed," said Heidi Daniels, Executive Director of the Juvenile Diabetes Research Fund-New England. "This significant investment in research will help Massachusetts continue to be a leader in the research world, help Massachusetts retain the brightest minds in science to focus on solving problems, and most importantly, help all its residents move closer to cures for chronic diseases, such as type 1 diabetes, that affect so many of our loved ones."

The new law also strengthens the Massachusetts Life Sciences Center, which has been charged with executing much of the life sciences initiative by focusing its attention on science and economic development, strategic investments, and collaboration with the private sector to create innovation infrastructure critical to both researchers and companies. The Center, which has just named its new CEO and President, Susan Windham-Bannister, Ph.D., willuse its scientific and financial expertise to allocate the $25 million per year dedicated to the MLSC Fund. It will also be empowered to direct approximately $200 million of the $500 million in capital funds.

"This is an exciting moment for our life sciences supercluster, and I am committed to doing all I can to advance the Governor's vision for the Mass Life Sciences Center," said Dr. Windham-Bannister. "This law will open the door for tremendous scientific, research, academic, and business opportunities here in the Commonwealth, and I am thrilled to be able to lead the Center as we begin this new chapter.

"This bill will do a great deal to increase the infrastructure for life sciences research and development in the Commonwealth," said Harvey F. Lodish, a member of the Whitehead Institute for Biomedical Research and Chair of the Massachusetts Life Sciences Center Scientific Advisory Board. "Our Scientific Advisory Board will do its best to insure that these moneys are spent on the projects, people, and facilities that have the greatest promise for developing new treatments and medical devices to address the conditions and diseases that affect us all."

"This ambitious legislation will accelerate innovation in the Commonwealth's life sciences cluster and allow Massachusetts researchers and companies to solidify our state's national and international leadership in the growing biomedical and life sciences industry. This bill is a game-changer for the Commonwealth--it will create new breakthroughs, new jobs and new companies today and will help the University of Massachusetts and other academic institutions break new ground and train the life sciences workforce of tomorrow," said Jack M. Wilson, President of the University of Massachusetts.

"The University of Massachusetts is excited to play such an important role in implementing this landmark life sciences legislation. The Governor, the House and the Senate have placed a great deal of trust in our research prowess and technology transfer abilities and every UMass campus will now be positioned to deliver," said Robert J. Manning, Chairman of the UMass Board of Trustees.

The signing comes just before Governor Patrick, key legislators and industry leaders head to San Diego for an international biotechnology convention. It was during the same convention held in Boston in May 2007 that Governor Patrick first took the stage with Senate President Murray and Speaker DiMasi to announce the $1 billion Life Sciences Initiative.

# 06.16.08 - Life Science Bill Signing

### Governor Patrick:

I can tell you that the Lieutenant Governor and I are very, very proud to be with all of you today to sign the Life Sciences Initiative into law. About a year ago, many of us here stood together to announce this 10-year, one billion dollar strategy to strengthen our position and extend our leadership in the world in this field, and here we are to make that commitment real.

Tomorrow, when the Life Sciences community gathers from around the world at the BIO Conference in California, Massachusetts will have a new and broader set of tools to help us compete. Massachusetts will have the largest registry of stem cell lines in the world, housed at the University of Massachusetts Medical Center in Worcester. Massachusetts will have a half-billion dollars in capital funding to offer entrepreneurs, for infrastructure investment and economic growth. Massachusetts will have 250 million dollars to offer researchers for fellowships, matching grants and loans to attract and retain rising stars in this field. Massachusetts will have incentives to offer companies to locate and expand here and five regional tech/innovation centers to extend these opportunities to every region of the Commonwealth.

And Massachusetts will have Dr. Harvey Lodish and his advisory board of distinguished scientists, educational and business leaders and the leadership of Dr. Susan Windham-Bannister to assure the Life Sciences funding decisions are based on sound science and not politics.

The people of Massachusetts have something too. They have the thousands of good jobs and good wages, from researchers to lab technicians to manufacturing workers, and the training opportunities to prepare for that world.

So, I want to thank the entire legislature for the overwhelming support you've given to this initiative. I'm grateful indeed. And I want to say a special thank you to Speaker DiMasi, my pal, to the Senate President who can-could not be here but is very much here in spirit today and to her predecessor Bob Travaligni, who has been a partner in this from the beginning and has stayed focused even after leaving office-I'm very glad to see you here today Bob. I want to acknowledge and thank Chairman Jack Hart, Chairman Dan Bosley, Chairman Mike Rodrigues, the House and Senate conferees, and people who don't often get thanked but their respective staffs, who we worked nearly to death to get this right. I appreciate very much all of you.

And I want to thank the members of the administration who toiled so hard and so well and with such dedication to get these results, including Secretary Dan O'Connell, Stan McGee, Maureen Flynn of his staff and David Simas, and most especially David Morales from my staff who's here, thank you.

[applause] Very, very proud of all of you.

Sometimes in this, in this business of ours people keep score in purely political terms. And there is no denying of the fact that signing this bill today makes clear, a clear and important political point that the legislature and the administration can work together on big and complex initiatives when we set our mind to it, but there are other measures, beyond political ones, arguably more lasting ones.

Over a century ago when Dr. Elliott P. Joslin founded this Center where we gather today, the life expectancy of patients diagnosed with diabetes was two years. Today, in thanks to large part to the work done here, people with type 1 and type 2 diabetes can live rich, full and long lives. Tomorrow there may be a cure for diabetes and that cure may well come right here in Massachusetts. That is an enormously important thing. [applause]

The point is that this initiative is about so much more than putting researchers and resources together; it's about Massachusetts advancing human healing. Yes, there will be many thousands of jobs for scientists and manufacturing workers, for researchers to lab technicians alike and we look forward to those. But there will also be the chance to apply the creativity and ingenuity of the people of Massachusetts, to relieving suf-suffering and giving comfort and hope to millions of people around the world.

So I am proud and excited to sign this legislation, and of the means it offers through this bill, in this field today. But I am even more excited about what miracles may come tomorrow. I am delighted you could all be a part of this today. Thank you very much.

# Governor Patrick Receives "Governor of the Year" Award from International Biotechnology Industry Organization

SAN DIEGO, CALIF. -Tuesday, June 17, 2008 - One day after signing his 10-year, $1 billion Life Sciences Initiative, Governor Deval Patrick today received the Biotechnology Industry Organization's (BIO) Governor of the Year Award in recognition of his leadership and support of the biosciences industry.

"I am honored to receive this award from BIO, and I share it proudly with the many people who helped us move the Life Sciences Initiative forward," said Governor Patrick. "Since our announcement of the Massachusetts Life Sciences Initiative at BIO 2007, it has been one of the most important priorities of my administration. It is wonderful to know that the international community recognizes that we in Massachusetts are doing things differently, doing them well, and making a real difference in the life sciences cluster and in real people's lives."

The award was presented to the Governor by Joshua Boger, PhD., Chairman of BIO's Board of Directors and President & CEO of Cambridge-based Vertex Pharmaceuticals Incorporated during a keynote luncheon before 3,000 people at the BIO 2008 International Convention.

"The Governor has demonstrated unflinching dedication to our state's tradition as a welcoming home to research institutions and companies dedicated to combating the diseases that plague mankind," said Boger. "The signing of the Massachusetts Life Sciences Initiative is yet another example of the comprehensive approach Governor Patrick and his staff take to ensure the long-term success of life sciences in Massachusetts."

"We are pleased to see that Governor Patrick has been awarded with this well-deserved recognition, and to watch his efforts coming to fruition," said Geoff McKay, CEO of regenerative medicine leader Organogenesis, Inc. "Governor Patrick has been instrumental, along with state House and Senate leadership, in directing the efforts to pass the new life sciences bill. Organogenesis is a spin-off of technology developed at MIT, and our living cell therapies have helped to treat hundreds of thousands of patients around the world. We have spent an incredible amount of time, energy and funds to pioneer the regenerative medicine industry, including the industry's first-ever FDA approvals. We had outgrown our existing facilities, and were ready to make a commitment to a major expansion. Governor Patrick was a major catalyst for Organogenesis' decision to remain and expand in Massachusetts, and he in fact helped reverse our decision to leave the state. The life sciences bill solidified the state of Massachusetts as the best place in the world to translate potentially life-saving research into viable, successful businesses."

Following the presentation of the award, Governor Patrick participated in a panel discussion with former Governor Jeb Bush of Florida, where the two spoke about the role of government in facilitating and fostering innovation and growth in the life sciences and biotechnology field. The panel was moderated by FOX Network's Neil Cavuto, host of Your World With Neil Cavuto.

During the panel discussion, Governor Patrick spoke about the need for a collaborative approach to investing in and attracting life sciences talent. Asked what the next President should do to advance life sciences, Governor Patrick spoke about the need to recognize the need to keep politics out of science and make investments for the long term.

# GOVERNOR PATRICK HIGHLIGHTS JOB CREATION, RESEARCH AND DEVELOPMENT EXPANSION AT CUBIST PHARMACEUTICALS

## Two new floors of lab space to be completed by early 2012

(Photo credit: Matt Bennett/Governor's Office). View additional photos.

LEXINGTON - Wednesday, September 8, 2010 - Governor Deval Patrick and Massachusetts Life Sciences Center President & CEO Susan Windham-Bannister today joined company employees and local officials at Cubist Pharmaceuticals, Inc. in Lexington to highlight the company's expansion in Massachusetts. The Governor participated in the company's "Raising the Roof" ceremony, marking the beginning of a construction project that will add an additional 104,000 square feet of lab and associated administrative space to Cubist's existing lab facility by early 2012.

The Life Sciences Center, charged with implementing the State's ten-year, $1 billion Life Sciences Initiative proposed by Governor Patrick in 2007 and signed into law in June of 2008, awarded a tax incentive of $1.7 million to Cubist last year to facilitate their expansion plans in Lexington. As part of the tax incentive agreement Cubist has committed to creating 58 new jobs this year.

"The Massachusetts economy is an innovation economy, and Cubist is one of the best examples of how that innovation translates into jobs and scientific advancement," said Governor Patrick. "This is just the sort of growth that we envisioned when we proposed the Life Sciences Initiative back in 2007 and I am confident there will be many more announcements like this to come."

"We are excited to support Cubist's ongoing expansion through the Life Sciences Center's Tax Incentive Program," said Windham-Bannister. "Cubist is a great example of a growing life sciences company - they are expending their facilities, adding dozens of jobs, and keeping their pipeline of innovative new drugs and therapies strong."

"As a growing biopharmaceutical company, focused on developing and commercializing therapies administered in the acute care setting, we are driven by a desire to discover new medicines that will save lives," said Cubist President and CEO Mike Bonney. "We believe that the 21st century will be marked by enormous advances in all facets of the life sciences industry that will result in groundbreaking and lifesaving achievements in medical science, and will lead to brand new medical discoveries and therapies - that is our hope for additional lab space we are building here."

This expansion will position Cubist for continued success and further enhance its groundbreaking work in developing treatments for unmet medical needs in the acute care setting. The vertical expansion of the North Building will create two additional floors above the current floor for Research and Development, Technical Operations and related support functions. Once completed, the new space will accommodate both current and anticipated future needs of both groups. Specifically, new labs will be created for Medicinal Chemistry, Crystallography, High-Throughput Purification, Down-Stream Processing & Formulation, Toxicology and Discovery Biology. Other areas will include a new molecular modeling room, a suite of conference rooms and executive offices, administrative and break areas, and space for the future expansion of Discovery Biology and Non-Clinical Development. Also part of the expansion project will be the creation of a multi-story, glass atrium that will link the new upper floors of the North Building to the existing upper floors of the South Building. The atrium will contain a new main entrance, café, passenger & service elevators, walkways and informal meeting spaces.

"This expansion is good for the district and for the Commonwealth," said Senator Kenneth Donnelly. "It's yet another example of the Commonwealth's commitment to making Massachusetts the leader in this field."

"The whole Commonwealth benefits from this kind of partnership," said Senator Susan Fargo. "The commitment by the Massachusetts Life Sciences Center and Cubist Pharmaceuticals is a wonderful step forward for economic development and for our health and well-being."

"I am thrilled to see yet another ambitious expansion effort by a life sciences company committed to growing their business in the Commonwealth, an effort that will bring much-needed jobs and economic stability to our region," said Representative Jay Kaufman. "With Cubist's announcement coming on the heels of other recent expansion initiatives, Lexington is fast becoming a major player in the life sciences."

"Cubist's expansion is great news for our local economy in Lexington, and for the entire region," said Representative Thomas Stanley. "It is terrific to see the state's Life Sciences Initiative bringing new jobs and economic opportunity to our communities."

"The future growth of our economy is in the life sciences sector," said Representative Peter Koutoujian. "By providing the financial tools necessary for companies like Cubist to expand, we are keeping quality firms in Massachusetts and providing much needed business growth and good paying jobs."

In addition to the expansion underway at 65 Hayden Avenue, a building owned by Cubist, the company occupies approximately 180,000 square feet at both 55 Hayden Avenue and 45 Hayden Avenue where interior renovations are underway. When the expansion work is completed, Cubist will occupy a total of 373,000 square feet at its Lexington campus---up from 269,000 square feet today. The expanded facility is projected to be home to an additional 150 new scientists and support staff.

***About the Massachusetts Life Sciences Center***

The Massachusetts Life Sciences Center ("the Center") is a quasi-public agency of the Commonwealth of Massachusetts tasked with implementing the Massachusetts Life Sciences Act, a ten-year, $1 billion initiative that was signed into law in June of 2008. The Center's mission is to create jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties between sectors of the Massachusetts life sciences community. For more information, visit www.masslifesciences.com.

***About Cubist***

Cubist Pharmaceuticals, Inc. is a biopharmaceutical company focused on the research, development, and commercialization of pharmaceutical products that address unmet medical needs in the acute care environment. In the U.S., Cubist markets CUBICIN® (daptomycin for injection), the first antibiotic in a class of anti-infectives called lipopeptides. The Cubist clinical product pipeline currently consists of a Phase 2 program, added with Cubist's acquisition of Calixa Therapeutics Inc. in December 2009, focused on the development of a novel cephalosporin to address certain serious infections caused by multi-drug resistant (MDR) Gram-negative organisms; a Phase 2 program for the treatment of CDAD (Clostridium difficile-associated diarrhea); and a Phase 1 program intended to address the unmet medical need for a treatment for serious infections caused by MDR Gram-negative pathogens. Cubist is also working on several pre-clinical programs being developed to address areas of significant medical needs. These include an anti-infective program for the treatment of respiratory syncytial virus (RSV) in children, therapies to treat various serious bacterial infections, and agents to treat acute pain. Cubist is headquartered in Lexington, Mass. Additional information can be found at Cubist's web site atwww.cubist.com.

# GOVERNOR PATRICK SIGNS AGREEMENT WITH ISRAEL TO STRENGTHEN PARTNERSHIP, ENCOURAGE COLLABORATION BETWEEN MASSACHUSETTS AND ISRAELI INNOVATION ECONOMIES

Governor Patrick and Shalom Simhon, Minister of Industry, Trade and Labor, sign a Memorandum of Understanding in Jerusalem. (Photo Credit: Alex Goldstein/Governor's Office)

JERUSALEM - Thursday, March 10, 2011 - Governor Deval Patrick today signed a Memorandum of Understanding (MOU) with Israel that will allow for further collaboration in research and development (R&D) programs between Massachusetts and Israeli companies.

During a meeting with Israeli Chief Scientist Avi Hasson at the Ministry of Industry, Trade and Labor in Tel Aviv this afternoon, Governor Patrick and Mr. Hasson discussed Israel and Massachusetts' mutual commitment to life sciences and clean and alternative energy research, and how this new agreement will strengthen the partnership between Massachusetts and Israel to facilitate greater economic development and job creation opportunities in the years ahead.

"Today, we take a new step that will ensure our mutual prosperity and leverage the talents of our uniquely skilled workforces," said Governor Deval Patrick. "This Memorandum of Understanding formalizes our already strong relationship and builds a framework to explore new research and development

opportunities in the innovation economy. The agreement will strengthen out ties to our partners in Israel and help support job growth in both Massachusetts' and Israel's innovation industries."

This agreement comes on the fourth day of the Massachusetts Innovation Economy Partnership Mission, a ten-day trade mission to Israel and the United Kingdom (UK) where Governor Patrick and a coalition of the state's leading business executives and senior government officials are exploring growth opportunities within the Commonwealth's innovation-based industries - technology, life sciences and clean energy - and areas of common interest between the state's established and emerging partners in Israel and the UK.

The MOU signed with Israel today will allow the Massachusetts International Trade Office and the Office of the Chief Scientist to work together to identify pre-existing programs in their respective jurisdictions and explore how those programs can partner resources to expedite and enhance both new and ongoing R&D projects. The MOU will enable entities like the Massachusetts Life Sciences Center and the Massachusetts Clean Energy Center (MassCEC) to work across international lines with counterparts in Israel to enhance their competitiveness in these key sectors.

"MassCEC is a unique public entity dedicated entirely to accelerating job growth and economic development in the Massachusetts clean energy industry," said Energy and Environmental Affairs Secretary Richard K. Sullivan Jr., who chairs MassCEC's board of directors. "Its role as a clearinghouse and support center for the Commonwealth's clean energy sector will be strengthened through this agreement, and we look forward to exploring new opportunities with our Israeli partners."

"This agreement builds upon a strong existing relationship between Massachusetts and Israel and will facilitate the identification of joint investment opportunities that will further that relationship," said Dr. Susan Windham-Bannister, President & CEO of the Massachusetts Life Sciences Center and a member of the official delegation. "By working with our counterparts in Israel, we will seek to promote research collaborations, industrial partnerships, and collaborative investment in early-stage technologies, all with the bookend objectives of job growth and scientific discovery."

The Massachusetts Life Sciences Center will pursue follow-up implementation projects with counterpart agencies in Israel involving collaborative programs that will provide economic and scientific benefit to both regions.

"Both Massachusetts and Israel share a strong research and development community that is key to our clean energy leadership," said MassCEC Executive Director Patrick Cloney. "We look forward to collaborating and partnering with Israel in clean tech research and development projects with the ultimate goal of helping clean energy enterprises achieve success faster."

Today there are nearly 100 companies with Israeli founders or Israeli-licensed technologies in Massachusetts. In 2009, these companies employed nearly 6,000 people and generated $2.4 billion in direct revenue for the state. Local firms exported over $180 million worth of goods to Israel in 2009 and, at 12.35 percent, the United States is Israel's largest source of imports. An important market for health-related technologies, Israel is home to 377 hospitals, and 37,000 practicing physicians.

# MASSACHUSETTS AND ISRAEL UNVEIL $2 MILLION AGREEMENT TO FINANCE JOINT R&D PROJECTS THAT FOSTER ECONOMIC DEVELOPMENT

## Bilateral State Agreement to Facilitate Technology Commercialization for Life Sciences, Clean Energy and Technology Industries

WASHINGTON, D.C. - Wednesday, June 29, 2011 - Governor Deval Patrick today joined Israel's Office of the Chief Scientist (OCS), the U.S.-Israel Science and Technology Foundation (USISTF), and three Massachusetts economic development agencies to announce a formal collaboration between the State of Israel and the Commonwealth of Massachusetts to encourage and support innovation and entrepreneurship between Massachusetts' and Israel's life sciences, clean energy and technology sectors. This partnership will be known as the Massachusetts-Israel Innovation Partnership ("MIIP").

The agreement includes a joint solicitation for industrial Research & Development (R&D) collaborations between Massachusetts and Israeli companies. The three participating Massachusetts agencies, the Massachusetts Life Sciences Center (the Center), the Massachusetts Technology Collaborative (MTC) and the Massachusetts Clean Energy Center (MassCEC), are committing nearly $1 million in collective funding for Massachusetts companies that are engaged in cooperative industrial research and development projects with an identified Israeli partner company. The Office of the Chief Scientist will provide up to $1 million in matching dollars for the corresponding Israeli partner companies. Massachusetts is the first U.S. state to enter into such an agreement with the State of Israel.

"Today we have made a significant commitment to the long-term success of our economy," said Governor Patrick. "This Agreement will promote research collaborations, industrial partnerships and commercialization of new technologies, expanding opportunity and job growth both in Massachusetts and in Israel."

The initiative comes as a direct result of Governor Patrick's Massachusetts Innovation Economy Partnership Mission, a ten-day trade mission in March that included travel to Israel, where a coalition of the state's leading business executives and senior government officials explored growth opportunities of common interest for Massachusetts' and Israel's innovation industries. During that mission Governor Patrick and Shalom Simhon, Israeli Minister of Industry, Trade and Labor, signing on behalf of their respective states, signed a Memorandum of Understanding (MOU) in Jerusalem. MIIP has been established to implement the spirit of the MOU's framework. The MIIP initiative will be officially launched once the Israeli Knesset ratifies the MOU.

The initiative will support joint investment opportunities that will further the Massachusetts/Israeli relationship in ways that bring mutual economic benefit to both states and that further scientific discovery.

A Request for Proposals (RFP) will be issued jointly by the Center, MTC and MassCEC seeking applications for funding. The OCS will concurrently issue a solicitation seeking applications for funding from Israeli companies wishing to engage in industrial R&D collaborations with Massachusetts counterparts.

"This Agreement serves as another example of the Office of Chief Scientist's mission to implement programs that establish Israel as a hub of hi-tech industry," said Chief Scientist Avi Hasson, Israel Ministry of Industry, Trade and Labor. "We will continue to build international partnerships like the one with Massachusetts that enable Israeli and international companies to engage in joint technology development projects that drive economic growth."

The R&D Cooperation Agreement is designed to help Massachusetts and Israeli companies accelerate development cycles, promote mutually beneficial business-to-business cooperation to enhance opportunities for marketplace success and expand their global reach. It proposes a flexible framework of parallel funding for each participating company, having its R&D expenses supported by its own state according to its respective laws, regulations, rules and procedures.

"The Economic Development Administration (EDA) is pleased to collaborate in this important public-private partnership to promote technology commercialization in the biotechnology and life sciences industries to increase economic and job growth," said U.S. Assistant Secretary of Commerce for Economic Development John R. Fernandez. "This partnership between Massachusetts and Israel will be a great boost to the many innovators and entrepreneurs who are tackling today's challenges in clean energy, medicine and other fields and fueling the innovation economy."

"Helping businesses move forward with R&D projects through strategic international partnerships is the mission of the U.S.-Israel Science and Technology Foundation," said Ann Liebschutz, executive director at USISTF. "This Agreement exemplifies how we are encouraging the U.S. to tap into Israel's zeal for developing highly advanced and in-demand technologies to facilitate the competitiveness of American companies in this challenging global economy."

"This Agreement stems directly from the Governor's recent trade mission to Israel," said Susan Windham-Bannister, President & CEO of the Massachusetts Life Sciences Center. "A strong collaboration between two of the world's leading centers for life sciences innovation -- Israel and Massachusetts -- will undoubtedly advance scientific research, as well as development and commercialization of important new advances in medical devices, biotechnology, pharmaceuticals and other fields. We also are confident that this collaboration between Israel and Massachusetts will deliver meaningful economic benefits to both states."

"Israel and Massachusetts share a parallel asset in our world-class academic and research institutions, which have led to numerous technological discoveries and business start-ups in the clean energy sector," said MassCEC Executive Director Patrick Cloney. "This partnership will strengthen Massachusetts' relationship with the Israeli clean energy industry, and promote Massachusetts as an international clean energy leader, while providing Massachusetts companies access to the cutting edge expertise of their Israeli collaborators. With partnerships such as this we are on our way to making clean energy a marquee industry in Massachusetts, just like life sciences and IT."

"During the Governor's recent Trade Mission, we were impressed by the many synergies between the Israeli and Massachusetts technology sectors in areas such as cybersecurity, social media and digital healthcare management," said Patrick Larkin, Director of the Massachusetts Technology Collaborative's John Adams Innovation Institute. "We believe this public-private collaboration can serve as a catalyst to energize our state's entrepreneurs and innovation-led industries to develop new products for global markets and create new economic opportunities for Massachusetts."

Today there are nearly 100 companies with Israeli founders or Israeli-licensed technologies in Massachusetts. In 2009, these companies employed nearly 6,000 people and generated $2.4 billion in direct revenue for the state. Local firms exported over $180 million worth of goods to Israel in 2009 and, at 12.35 percent, the United States is Israel's largest source of imports. An important market for health-related technologies, Israel is home to 377 hospitals and 37,000 practicing physicians.

Governor Patrick also announced today that Massachusetts has hired a new Trade Representative to Israel, Hadas Bar-Or. Ms. Bar-Or is an experienced international economic development expert with a strong background in business development within the innovation economy and building collaborations between the public and private sectors. The new Representative will be responsible for increasing trade, investment, and commercial partnerships between Massachusetts and Israel. Governor Patrick announced that Massachusetts would be hiring a Trade Representative to Israel as part of his Innovation Economy Partnership Mission to Israel in March. Ms. Bar-Or will report to Secretary Greg Bialecki, Governor Patrick's Economic Development Cabinet Secretary and Chairman of the Massachusetts Marketing Partnership.

"Massachusetts and Israel today have extensive business relationships, due to our region's common industrial focus areas of life sciences, IT, and clean energy," said Housing and Economic Development Secretary Greg Bialecki. "Building on a strong foundation, our new trade representative will extend these business collaborations to new customers and industries."

# GOVERNOR PATRICK BREAKS GROUND ON ALEXANDRIA CENTER SCIENCE AND TECHNOLOGY CAMPUS IN CAMBRIDGE

## Campus will be future headquarters of life sciences company Biogen Idec and its 530 employees

Governor Patrick highlights his Administration's job creation efforts at a groundbreaking ceremony for Alexandria Center at Kendall Square.(Photo: Matt Bennett/Governor's Office)

CAMBRIDGE -- Thursday, October 27, 2011 -- Governor Deval Patrick today joined state and local officials, business leaders and members of the life sciences community for the groundbreaking of the first building of the Alexandria Center science and technology campus at Kendall Square. The properties will be the future home of Biogen Idec, a global, biopharmaceutical company moving its headquarters, along with 530 employees, to Cambridge.

"The innovation economy is Massachusetts' global calling card and projects like Alexandria Center confirm that our investments are paying off," said Governor Patrick. "Alexandria's Kendall Square development will create new jobs for the region and strengthen our already robust innovation economy."

Alexandria Center at Kendall Square is a 1.73 million square foot, 11 acre world-class, build-to-suit science and technology campus located in the heart of Cambridge. The development will ultimately include five state-of-the-art buildings with flexible, modern laboratory and high-tech office settings, as well as a variety of innovative spaces designed to encourage collaboration.

“We are delighted that Biogen Idec is moving its headquarters to Cambridge and that the Alexandria Real Estate development in Kendall Square is commencing," said Cambridge Mayor David P. Maher. "This development promises to create more open space, retail space and housing opportunities, in addition to the new lab and commercial spaces. This project is further evidence that Cambridge remains the Innovation Hub of the region."

The Patrick-Murray Administration has made unprecedented investments in the life sciences industry. In June 2008, Governor Patrick signed the Massachusetts Life Sciences Act, a 10-year, $1 billion initiative. The act tasked the Massachusetts Life Sciences Center with creating jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization, as well as building ties between sectors of the Massachusetts life sciences community.

"Biogen Idec’s selection of Alexandria Center at Kendall Square for its executive offices demonstrates the unparalleled quality, flexibility and cutting-edge design that define Alexandria’s properties worldwide,” said Tom Andrews, senior vice president and regional market director of Alexandria Real Estate Equities, Inc. “Many leading biopharmaceutical companies are strategically locating in Alexandria’s Cambridge-area properties because of their proven ability to support the development of scientific breakthroughs by providing outstanding facilities in this globally recognized center of life sciences research and development.”

The six-story, 307,000 square foot, highly-sustainable building at 225 Binney is being designed specifically for Biogen Idec by award-winning firm Spagnolo Gisness & Associates, Inc. The innovative design will feature a glass and brick facade and will incorporate two historic buildings. The building at 17 Cambridge Center, being developed by Boston Properties, is a 190,000 square foot building. Both properties will be ready for Biogen Idec in 2013 and will be the first buildings of the Alexandria Center at Kendall Square and the future home of Biogen Idec, a global, investment-grade Biopharmaceutical company.

“Massachusetts is already seen as a leader in healthcare technology, life sciences and clean technology and in order to keep our economy moving forward, continued investment in these cutting-edge industries is crucial,” said Senator Karen Spilka, Senate chair of the Joint Committee on Economic Development and Emerging Technologies. “By basing their headquarters in the Commonwealth, Biogen Idec will solidify our reputation as a leader in the biopharmaceutical industry and will also help to ensure continued economic development and job creation for the state.”

“This project highlights the city of Cambridge’s continued role as global center for innovation,” said Senator Sal DiDomenico. “As life science companies continue to make this region their home, it will help grow the local economy and create long-term employment opportunities for our state’s residents.”

The Patrick-Murray Administration's strategy brings together industry, academic research hospitals and public and private colleges and universities to coordinate this effort, spur new research, strengthen investments, create new jobs and produce new therapies for a better quality of life. The initiative is focused on five points of the development cycle to ensure a comprehensive statewide strategy: funding, planning, research, development and commercialization. According to the MassBIO, the Commonwealth is home to 1,400-1,500 biotechnology and life sciences companies, including agricultural or industrial biotechnology, bioinformatics, contract research and manufacturing, drug development, human diagnostic development, medical device and research products and instrumentation.

"Alexandria has been a generous community partner, agreeing to provide an unprecedented level of sorely-needed parkland and community space to the residents of East Cambridge who will be directly impacted by the development," said Representative Timothy J. Toomey, Jr. "As Kendall Square continues its exciting, meteoric growth into what has been described as 'the most innovative square mile on the planet,' it is important to partner with responsible developers, like Alexandria, who demonstrate a vested interest in the surrounding neighborhood."

"Massachusetts has secured its position as a global leader in the life sciences through smart investments and effective partnerships between industry and state government," said Representative Joseph F. Wagner, House chair of the Joint Committee on Economic Development and Emerging Technologies. "With projects like Alexandria's Kendall Square development, we are seeing that commitment foster economic growth and create new jobs for our residents."

To learn more about the Massachusetts Life Sciences Center and how it is supporting job growth and helping support the Commonwealth's innovation economy, please be sure to visit www.masslifesciences.com.

# GOVERNOR PATRICK CELEBRATES PFIZER EXPANSION IN CAMBRIDGE

## Company to bring 400 new research jobs to Cambridge

Governor Deval Patrick today joined Pfizer and the Massachusetts Institute of Technology (MIT) to break ground on Pfizer's new facility in Cambridge's Kendall Square. The facility will allow the company to expand its footprint in the growing biopharmaceutical cluster in Cambridge and will create 400 new jobs.(Photo: Eric Haynes / Governor's Office)

CAMBRIDGE – Monday, November 21, 2011 – Governor Deval Patrick today joined Pfizer and the Massachusetts Institute of Technology (MIT) to break ground on Pfizer's new facility in Cambridge's Kendall Square. The facility will allow the company to expand its footprint in the growing biopharmaceutical cluster in Cambridge and will create 400 new jobs.

"It is welcome news that Pfizer is increasing its presence and bringing new jobs to Massachusetts," said Governor Patrick. "Companies like Pfizer know that Massachusetts is unmatched when it comes to providing a high-quality workforce, a high quality of life, and nation-leading investments in health care, education and innovation."

Pfizer announced in February 2011 that the company would be making a strategic shift in research and development. Part of this strategic plan included turning the company's focus on a smaller number of research areas where the potential impact is greatest. This included the company's CVMED and Neuroscience research units. To help accommodate these changes, Pfizer announced it would increase its presence in Cambridge by moving these two important research units there, making the company the second largest biopharmaceutical company in Massachusetts in terms of number of employees. In September, Pfizer announced it had entered into a 10-year lease agreement with MIT for more than 180,000 square feet.

"We deliberately chose to move to Cambridge as a key part of our research and development strategy, in order to foster productive collaborations between our drug discovery experts and the outstanding scientists of Cambridge's world-class institutions," said Pfizer Worldwide R&D President Mikael Dolsten.

"Global biopharma leaders like Pfizer continue to invest in Massachusetts and are helping to strengthen and grow our life sciences Super Cluster," said Susan Windham-Bannister, Ph.D., President & CEO of the Massachusetts Life Sciences Center. "The Patrick-Murray Administration and the Life Sciences Center are actively engaged in doing all that we can to ensure that this trend continues."

In June 2008, Governor Patrick signed the Massachusetts Life Sciences Act, a 10-year, $1 billion initiative, which tasked the Massachusetts Life Sciences Center, a quasi-public agency of the Commonwealth with implementing the initiative. The center's mission is to create jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties between sectors of the Massachusetts life sciences community. As a result of these investments, Massachusetts has already created more than one million square feet of new laboratory and biomanufacturing space.

Pfizer also recently launched their newest Centers for Therapeutic Innovation (CTI) at Longwood Medical Center, which will serve as the worldwide headquarters for CTI, a network of partnerships between Pfizer and Academic Medical Centers (AMC) across the country that aim to accelerate and transform drug discovery and development. Pfizer intends to invest approximately $85 million over the next five years and create approximately 50 new or newly funded research jobs in conjunction with CTI in Boston.

The Patrick-Murray Administration has made a commitment to growing the Massachusetts economy through investments in education, innovation and infrastructure. Today's groundbreaking demonstrates that these investments are working to help create jobs and support the Massachusetts economic recovery. As a result, Massachusetts leads the nation in biotechnology research and development employment according to the U.S. Bureau of Labor Statistics and has three cities, Boston, Worcester and Springfield, listed in the top 20 metropolitan areas for recovery performance.

For more information on the Massachusetts Life Sciences Initiative, visit www.masslifesciences.com.

# GOVERNOR PATRICK CELEBRATES GRAND OPENING OF NEW THERMO FISHER SCIENTIFIC FACILITY IN TEWKSBURY

## Additional center will add 100 jobs in research, development and manufacturing

*Governor Patrick and U.S. Senator Kerry participate in a ribbon cutting ceremony at Thermo Fisher Scientific's Center for Excellence. (Photo credit: Eric Haynes / Governor's Office). View additional photos.*

TEWKSBURY – Monday, June 11, 2012 – Governor Deval Patrick today celebrated the grand opening of Thermo Fisher Scientific's Center for Excellence for portable analytical instruments. Thermo Fisher's Tewksbury location currently employs 400, and the additional center will add another 100 jobs in research, development and manufacturing over the next five years. The grand opening served as another event in a series of Massachusetts life sciences growth announcements taking place in the days prior to the BIO International Convention, which opens June 18 at the Boston Convention & Exhibition Center. Last week, Governor Patrick celebrated the grand opening of Navidea Pharmaceuticals' new business and commercialization facility in Andover.

"Massachusetts leads the world in life sciences thanks to our growth strategy of investing in education, innovation and infrastructure," said Governor Patrick. "I want to congratulate Thermo Fisher on the

opening of their new facility in Tewksbury, and on their plans for future expansion in Massachusetts. We look forward to working with them to create more jobs and opportunities in the Commonwealth."

The 156,000-square-foot Tewksbury facility is the new home to the company's comprehensive line of Thermo Scientific portable and analytical instruments.

"Our Commonwealth, with its significant access to talent, investment and innovation, supports growth of life sciences, biotech and high-tech businesses unlike any other state or region," said Marc N. Casper, president and chief executive officer of Thermo Fisher Scientific. "This new Center of Excellence creates a strong base for our continued growth in portable and handheld instruments – high-tech tools that are enabling our customers to make the world safer. We've been able to take analytical technologies that were typically only found in the laboratory, and adapt them for use in the field by non-scientists. Our $20 million investment in this world-class facility reaffirms our commitment to Massachusetts and a growing economy that is fueled by new scientific discoveries."

There are now more than 1,400 Thermo Fisher employees in Massachusetts. In addition to its global corporate headquarters in Waltham, businesses in the Commonwealth include Environmental and Process Monitoring in Franklin; Water Analysis Instruments in Beverly; and the BRIMS Center in Cambridge, which provides applications assistance in biomarker discovery and validation.

The BIO International Convention will provide Governor Patrick, Lieutenant Governor Timothy Murray, state and industry leaders with an opportunity to showcase Massachusetts as a global leader in the life sciences industry, and the preeminent place for life sciences companies to invest in and expand.

In 2008, Governor Patrick signed a 10-year, $1 billion investment package to strengthen the state's global leadership in the life sciences. The initiative melds all of the state's key resources in order to spur research, investment, innovation and commercialization. Now, the life sciences industry in Massachusetts is thriving, with more than 52 percent job growth in the biopharma sector since 2001 and more than 80,000 employees working in the life sciences.

# GOVERNOR DEVAL PATRICK AND SEVEN GLOBAL BIOPHARMA COMPANIES ANNOUNCE FORMATION OF NEUROSCIENCE CONSORTIUM

## Abbott, Biogen Idec, EMD Serono, Janssen Research & Development, LLC, Merck, Pfizer and Sunovion announce new collaboration at the BIO International Convention

BOSTON — Wednesday, June 20, 2012 — Governor Deval Patrick today joined seven global biopharmaceutical companies to announce the formation of the Massachusetts Neuroscience Consortium. Participating companies include Abbott, Biogen Idec, EMD Serono, Janssen Research & Development, LLC, Merck, Pfizer and Sunovion Pharmaceuticals Inc. The Consortium will fund pre-clinical neuroscience at Massachusetts academic and research institutions.

“From Alzheimer’s disease, to Parkinson’s disease, to multiple sclerosis, neurological diseases affect millions of Americans and millions more across the globe,” said Governor Patrick. “Through the research that this consortium will fund, we aim to bring those people, their families, and many others hope for a better future.”

The announcement took place in the Massachusetts Pavilion at the 2012 BIO International Convention.

The Consortium is a pioneering new model that is designed to leverage Massachusetts’ rich environment for purposes of accelerating early-stage research available to the pharmaceutical industry, introducing academic researchers to the challenges of targeted research, and facilitating industry-academic collaborations.

A number of factors make the Massachusetts Neuroscience Consortium unique:

- Proposed projects will be short-term and results-oriented. Timelines, milestones, budgets and objectives will be clearly defined by the industry sponsors.
- Industry sponsors will identify common standards, e.g. levels of validation necessary for a project objective to be considered “complete.”
- Industry sponsors will work in collaboration with principal investigators and their teams; sponsors also will contribute tools, data and other resources to the project teams to expedite their work.

Results are shared with all participants; companies and academic researchers will have access to the use of any tools developed by each project; industry sponsors will determine their interest in validated targets as projects are completed.

“The Consortium is a pioneering new model that is designed to leverage the rich research environment in Massachusetts for purposes of accelerating pre-clinical research available to the biotech and pharmaceutical industry, introducing academic researchers to the challenges of targeted research, and facilitating industry-academic partnerships,” said Susan-Windham Bannister, Ph.D., President and CEO of the Massachusetts Life Sciences Center. “I sincerely thank our seven charter members for stepping up to this challenge and joining in this new collaboration.”

Each participating company has pledged to contribute $250,000 to the Consortium, for total initial funding of $1.75 million. Members of the Consortium will solicit and review proposals from academic research institutions for pre-clinical neuroscience research. The first solicitation is expected to open in the fall of 2012. All Massachusetts academic and research institutions will be eligible to apply for grant funding through the Consortium. The Massachusetts Life Sciences Center will administer the Consortium, and will use its convening power to reduce barriers to collaboration and to expedite access to the research community.

Massachusetts is a center of excellence in the field of biomedical neuroscience with world leaders representing all major fields of neurobiology and neurology. The combination of basic neuroscience, translational and clinical research across more than a dozen world-renowned institutions represents what may be the world’s highest density of neuroscience research. This provides a rich and fertile environment within which to advance the understanding and treatment of brain disorders.

“EMD Serono is proud to be a part of this new initiative to further neuroscience research within our company’s home state of Massachusetts,” said James Hoyes, President of EMD Serono. “This Consortium represents true collaboration amongst industry leaders, to foster breakthroughs in science today that will change the shape of medicine for tomorrow. We look forward to accelerating research and innovation in the area of neuroscience, and together, making a difference in the lives of patients.”

“Janssen Research & Development is pleased to be a charter sponsor of this innovative approach to advance neuroscience research,” said Husseini Manji, MD, Global Therapeutic Area Head, Neuroscience, Janssen R&D. “We believe scientific collaboration that brings together the best ideas and expertise from both academia and industry will play an important role in helping translate basic science discoveries into promising new treatments.”

“We are delighted to be a founding member of the Neuroscience Consortium,” said Douglas E. Williams, Ph.D., Executive Vice President, Research and Development at Biogen Idec. “New types of

collaborations among academia and industry are increasingly important to stimulating the discovery of better therapies and advancing science and medicine. At Biogen Idec, we are working on discovering and developing drugs across a number of areas in neurodegenerative disease and believe that this first-of-its-kind collaboration among the state, biopharmaceutical companies and top academic researchers is important for maintaining a vibrant and innovative research organization and making sure we deliver better therapies to patients with these difficult diseases."

"Pfizer Neuroscience is in Cambridge, Massachusetts, largely due to the intense concentration of neuroscience thought leaders," said Dr. Michael Ehlers, Chief Scientific Officer for Pfizer Neuroscience. "This collaboration is a step forward in our effort to address the urgent need for therapies in neurologic and psychiatric disease."

"This is an exciting and promising new model for collaboration to advance the study of behavioral health and neuroscience disorders. Sunovion is proud to participate in this initiative," said Richard Russell, Executive Vice President and Chief Commercial Officer, Sunovion Pharmaceuticals Inc. "The Life Sciences Center has played an essential role in convening this group and making this collaboration happen, and we thank them for their leadership."

"The academic research community is committed to understanding these neurologic conditions at the most basic and fundamental molecular level, and most importantly, to translating that depth of understanding into clinical application," said Jeffrey S. Flier, Dean of Harvard Medical School. "Basic discovery and translational science are essential to our success, and we in academia have the infrastructure to do it."

"When I was first diagnosed with MS nearly 20 years ago, there were no approved treatments on the market," said Joann D'Amico Stone of Waltham. "Since that time, there have been tremendous advancements made, opening up a number of options for patients – including my MS treatment from Biogen Idec. It's heartening to see these companies collaborating, because I think that it will ultimately help speed and increase the number of important treatments that can benefit patients like me."

"In 2009 I became the fourth member of my extended family to be officially diagnosed with Alzheimer's Disease," said Allen Krieger of Lexington, a distinguished astrophysicist. "Alzheimer's has changed my life in a number of ways - I have difficulty finding things, making decisions, and remembering things that used to be routine. I've participated in clinical trials and other research to do what I can to help. This consortium is a new and promising approach to advancing Alzheimer's research through collaboration between the companies and academic institutions that are leading the way in the search for a cure."

"We are in a race against time in our fight to find treatments and a cure for Alzheimer's," said James Wessler, President and CEO of the Alzheimer's Association, MA/NH Chapter. "We applaud Governor

Patrick and the Massachusetts Life Sciences Center for the foresight shown in the creation of this new neuroscience consortium.  For the 120,000 people in Massachusetts with Alzheimer's, this cannot come soon enough."

The BIO International Convention provides Governor Patrick, Lieutenant Governor Timothy Murray, state and industry leaders with an opportunity to showcase Massachusetts as a global leader in the life sciences industry, and the preeminent place for life sciences companies to invest in and expand.

Governor Patrick's ten-year, $1 billion life sciences investment package has strengthened the state's global leadership in the life sciences. The initiative melds all of the state's key resources in order to spur research, investment, innovation and commercialization. Now the life sciences industry in Massachusetts is thriving, with more than 52 percent job growth in the biopharma sector since 2001 and more than 80,000 employees working in the life sciences.

# NXSTAGE MEDICAL OPENS NEW COMPANY HEADQUARTERS IN LAWRENCE

LAWRENCE – Monday, October 15, 2012 – Governor Deval Patrick today joined NxStage Medical, Inc., a leading manufacturer of innovative dialysis products, to officially open the company's new headquarters in Lawrence. Thanks to the Patrick-Murray Administration's commitment to life sciences, Massachusetts has become a global hub for life sciences development and research.

"Thanks to our growth strategy of investing in education, innovation and infrastructure, Massachusetts continues to lead the world in life sciences," said Governor Patrick. "I congratulate NxStage on this significant achievement and for reaffirming its commitment to Massachusetts."

The new 137,000 square foot facility replaces the company's prior 58,000 square foot Lawrence facility. The facility houses NxStage's corporate offices which include over 300 employees within research and development, sales and marketing, customer and technical support, among other functions, and is expected to accommodate the company's future growth.

"During the Industrial Revolution, our region's gateway cities led the way in pioneering American industry. Today, companies like NxStage pay homage to the Fifth District's long tradition of sparking progress," said Congresswoman Niki Tsongas. "By committing to Lawrence, NxStage ensures the presence of good jobs and continued innovation in the years ahead and I look forward to working with them as a federal partner to ensure that they are able to continue to grow and thrive here in the Commonwealth."

The Massachusetts Life Sciences Center (MLSC), the agency charged with implementing Governor Patrick's 10-year, $1 billion Life Sciences Initiative, awarded approximately $1.3 million in tax incentives to NxStage Medical in 2010 to encourage the company's growth in Massachusetts.

"As one of the largest and fastest growing medical device companies in Massachusetts, NxStage is proud to contribute to the growth and vitality of the area," said Jeffrey H. Burbank, Founder and Chief Executive Officer of NxStage Medical. "NxStage is revolutionizing renal care with innovative technologies including our System One, which provides life-changing therapy to thousands of patients. We are very appreciative that the Governor and others recognize the importance of what we're working to accomplish to ensure that this life-changing therapy option is available to all dialysis patients."

"Being at home and in control of my treatment is what was important to me when I sought home hemodialysis therapy with NxStage," said NxStage dialyzor Richard Sicurella of Winthrop. "But the health and quality of life benefits are what are helping me to live a good life, a life where my wife and I can enjoy our retirement and spend time together. This would not be possible without NxStage. This therapy has changed my life."

Governor Patrick strengthened Massachusetts' global leadership in life sciences in 2008 by signing a 10-year, $1 billion life sciences investment package. Over the last four years, the Commonwealth has

invested more than $300 million in the industry, leveraging more than $938 million in third-party investments and creating thousands of jobs in both construction and the life sciences.

“NxStage Medical is a great example of the state’s investment in the life sciences paying off. This new, expanded headquarters will allow NxStage to grow its business and create jobs right here in the City of Lawrence,” said Senator Barry Finegold. “Additionally, the fact that this is only one of a dozen new businesses opening in the Riverwalk this year shows that the City of Lawrence is a great place to do business. Sal Lupoli should be commended for the work he has done here at the Riverwalk, bringing renewed life to this once thriving area.”

The Life Sciences Initiative melds all of the state’s key resources in order to spur research, investment, innovation and commercialization. Now the life sciences industry in Massachusetts is thriving, with more than 52 percent job growth in the biopharma sector since 2001 and more than 80,000 employees working in the life sciences.

Earlier this month Massachusetts hosted the AdvaMed Convention, the annual convention of the U.S. medical device industry. In June Massachusetts hosted the BIO International Convention, which brought more than 15,000 participants and 3,000 companies to Boston. Both AdvaMed and BIO gave Governor Patrick, Lieutenant Governor Timothy Murray, and state and industry leaders an opportunity to showcase Massachusetts as a global leader in the life sciences industry, and the preeminent place for life sciences companies to invest in and expand. During the BIO convention, Governor Patrick announced innovation partnerships with regions in Spain, and Denmark and Sweden, and the creation of a neuroscience consortium formed by seven companies.

"The Center is pleased to be supporting NxStage Medical as the company expands its facilities in the Commonwealth,” said Susan Windham-Bannister, Ph.D., President & CEO of the MLSC. “NxStage’s important technologies address the challenges of renal failure -- a condition with a rising incidence and prevalence but poor outcomes. Through NxStage, Massachusetts is leading the way in providing better solutions to patients.”

# ISRAELI-FOUNDED ARGO MEDICAL TECHNOLOGIES SELECT MASSACHUSETTS AS U.S. HEADQUARTERS

## Announcement at AdvaMed 2012 highlights Massachusetts life sciences industry with demonstration of ARGO's ReWalk exoskeleton that enables paraplegics to walk

BOSTON – Tuesday, October 2, 2012 – Governor Deval Patrick joined ARGO Medical Technologies at the AdvaMed 2012 conference today to announce that Israeli-founded exoskeleton technology leader ARGO has selected Massachusetts as its U.S. headquarters.

"Massachusetts is a global leader in the life sciences industry because of our strong investment in education and innovation," said Governor Patrick, who led a trade mission to Israel last spring to further strengthen ties between the innovation industries in Massachusetts and Israel. "I am pleased to welcome ARGO and their remarkable technology to Massachusetts and I look forward to the continued growth of their company as they bring new jobs into the Commonwealth."

ARGO Medical Technologies' product the ReWalk is an exoskeleton suit that enables persons with lower limb disabilities such as paraplegia to stand and walk independently without assistance. The company's founder, Dr. Amit Goffer, is a person with quadriplegia who was inspired to invent the exoskeleton device because of his own personal story. ARGO was founded in Israel, but has grown internationally. Along with its Massachusetts headquarters, it now has centers in Germany and Israel. The new Massachusetts headquarters, which the company expects to house up to 40 employees, will be located in Marlborough.

"As ARGO expands from a research and development firm to an international leader in commercial exoskeleton technology, we have selected Massachusetts with its strong commitment to the life sciences industry as our U.S. headquarters," said Larry Jasinski, CEO of ARGO Medical Technologies. "The ReWalk is a cutting edge device that will revolutionize the mobility industry and we are committed to making this technology commercially available to anyone who wants one here in the U.S. and around the world."

"ARGO's technology is truly life-changing," said Susan Windham-Bannister, Ph.D., President & CEO of the Massachusetts Life Sciences Center, the agency charged with implementing Governor Patrick's Life Sciences Initiative. "Millions of people with neurodegenerative diseases and spinal cord injuries, including many of our returning veterans, have been waiting for this kind of breakthrough technology. We are proud to welcome ARGO to the Massachusetts life sciences community."

At the press conference, U.S. Army Veteran Theresa Hannigan demonstrated the ReWalk exoskeleton technology. Hannigan is a former Army Sergeant who served during the Vietnam era and was left paralyzed two years ago as a result of a progressive autoimmune disease which she contracted while in the Army. Hannigan has been training with the ReWalk at the National Center of Excellence for the

Medical Consequences of Spinal Cord Injury at the James J. Peters VA Medical Center, Bronx, NY and is planning to use the exoskeleton on October 20, 2012 to walk a 1 mile road race in Lindenhurst, NY to raise money for the organization “Hope for the Warriors” which helps U.S. service men and women.

“I am very excited for the day I can take the ReWalk home to use in my daily life,” said Hannigan. “It’s the simple things that I miss that I can’t do in my wheelchair. When I’m sitting on the couch it is difficult and time consuming to transition into my wheelchair for a simple task like getting a glass of water. With the ReWalk I can just stand up, walk in to the kitchen, get a glass in the cabinet, and pour it for myself.”

The ReWalk is currently available in the U.S. at rehabilitation centers and is awaiting FDA clearance for personal use. In Europe it is also being used in rehabilitation facilities, and ARGO has recently announced its commercial availability to take home for personal use throughout the European Union.

Governor Patrick strengthened Massachusetts’ global leadership in life sciences in 2008 by signing a 10-year, $1 billion life sciences investment package. Over the last four years, the Commonwealth has invested more than $300 million in the industry, leveraging more than $938 million in third-party investments and creating thousands of jobs in both construction and in the life sciences.

The Life Sciences Initiative melds all of the state’s key resources in order to spur research, investment, innovation and commercialization. Now the life sciences industry in Massachusetts is thriving, with more than 52 percent job growth in the biopharma sector since 2001 and more than 80,000 employees working in the life sciences.

In 2011, Governor Patrick led the Massachusetts Innovation Economy Partnership Mission, a 10-day trade mission that included travel to Israel, where a coalition of the state’s leading business executives and senior government officials explored growth opportunities of common interest for Massachusetts’ and Israel’s innovation industries.

**About ARGO Medical Technologies**

ARGO Medical Technologies develops, manufactures and markets walk restoration devices for people with lower limb disabilities. The company's ReWalk™ exoskeleton allows an ambulation and rehabilitation alternative to wheelchair users, enabling people with lower limb disabilities, such as paraplegia, to stand and walk independently. ARGO is operated by a team of experts in the fields of rehab devices, control and computer sciences with decades of combined experience in R&D, engineering and manufacturing of multidisciplinary systems. The company is assisted by renowned international experts in the fields of medicine, biomedical engineering, robotics and marketing. Founded in 2001 in Israel, ARGO is today an international company with headquarters in the U.S., Germany and Israel. For more information, please visithttp://www.argomedtec.com/.

**About the Massachusetts Life Sciences Center**

The Massachusetts Life Sciences Center is a quasi-public agency of the Commonwealth of Massachusetts tasked with implementing the Massachusetts Life Sciences Act, a ten-year, $1 billion initiative that was signed into law in June of 2008. The Center’s mission is to create jobs in the life

sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties among sectors of the Massachusetts life sciences community. For more information, visit www.masslifesciences.com.

# GOVERNOR PATRICK CELEBRATES NEW GENZYME BIOMANUFACTURING FACILITY OPENING IN FRAMINGHAM

FRAMINGHAM – Monday, October 22, 2012 – Governor Deval Patrick today joined Genzyme, a Sanofi subsidiary and the world's third-largest biotechnology company, at an open house to celebrate the recent opening of the company's new biomanufacturing facility in Framingham. Genzyme's ability to locate the facility at Framingham Technology Park was enabled through infrastructure funding from the Massachusetts Life Sciences Center, the agency charged with implementing Governor Patrick's ten-year, $1 billion Life Sciences Initiative.

"Thanks to our growth strategy of investing in education, innovation and infrastructure, Massachusetts continues to lead the world in life sciences," said Governor Patrick. "Genzyme's new facility represents Massachusetts competing successfully for jobs in advanced manufacturing. I congratulate Genzyme, and appreciate the company's ongoing commitment to growing in Massachusetts."

The Massachusetts Life Sciences Center (MLSC) awarded grant funding totaling $14.3 million to the town of Framingham to upgrade its wastewater collection system in conjunction with Genzyme's large-scale biomanufacturing expansion project. Over the past four years, the Commonwealth has invested more than $300 million in the state's life sciences cluster, leveraging more than $1 billion in third-party investments and creating thousands of jobs in both construction and in the life sciences. The life sciences industry in Massachusetts is thriving, with more than 52 percent job growth in the biopharma sector since 2001 and more than 80,000 employees working in the life sciences.

Genzyme employs approximately 4,500 people in Massachusetts, with 2,300 employees at the Framingham campus. Approximately 500 of the Framingham jobs are at the new Framingham biomanufacturing facility.

"The state's commitment to the life sciences, partnership with industry, and the infrastructure grant for Framingham has helped us meet our most important commitment of restoring the supply of medicine to the patients who depend on us," said David Meeker, M.D., President and CEO of Genzyme. "The investments we have made to improve our Allston manufacturing plant and build the new facility here in Framingham are clear indicators of our commitment to meet that need for people living with rare diseases such as Fabry and Gaucher."

Earlier this month, Massachusetts hosted the AdvaMed Convention, the annual convention of the U.S. medical device industry. In June, Massachusetts hosted the BIO International Convention, which brought more than 15,000 participants and 3,000 companies to Boston. Both AdvaMed and BIO gave Governor Patrick, Lieutenant Governor Timothy Murray, and state and industry leaders an opportunity to showcase Massachusetts as a global leader in the life sciences industry, and the preeminent place for life sciences companies to invest in and expand. During the BIO convention, Governor Patrick announced innovation

partnerships with regions in Spain, and Denmark and Sweden, and the creation of a neuroscience consortium formed by seven companies.

"The Center is pleased to support the town of Framingham through a true public/private partnership that has enabled Genzyme to expand their biomanufacturing efforts in Massachusetts and create hundreds of new jobs," said Susan Windham-Bannister, Ph.D., President & CEO of the MLSC. "When we support biomanufacturing we create jobs that are available to people with a variety of skills and levels of education attainment. Genzyme is a company built on groundbreaking science that fundamentally changes the lives of patients with rare diseases, such as Fabry's disease. With the opening of Genzyme's new biomanufacturing facility we will see therapies reaching patients quicker – and that's what the Massachusetts life sciences industry is all about."

**About Genzyme, a Sanofi Company**

Genzyme has pioneered the development and delivery of transformative therapies for patients affected by rare and debilitating diseases for over 30 years. We accomplish our goals through world-class research and with the compassion and commitment of our employees. With a focus on rare diseases and multiple sclerosis, we are dedicated to making a positive impact on the lives of the patients and families we serve. That goal guides and inspires us every day. Genzyme's portfolio of transformative therapies, which are marketed in countries around the world, represents groundbreaking and life-saving advances in medicine. As a Sanofi company, Genzyme benefits from the reach and resources of one of the world's largest pharmaceutical companies, with a shared commitment to improving the lives of patients. Learn more atwww.genzyme.com.

**About the Massachusetts Life Sciences Center**

The Massachusetts Life Sciences Center is a quasi-public agency of the Commonwealth of Massachusetts tasked with implementing the Massachusetts Life Sciences Act, a ten-year, $1-billion initiative that was signed into law in June of 2008. The Center's mission is to create jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties among sectors of the Massachusetts life sciences community. For more information, visit www.masslifesciences.com.

# GOVERNOR PATRICK CELEBRATES GRAND OPENING OF ALBERT SHERMAN CENTER AT UMASS MEDICAL SCHOOL

## $90 million capital grant from the Massachusetts Life Sciences Center is the Center's largest investment to date

WORCESTER – Jan. 30, 2013 – Governor Deval Patrick and Lieutenant Governor Timothy Murray today joined UMass leadership, educators and state and local officials to celebrate the grand opening of the new Albert Sherman Center at the University of Massachusetts Medical School. Built in partnership with the University of Massachusetts Building Authority and funded in part with a $90 million grant from the Massachusetts Life Sciences Center, investments of this kind are a key component of the Governor's plan to grow jobs and expand economic opportunity.

"Our investments in education, innovation and infrastructure have come together to support the completion of the Albert Sherman Center here at UMass Medical School," said Governor Patrick. "This landmark project is a testament to what is possible when we work together to invest in this generation and the next."

"As we continue to invest in innovation in all regions of the Commonwealth, the Sherman Center at UMass Medical School stands out as a leading research and educational institution not just for Worcester County but for the entire state," said Lieutenant Governor Timothy Murray. "We look forward to the tremendous knowledge and growth this institute will lend in finding cures to complex diseases, supporting the medical and life sciences industries, and creating jobs and investment in Massachusetts."

Named for UMass Medical School's former vice chancellor for university relations, the Albert Sherman Center has doubled the research capacity of the Worcester campus with 512,000 square feet of interdisciplinary research and education space designed to maximize collaboration among scientists, educators and students across multiple fields. It is the new home of the Advanced Therapeutics Cluster, comprising the RNA Therapeutics Institute, the Center for Stem Cell Biology and Regenerative Medicine and the Gene Therapy Center, and contains wet research space for more than 90 investigators. These translational scientists pursue novel bench-to-bedside research in emerging scientific fields with the goal of developing new innovative therapies for diseases ranging from cancer to amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, and cystic fibrosis.

"The Albert Sherman Center was one of the MLSC's earliest investments, and at $90 million remains our largest investment to date," said Susan Windham-Bannister, Ph.D., President & CEO of the Massachusetts Life Sciences Center. "The advanced therapeutic research that will be housed in this facility will generate promising new treatments as well as spin out new companies. UMMS, the state's first and only public medical school, is a science pioneer and the Center is very pleased to advance their work through this investment. With this investment we also are implementing the Patrick/Murray Administration's vision to grow the life sciences all across the Commonwealth."

Last week, Governor Patrick unveiled a budget proposal that includes new investments in education, innovation and infrastructure, areas that have proven to create new jobs and economic opportunities through increased public investments for every part of the Commonwealth. This includes $25 million for the Massachusetts Life Sciences Center in the coming fiscal year to continue their landmark investments in innovation for the life sciences.

Through the Massachusetts Life Sciences Center, Massachusetts is investing $1 billion over 10 years in the growth of the state's life sciences supercluster. These investments are being made under the Massachusetts Life Sciences Initiative, proposed by Governor Patrick in 2007, and passed by the State Legislature and signed into law by Governor Patrick in 2008.

"The completion of the Albert Sherman Center is a transformative event in the history of the Commonwealth's medical school," said Chancellor Michael F. Collins. "It would be hard to overstate the importance of this new center to our campus, or the positive impact of the work that will go on within it."

"We are honored and privileged to be part of this ground breaking, collaborative construction effort," said Peter Campot, Suffolk's president of Healthcare and Science-Technology and chief innovation officer. "This unique project gave us an opportunity to implement the most innovative planning and construction methods in the industry, including virtual design and construction and six-dimensional facility modeling. These state-of-the-art processes and tools, along with our 'build smart' approach to construction management, allowed us to deliver a facility that will set a new standard for biomedical research for generations to come."

# Governor Patrick Announces Major Life Sciences Investment in Western Massachusetts

## Grants to fund lab renovations, equipment and planning for community colleges and vocational schools, and expansion of life sciences capacity at MGHPCC

HOLYOKE – Thursday, February 28, 2013 – Governor Deval Patrick and the Massachusetts Life Sciences Center (MLSC) today announced more than $9 million in grants for life-sciences-related capital projects in Western Massachusetts, including $3.8 million to support the creation of a Center for Life Sciences at Holyoke Community College (HCC), and $4.54 million that will allow the Massachusetts Green High Performance Computing Center (MGHPCC) in Holyoke to expand its capacity for life sciences-related research and data analysis. Through the Massachusetts Life Sciences Center, Massachusetts is investing $1 billion over 10 years in the growth of the state's life sciences supercluster. These investments are being made under Governor Patrick's Massachusetts Life Sciences Initiative.

"Supporting innovation propels our economy forward and prepares our citizens for the 21st century global marketplace," said Governor Patrick. "Our innovation economy relies on a well-educated, well-skilled workforce, and these grants will expand opportunity and grow jobs in communities throughout the Commonwealth."

"Our Administration is committed to investing in innovation across the state, including the life sciences industry in Western Massachusetts," said Lieutenant Governor Timothy Murray. "These capital project investments will enhance research, workforce training and job creation, expand opportunities to develop improved medicine and support the region's long-term economic growth."

"Schools like Holyoke Community College and Springfield Technical Community College play major roles in training the next generation of our state's life sciences workforce, and they ensure that training for innovation economy jobs is inclusive and available all across the state," said Dr. Susan Windham-Bannister, President & CEO of the MLSC. "Our grants help ensure that these schools can provide students in Western Massachusetts with first-rate training facilities "Our grant to the MGHPCC leverages prior investments by the state and five of our top universities by expanding the MGHPCC's capacity to make advanced computing available to the life sciences community."

The largest grant awarded today went to the MGHPCC. This investment will build on an infrastructure for large-scale data analysis that is already in place in Holyoke and was created by a strong partnership among academia, industry and the Commonwealth. Boston University, Harvard University, the Massachusetts Institute of Technology, Northeastern University and the University of Massachusetts have teamed with Astra-Zeneca, Pfizer, Merck, Merrimack Pharmaceuticals, EMC and IBM, among others, to create this computing resource. The MLSC funding of $4.54 million will allow the MGHPCC to create a cloud-based resource for data-driven biology.

“As with other scientific disciplines, discovery and innovation in the life sciences are dependent on high-performance computing,” said John Goodhue, Executive Director of the MGHPCC. “This investment will leverage the capabilities of the MGHPCC and its university partners to strengthen the state's position as a leader in life sciences research, an important driver of the Massachusetts economy. The MLSC's investment will also add a new dimension to the ongoing partnership between the MGHPCC and western Massachusetts business and educational institutions.”

“Biomedical sciences are in the midst of a revolution where many of the challenges are becoming large-scale data problems,” said Manuel Garber, Associate Professor in the Program in Bioinformatics and Integrative Biology at the University of Massachusetts Medical School. “The investment in this computer system will poise the state of Massachusetts as a leader in the development of computational methods to understand and a catalytic force in applying these discoveries to improve health care.”

HCC was granted $3.8 million to support the renovation of 13,000 square feet of lab space and the creation of a Center for Life Sciences. This will include a clean room for the biological sciences, which will be the only clean room in Western Massachusetts to support training for students, faculty and industry partners.

“The importance of community colleges in providing access to life sciences education for minority, low-income and first-generation students cannot be overstated,” said HCC President William F. Messner. “This grant will enable us to expand our partnerships and establish a solid pipeline from high school, to college, to the workforce. It will allow HCC to strengthen articulations with Mount Holyoke and Smith College and increase the number of women in life sciences fields. It will provide the college with the resources necessary to support our industry partners, and ensure our curriculum aligns with their needs and equips our graduates with the knowledge and skills they need to pursue further education or enter the workforce.”

“This project at Holyoke Community College is absolutely essential for regional life science economic development,” said Steve Richter, President & Scientific Director of Microtest Labs in Agawam. “The caliber of this project adds to the force required for real change and job development. The focus on microbiology and clean room technology creates value for students and industry. The medical device, biotech and compounding pharmacies will benefit from future graduates.”

The MLSC also awarded two planning grants to academic institutions in the region. These grants allow institutions to propose and develop studies in order to further identify what types of life sciences resources would be most useful to them:

- Springfield Technical Community College (STCC) was awarded $150,000, which will be used to update its equipment and labs to align with the needs of life sciences companies. MLSC funding will allow STCC to conduct a study to identify the most appropriate equipment that will best deliver a life sciences education leading to employment in the field.

- Bay Path College in Longmeadow recently received a $2 million grant from the U.S. Department of Education aimed at improving undergraduate student retention, supporting curricular redesign, faculty professional development, and student academic and career support services. The MLSC planning grant

of $50,000 will enable Bay Path College to engage key stakeholders from the life sciences industry, workforce development, and educational institutions to identify the capital needs and other resources needed to fully implement this initiative in the sciences at Bay Path College.

“STCC applauds Governor Patrick and the Massachusetts Life Sciences Center for their investment in life sciences education,” said Dr. Lisa Rapp, Chair of STCC's Biotechnology Department. “STCC's planning grant will allow the college to determine which capital resources we most need to create and furnish up-to-date, industry-aligned, teaching laboratories to educate and train a skilled life sciences workforce for the Commonwealth.”

“We have always been responsive to the workforce development needs of our region.  As Bay Path continues to invest and grow our programs in the life sciences, our planning must be conducted in collaboration with the life sciences industry in Massachusetts where our students are most likely to pursue careers, thereby ensuring their success and also enabling the industry as a whole to flourish,” said Dr. Melissa Morriss-Olson, Provost and Vice President for Academic Affairs of Bay Path College.

In December, 2012, Lieutenant Governor Murray and the MLSC announced a round of equipment and supply grants for vocational and technical high schools and public high schools in gateway cities, with the idea of furthering STEM education. High schools in Western Massachusetts received more than $500,000 toward lab renovation and equipment. The six schools in Western Massachusetts, the city or town in which they are located, and the amount of their respective grants are as follows:

**About the Massachusetts Life Sciences Center**

The Massachusetts Life Sciences Center (MLSC) is a quasi-public agency of the Commonwealth of Massachusetts tasked with implementing the Massachusetts Life Sciences Act, a 10-year, $1-billion initiative that was signed into law in June of 2008. The MLSC’s mission is to create jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties among sectors of the Massachusetts life sciences community. For more information, visit www.masslifesciences.com.

# REPORT CONFIRMS THAT GOVERNOR PATRICK'S LIFE SCIENCES INITIATIVE IS CREATING JOBS AND ECONOMIC OPPORTUNITY

## Massachusetts leads the nation in creating jobs in the life sciences sectors

*Governor Patrick joins the Boston Foundation for an announcement relative to the Massachusetts Life Sciences sector. (Photo credit: Eric Haynes / Governor's Office)*
View more photos

BOSTON – Tuesday, March 26, 2013 – The Boston Foundation today released a report showing that the Patrick-Murray Administration's investments in the life sciences sector are making a measurable impact on job creation and spurring economic growth across the Commonwealth. The report also encourages continued funding of the Life Sciences Initiative, the Administration's 10-year $1 billion investment package in the Life Sciences industries that has helped make Massachusetts a national leader in this growing sector.

“The Life Sciences Initiative is meeting its growth objectives and then some,” said Governor Deval Patrick in an event announcing the report at the Boston Foundation earlier today. “Because we chose to shape the future we wanted, rather than just wait to see what happens, Massachusetts is now the world's leading life sciences supercluster, and we have the jobs and economic opportunity that come with that.”

In 2007, Governor Patrick proposed a 10-year, $1 billion Massachusetts Life Sciences Initiative. The initiative was passed by the Legislature in 2008, and the Massachusetts Life Sciences Center (MLSC) was charged with implementing it. The goal of this initiative has been to make the Commonwealth home to the most vibrant life sciences supercluster in the world, attracting investment dollars, creating well-paying jobs, expanding a technically skilled workforce and supporting an energetic landscape for innovation and entrepreneurship.

The report, Life Sciences Innovation as a Catalyst for Economic Development: The Role of the Massachusetts Life Sciences Center, was unveiled earlier today at an Understanding Boston forum at the Boston Foundation. The research found that the MLSC has had a measurable impact on job creation through its over $300 million in investments as of June, 2012. Over the last 10 years the state’s life sciences cluster has created jobs in Massachusetts at a faster pace than any other industry sector in the Commonwealth, and since 2008, Massachusetts has overtaken all competitor states in the rate of life sciences job creation. The report also commends the MLSC for its administrative efficiency and sound judgment in its investments and applauds the Governor and the Legislature for its foresight in creating the Center.

The MLSC is driving job creation in Massachusetts through several different programs, including loans to early-stage companies, grants to support industry-academic research collaborations, cutting edge infrastructure, growth incentives, workforce training and internships that help smaller companies access Massachusetts workers. The research found that the MLSC’s investments in start-up companies is an especially strong draw to Massachusetts for larger companies, which rely on smaller companies to help them access and develop new technologies at a faster rate. The MLSC’s role in helping these start-up firms gain traction in Massachusetts has been instrumental in encouraging the larger bioscience companies to locate and create jobs in the Commonwealth.

Building on these targeted investments, Governor Patrick unveiled a budget proposal in January that includes new investments in education and transportation, investments that have proven to create new jobs and economic opportunities. The Governor’s plan includes a $1 billion annual investment in the Commonwealth’s transportation system to maintain the transportation assets we have today and launch a number of high-impact transportation projects across Massachusetts that, if built, will create thousands of jobs and spur economic development across the Commonwealth. The plan also includes a $550 million investment in education, reaching $1 billion over four years, to expand access to high quality educational opportunities and make higher education more affordable for all students in Massachusetts.

The report was conducted through the Kitty and Michael Dukakis Center for Urban and Regional Policy at Northeastern University and authored by Barry Bluestone and Alan Clayton-Matthews. Click here to view the full report.

# Appendix B:
Legislation

Print

**Acts 2008**

**CHAPTER 130** AN ACT PROVIDING FOR THE INVESTMENT IN AND EXPANSION OF THE LIFE SCIENCES INDUSTRY IN THE COMMONWEALTH.

*Whereas,* The deferred operation of this act would tend to defeat its purpose, which is to provide forthwith for the immediate investment in and expansion of the life sciences in the commonwealth, therefore it is hereby declared to be an emergency law, necessary for the immediate preservation of the public convenience.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same as follows:*

**SECTION 1.** To provide for supplementing certain items in the general appropriation act and other appropriation acts for fiscal year 2008, the sums set forth in section 2 are hereby appropriated from the General Fund unless specifically designated otherwise in this act or in those appropriation acts, for the several purposes and subject to the conditions specified in this act or in those appropriation acts, and subject to the laws regulating the disbursement of public funds for the fiscal year ending June 30, 2008; provided, however that notwithstanding any general or special law to the contrary, appropriations made in this act shall not revert and shall be available for expenditure until June 30, 2009. These sums shall be in addition to any amounts previously appropriated and made available for the purposes of those items.

**NO SECTION 2.**

**SECTION 2A.**

**EXECUTIVE OFFICE OF ADMINISTRATION AND FINANCE.**

*Small Business Capital Access Program.*

1599-7107 For a capital access reserve to provide loan guarantees to small businesses pursuant to section 57 of chapter 23A of the General Laws ..... $5,000,000

**SECTION 2B.** To provide for a program of infrastructure development, improvements and various capital investments, the sums set forth in this section for the several purposes and subject to the conditions specified in this act, are hereby made available, subject to the laws regulating the disbursement of public funds and approval thereof.

**EXECUTIVE OFFICE OF HOUSING AND ECONOMIC DEVELOPMENT.**

*Massachusetts Life Sciences Center.*

7002-0015 For the Massachusetts Life Sciences Investment Fund established by section 6 of chapter 23I of the General Laws; provided, however, that not less than $12,900,000 shall be expended for and used to assist in water and waste water infrastructure improvements for the proposed cell culture manufacturing facility and purification plant containing office and lab facilities in the town of Framingham; provided, further, that not less than $12,600,000 shall be expended for the construction of supporting infrastructure, comprised of local arterial and connector roads for the I-93 interchange in the towns of Andover, Wilmington and Tewksbury; provided, further, that not less than $6,500,000 shall be expended for the design, construction and development for a life science incubator building at the William Stanley Business Park in the city of Pittsfield; provided, further, that not less than $10,000,000 shall be expended for a new nano and biomanufacturing facility at the University of Massachusetts at Lowell; provided, further, that $5,500,000 shall be appropriated to the Baystate Medical Center for the purpose of executing a lease agreement with the Pioneer Valley Life Sciences Institute in the city of Springfield for costs associated with the capital expansion of a life sciences incubator; provided, further, that not less than $1,100,000 shall be expended for the purchase and conversion of 3 vehicles into mobile science laboratories to support biotechnology education initiatives of the Massachusetts Academy for Life Sciences established by subsection (c) of section 2MMM of chapter 29 of the General Laws; provided, further, that said mobile science laboratories shall advance the goals of the Massachusetts Academy for Life Sciences; provided, further, that funds for those purposes shall be provided through a contract with the Massachusetts Biotechnology Education Foundation to provide grants, in consultation with the board of higher education, to public and private institutions of higher learning to purchase and convert vehicles into mobile science laboratories; provided, further, that each vehicle shall be fueled with an alternative fuel, as defined in 42 U.S.C. section 13211; provided, further, that amounts expended shall include the cost of vehicles, equipment, furniture and other costs associated with the conversion of the vehicles into mobile science laboratories; provided, further, that all 3 mobile science laboratories shall be owned and operated by each participating institution of higher learning and assigned to a specific region of the commonwealth, as designated by the Massachusetts Academy for Life Sciences, in consultation with each institution of higher learning; provided, further, that the designated regions shall not overlap; provided, further, that not less than $9,500,000 shall be expended for construction and capital improvements at the Tufts University Cummings School of Veterinary Medicine New England Regional Biosafety Laboratory to improve public health, protect public safety, improve science education and stimulate economic development by providing the opportunity to translate laboratory discoveries into viable vaccines, therapies and cures for emerging infectious diseases and bioterrorist threats; provided, further, that not less than $10,000,000 shall be expended for construction, renovations and infrastructure improvements for the Marine Biological Laboratory located in Woods Hole; provided, further, that said Marine Biological Laboratory shall collaborate with the Regional Technology Development Corporation of Cape Cod and the University of Massachusetts at Dartmouth to create and support a Center for Regenerative Biology and Medicine located at said Marine Biological Laboratory to develop commercial marine technology, provide research and development for life sciences including, but not limited to, marine-based stem cell research, and expand life science and marine technology education; provided, further, that not less than $5,000,000 shall be expended for

the design, construction, development and related infrastructure improvements for a regional incubation center for life science initiatives to be located in the city of New Bedford and operated in conjunction with the University of Massachusetts at Dartmouth and Bristol Community College; provided, further, that not less than $5,000,000 shall be expended for the design, construction, development and related infrastructure improvements for a life sciences center which shall be located at the former Paul A. Dever State School in the city of Taunton and managed by a board of directors consisting of 13 members: 1 of whom shall be the chancellor of the University of Massachusetts at Dartmouth or his designee, 1 of whom shall be the president of Bridgewater State College or his designee, 1 of whom shall be the president of the Massachusetts Maritime Academy or his designee, 1 of whom shall be the president of Massasoit Community College or his designee, 1 of whom shall be the president of Cape Cod Community College or his designee, 1 of whom shall be the president of Bristol Community College or his designee, 1 of whom shall be the president of Wheaton College or his designee, 1 of whom shall be the commissioner of mental retardation or his designee, 1 of whom shall be the president of the Massachusetts Federationof Teachers or his designee, 1 of whom shall be the president of the Massachusetts Teachers Association or his designee, 1 of whom shall be the president of the Massachusetts AFL-CIO or his designee, 1 of whom shall be the president of the Taunton Area Chamber of Commerce or his designee, and 1 of whom shall be the director of Southeastern Regional Planning and Economic District or his designee; provided, further, that the life sciences center shall include, but not be limited to, an education and training facility and a laboratory research facility with state-of-the-art equipment offering research and development facilities for collaboration with industry partners; provided, further, that not less than $10,000,000 shall be deposited in the Massachusetts Small Business Matching Grant Fund established in section 9 of said chapter 23I of the General Laws; provided, further, that not less than $5,000,000 shall be deposited in the Massachusetts Life Sciences Education Fund established in section 10 of said chapter 23I of the General Laws; provided, further, that not less than $90,000,000 shall be expended for the design, construction, development and related infrastructure improvements for an advanced therapeutics cluster to be constructed at the University of Massachusetts Medical School in Worcester, which shall be named the Albert “Albie” Sherman Center, and shall include a RNAi institute, a stem cell biology cluster, cord blood bank and a gene therapy cluster; provided, however, that said funds shall not be used for faculty salaries; provided, further, that not less than $95,000,000 shall be expended for the design, construction, development and related infrastructure improvements of a life science laboratory research center complex including a laboratory research facility with state-of-the-art equipment offering research and development facilities for collaboration with industry partners to develop methods and technologies that may be translated into new commercial services and products at the University of Massachusetts at Amherst; provided, however, that said funds shall not be used for faculty salaries; provided, further, that not less than $10,000,000 shall be expended for the purchase of state-of-the-art equipment, renovations and related expenses to support the Center for Personalized Cancer Therapy at the University of Massachusetts at Boston, a collaboration of the University of Massachusetts at Boston and the Dana-Farber Harvard Cancer Center; provided, however, that said funds shall not be used for faculty salaries; provided, further, that funds

appropriated for the design, construction, development and related infrastructure improvements for an advanced therapeutics cluster to be constructed at the University of Massachusetts Medical School in Worcester, for the design, construction, development and related infrastructure improvements of a life science laboratory research center complex at the University of Massachusetts at Amherst, for the design, construction, development and related infrastructure improvements for a nano and biomanufacturing facility at the University of Massachusetts at Lowell and for the renovations and related expenses for the Center for Personalized Cancer Therapy at University of Massachusetts at Boston shall be transferred to the University of Massachusetts Building Authority for these infrastructure improvements and design and construction; provided, further, that no funds shall be transferred from this item for a phase of construction until the secretary of administration and finance certifies in writing to the board of the Massachusetts Life Sciences Center established by section 3 of said chapter 23I of the General Laws and to the house and senate committees on ways and means that all sources of funding for that phase of the facility have been committed and are available as necessary for commencement of design and construction; provided, further, that said written certification shall include copies of all business plans, letters of financial commitment and other documentation as said secretary and said board deem necessary to certify that all other sources of funding have been secured; provided, further, that the University of Massachusetts Building Authority shall submit to the clerks of the house of representatives and the senate a report which shall include the following: (1) a detailed list of all private donors and amounts donated for each facility, (2) a plan for design, construction, operation and maintenance and all associated costs and revenues of the facility, including the projected timeline for the completion of all phases of said projects, and (3) a description of proposed title to any and all assets associated with each facility; provided, further, that said secretary and said board shall not expend any funds until such report is filed with the clerks of the house and senate who shall forward the same to the house and senate committees on ways and means; provided, further, that notwithstanding any general or special law to the contrary, in the construction and financing of said nano and biomanufacturing facility, said advanced therapeutics cluster, said life science laboratory research center complex and said Center for Personalized Cancer Therapy, said authority may use an alternative method for procurement of design and construction including, but not limited to, sequential construction management, turnkey, design and build procurement and the phasing of such procurement including, but not limited to, approval of design and construction stages separate from combined phases; provided, further, that said building authority shall require the assurance of labor harmony during all phases of development, including construction, reconstruction and capital and routine maintenance and shall provide adequate remedies to address the failure to maintain labor harmony which shall include, but not be limited to, assessment of liquidated damages and contract termination; provided, further, that the payment of prevailing wages, pursuant to sections 26 to 27F, inclusive, of chapter 149 of the General Laws, shall be required for all phases of said projects; and provided further, that not less than $11,400,000 shall be expended as a grant for the acquisition of land pursuant to section 37 of this act to the University of Massachusetts at Dartmouth..... $500,000,000

**SECTION 3.** Chapter 23I of the General Laws is hereby amended by striking out section 2, as

appearing in section 24 of chapter 123 of the acts of 2006, and inserting in place thereof the following section:-

Section 2. As used in this chapter, the following words shall, unless the context clearly requires otherwise, have the following meanings:-

“Affiliate”, any business which directly or indirectly controls or is controlled by or is under direct or indirect common control of another business including, but not limited to, any business with which a business is merged or consolidated, or which purchases all or substantially all of the assets of a business.
“Board”, the board of directors of the Massachusetts Life Sciences Center.
“Center”, the Massachusetts Life Sciences Center established by section 3.
“Certification proposal”, a written proposal submitted by a life sciences company for approval as a certified life sciences company pursuant to section 5.
“Certified life sciences company”, a company that has been certified by the center for participation in the commonwealth life sciences investment program and the life sciences tax incentive program, established by section 5.
“Company”, a business corporation, partnership, firm, unincorporated association or other entity engaged or proposing to engage in economic activity within the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under chapter 62, 63, 64H or 64I.
“Department”, the department of revenue established pursuant to section 1 of chapter 14.
“Eligible new job”, a new job that shall not replace an existing job in the commonwealth and which may be a retained job; provided, however, that “eligible new job” may be further defined by rules, regulations or guidelines promulgated by the center pursuant to section 5; provided further, that an “eligible new job” shall be deemed to have been created in the commonwealth on the first day for which Massachusetts personal income tax withholding is required in connection with the compensation paid to an employee of a life sciences company or the first day for which Massachusetts estimated tax payments are payable by a partner of a partnership constituting a life sciences company.
“Enterprise”, a small business, as defined in chapters 23A or 40F, which has its principal place of business in the commonwealth and is, or proposes to be, engaged in research and development or manufacturing in the life sciences industry.
“Equity investment”, (a) a share in a life sciences company certified pursuant to section 5, whether or not transferable or denominated stock, or similar security; (b) interest of a limited partner in a limited partnership; or (c) warrant or right, other than a right to convert, to purchase, sell or subscribe to a share, security or interest of a kind specified in clauses (a) or (b); provided, however, that when making an equity investment in an enterprise pursuant to section 7, the center shall receive not less than 3 per cent of the equity in said enterprise.
“Independent research institution”, a nonprofit research organization that holds tax-exempt status granted under section 501(c)(3) of the Internal Revenue Code and shall be organized and operated exclusively for scientific or educational purposes; provided, however, that “independent research

institution" shall not mean a hospital, college, university or private foundation.
"Life sciences", advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
"Life sciences company", a business corporation, partnership, firm, unincorporated association or other entity engaged in life sciences research, development, manufacturing or commercialization in the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under chapter 62, 63, 64H or 64I.
"New state revenue", revenue derived from a life sciences company by the creation of any eligible new jobs or by new commercial activity that would otherwise not have taken place in the commonwealth or as may be defined by any rules or regulations promulgated by the center pursuant to section 5.
"Permanent full-time employee", an individual who: (i) is in an employment relationship which, at its inception, does not have a termination date which is a date certain or which is determined with reference to the completion of some specified scope of work; (ii) works a minimum number of weekly hours as the center may specify by rule, regulation or guideline; and (iii) receives employee benefits at least equal to those provided to other full-time employees of the employer, which shall be a life sciences company.
"Person", a natural person, corporation, association, partnership or other legal entity.
"Program", the commonwealth life sciences investment program established by section 5.
"Professional investor", a bank, bank holding company, savings institution, trust company, insurance company, investment company registered under the federal Investment Company Act of 1940, pension or profit-sharing trust or other financial institution or institutional buyer, licensee under the federal Small Business Investment Act of 1958 or any person, partnership or other entity of whose resources a substantial amount shall be dedicated to investing in securities or debt instruments and whose net worth exceeds $250,000.
"Qualified security", a note, stock, treasury stock bond, debenture, evidence of indebtedness, certificate of interest or participation in a profit-sharing agreement, preorganization certificate or subscription, transferable share, investment contract, certificate of deposit for a security, certificate of interest or participation in a patent or application therefor, or in royalty or other payments under such a patent or application; in general, any interest or instrument security, so-called, or any certificate for, receipt for, guarantee of, or option, warrant or right to subscribe to or purchase any of the foregoing; and debt of and partnership interest in, as a general or limited partner, any general or limited liability partnership organized under the laws of the commonwealth, and debt of and membership interest in any limited liability company organized under the laws of the commonwealth.
"Real estate project", real property where, after a life sciences company is certified, construction or renovation shall be initiated which, when completed, shall result in an increase in the assessed value

of the real property of at least 100 per cent over its assessed value as of the date of certification; provided, however, that if a real estate facility is a business incubator facility and is designated as a certified life sciences company pursuant to section 5, each business which executes a binding lease for space in that facility after the date on which the construction or renovation activity begins shall be eligible for separate designation as a certified life sciences company.

“Revenue”, receipts, fees, rentals or other payments or income received or to be received on account of obligations to the center including, but not limited to, income on account of the leasing, mortgaging, sale or other disposition of a project or proceeds of a loan made by the center in connection with any project, and amounts in reserves or held in other funds or accounts established in connection with the issuance of bonds and the proceeds of any investments thereof, proceeds of foreclosure and any other fees, charges or other income received or receivable by the center.

“Seed capital”, financing that is provided for the development, refinement and commercialization of a product or process and other working capital needs.

“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapter 62, 63, 64H or 64I.

“Vocational technical school”, education institutions established pursuant to sections 14 and 15 of chapter 71, providing vocational-technical education as defined in section 1 of chapter 74.

**SECTION 4.** Section 3 of said chapter 23I, as so appearing, is hereby amended by striking out subsection (b) and inserting in place thereof the following subsection:—

(b) The center shall be governed and its corporate powers exercised by a board of directors consisting of 7 directors: 1 of whom shall be the secretary of administration and finance or his designee; 1 of whom shall be the secretary of housing and economic development or his designee; 1 of whom shall be the president of the University of Massachusetts or his designee; and 4 of whom shall be appointed by the governor, 1 of whom shall be a physician licensed to practice medicine in the commonwealth and affiliated with an academic medical center, 1 of whom shall be a chief executive officer of a Massachusetts-based life sciences corporation which is a member of the board of directors of the Massachusetts Biotechnology Council, 1 of whom shall be a researcher involved in the commercialization of biotechnology, pharmaceuticals or medical diagnostic products and 1 of whom shall have significant financial experience in the life sciences sector. Each appointed member shall serve a term of 5 years, except that in making his initial appointments, the governor shall appoint 1 director to serve for a term of 1 year, 1 director to serve for a term of 2 years, 1 director to serve for a term of 3 years, 1 director to serve for a term of 4 years. The secretary of the executive office of administration and finance and the secretary of the executive office of housing and economic development, or their designees, shall serve as co-chairs of the board. Any person appointed to fill a vacancy in the office of an appointed director of the board shall be appointed in a like manner and shall serve for only the unexpired term of such director. Any director shall be eligible for reappointment. Any director may be removed from his appointment by the governor for cause.

**SECTION 5.** Subsection (c) of said section 3 of said chapter 23I, as so appearing, is hereby amended

by striking out the first paragraph and inserting in place thereof the following paragraph:-
Four directors shall constitute a quorum and the affirmative vote of a majority of directors present at a duly called meeting if a quorum is present shall be necessary for any action to be taken by the board. Any action required or permitted to be taken at a meeting of the directors may be taken without a meeting if all of the directors' consent in writing to such action and such written consent is filed with the records of the minutes of the meetings of the board. Such consent shall be treated for all purposes as a vote at a meeting. Each director shall make full disclosure, under subsection (d), of his financial interest, if any, in matters before the board by notifying the state ethics commission, in writing, and shall abstain from voting on any matter before the board in which he has a financial interest, unless otherwise permissible under chapter 268A.

**SECTION 6.** Said section 3 of said chapter 23I, as so appearing, is hereby further amended by striking out subsection (e) and inserting in place thereof the following:-

(e) The Board shall have the power to appoint and employ a president, and to fix his compensation and conditions of employment. The president shall be the chief executive, administrative and operational officer of the center and shall direct and supervise administrative affairs and the general management of the center. The president shall appoint and employ a chief financial and accounting officer and may, subject to the general supervision of the board, employ other employees, consultants, agents, including legal counsel, and advisors, and shall attend meetings of the board. The chief financial and accounting officer of the center shall be in charge of its funds, books of account and accounting records. No funds shall be transferred by the center without the approval of the board and the signatures of the chief financial and accounting officer and the treasurer, as appointed by the board pursuant to subsection (g).

**SECTION 7.** The first sentence of subsection (g) of said section 3 of said chapter 23I of the General Laws, as so appearing, is hereby amended by striking out the word "chairperson," and inserting in place thereof the following words:— treasurer and.

**SECTION 8.** Said subsection (g) of said section 3 of said chapter 23I, as so appearing, is hereby further amended by striking out the last sentence.

**SECTION 9.** Clause (14) of subsection (a) of section 4 of said chapter 23I of the General Laws, as so appearing, is hereby amended by striking out the words ", issue bonds and apply the proceeds thereof as provided in section 8,".

**SECTION 10.** Clause (15) of said subsection (a) of said section 4 of said chapter 23I, as so appearing, is hereby amended by striking out the words ", all as provided in section 8".

**SECTION 11.** Said section 4 of said chapter 23I, as so appearing, is hereby further amended by striking out clauses (16) and (17) and inserting in place thereof the following 2 clauses:-

(16) to act as the central entity and coordinating organization of life sciences initiatives on behalf of the commonwealth and to work in collaboration with governmental entities, bodies, centers, institutes and facilities and promote all areas of life sciences to advance the commonwealth's interests and investments in the life sciences;
(17) to promulgate a code of ethics to address collaborative state and business research activities; provided, further, that said code of ethics shall include recommendations, and proposed legislation if necessary, addressing the issue of exclusive licensing agreements for intellectual property developed using state funds between state-funded colleges and universities and private companies and institutions. Said code shall be forwarded to the clerks of the house and senate who shall forward the same to the joint committee on economic development and emerging technologies.

**SECTION 12.** Said section 4 of said chapter 23I, as so appearing, is hereby further amended by adding the following 3 clauses:-

(30) to operate as a licensed small business investment corporation pursuant to the provisions of the Small Business Investment Act of 1958, 15 U.S.C. section 661 et seq., as amended; provided, however, that as an alternative, the board may establish a subsidiary corporation to operate as a licensed small business investment corporation pursuant to said Small Business Investment Act of 1958, 15 U.S.C. section 661 et seq., and to make investments in qualified securities of enterprises through such subsidiary;
(31) to track and report to the general court on federal initiatives that have an impact on life sciences companies doing business in the commonwealth; and
(32) to create award programs to acknowledge successful companies, public and private institutions and programs in industry-specific areas, as determined by the center.

**SECTION 13.** Said chapter 23I is hereby further amended by striking out sections 5 to 8, inclusive, as so appearing, and inserting in place thereof the following 13 sections:-

Section 5. (a) There shall be established a commonwealth life sciences investment program which shall be administered by the center. The purpose of the program shall be to expand life sciences-related employment opportunities in the commonwealth and to promote health-related innovations by supporting and stimulating research and development, manufacturing and commercialization in the life sciences. Life sciences companies certified pursuant to subsection (b) shall be eligible for participation in the program.
(b) The center may, upon a majority vote of the board, certify a life sciences company as a certified life sciences company upon: (i) the timely receipt, as determined by the center, of a certification proposal supported by independently verifiable information, signed under the pains and penalties of perjury by a person expressly authorized to contract on behalf of the life sciences company and which shall include, but not be limited to: (A) an estimate of the projected new state revenue the life sciences

company expects to generate during the period for which the company seeks certification, together with a plan, including precise goals and objectives, by which the life sciences company proposes to achieve the projected new state revenue, including for each tax year, an estimate of new commercial revenue that the commonwealth would not otherwise have received, an estimate of the number of permanent full-time employees to be hired or retained, an estimate of the year in which the company expects to hire or retain the employees, an estimate of the projected average salaries of said employees, an estimate of the projected taxable income pursuant to chapter 62 or 63 generated by said employees and an estimate of the methods by which the company shall obtain new employees and pursue a diverse workforce; (B) documentation of an agreement, if any, between the life sciences company and banking institutions with which the life science company shall have agreed to establish accounts and by which the banking institutions shall have agreed to commit a specified percentage of the funds deposited in the accounts for loans made thereby to companies under the small business capital access program established pursuant to section 57 of chapter 23A; and (C) if appropriate, documentation that the life sciences company has received approval for a certified project, pursuant to section 3F of chapter 23A; and (ii) findings made by the center, based on the certification proposal, documents submitted therewith and any additional investigation by the center, and incorporated in its approval, that: (A) the life sciences company shall meet all statutory requirements and any other criteria that the center may prescribe including, but not limited to criteria in the following areas: whether the life sciences company has sufficient business contacts with the commonwealth as evidenced by its business activity within the commonwealth including, but not limited to, the number of full-time employees employed in the commonwealth; the life sciences company's potential to further technological advancements in the life sciences; the life sciences company's potential to offer a breakthrough medical treatment for a particular disease, or medical condition; the life sciences company's potential for leveraging additional funding or attracting additional resources to the commonwealth; the life sciences company's potential to promote life sciences manufacturing in the commonwealth; and evidence of potential royalty income and contractual means to recapture such income for the purposes of this chapter, as the center considers appropriate; and (B) a certified life sciences company shall meet the new state revenue and employment growth projections, as specified in the certification proposal, over the period for which it receives benefits.

(c) A certified life sciences company may, upon a majority vote of the board, be eligible for the following benefits which shall be awarded by the board on a competitive basis: (1) benefits from the life sciences tax incentive program established by subsection (d); (2) grants, loans or other investments from the Massachusetts Life Sciences Investment Fund established by section 6; (3) equity investments from the Dr. Craig C. Mello Small Business Equity Investment Fund established by section 7; (4) assistance from the regional technology and innovation centers established by section 11; (5) assistance from the center to obtain designation as a certified project in an economic opportunity area pursuant to section 3F of chapter 23A; (6) assistance from the center in accessing economic incentive programs within the Massachusetts office of business development, including access to the technical, human, financial, training, educational and site-finding resources necessary to expand or locate in the commonwealth; (7) assistance from the center in obtaining federal grants; (8) assistance from the center in facilitating clinical trials; (9) preference for funding for life science job

training programs; or (10) preference for pre-permitted industrial land as identified by the Massachusetts Development Finance Agency.

(d) There shall be established a life sciences tax incentive program. The center, in consultation with the department, may annually authorize incentives, including incentives carried forward, refunded or transferred, pursuant to the following: subsection (m) of section 6 of chapter 62, subsection (n) of said section 6 of said chapter 62, paragraph 17 of section 30 of chapter 63, section 31M of said chapter 63, paragraph 6 of subsection (f) of section 38 of said chapter 63, the fourth paragraph of section 38C of said chapter 63, subsection (j) of section 38M of said chapter 63, section 38U of said chapter 63, section 38V of said chapter 63, section 38W of said chapter 63, the third paragraph of section 42B of said chapter 63, and subsection (xx) of section 6 of chapter 64H, in a cumulative amount, including the current year cost of incentives allowed in previous years, that shall not exceed $25,000,000 annually. The center may, in consultation with the department, limit any incentive or incentives to a specific dollar amount or time duration, or in any other manner deemed appropriate by the department; provided, however, that the department shall only allocate said incentives among commonwealth certified life sciences companies pursuant to subsection (b) and shall award said tax incentives pursuant to subsection (c).

The center shall provide an estimate to the secretary of administration and finance of the tax cost of extending benefits to a proposed project before certification, as approved by the commissioner of revenue, based on reasonable projections of project activities and costs. Tax incentives shall not be available to any certified life sciences company unless expressly granted by the secretary of administration and finance in writing.

(e) (1) Certification granted pursuant to subsection (b) shall be valid for 5 years starting with the tax year in which certification is granted. Each certified life sciences company shall file an annual report with the center detailing whether it has met the specific targets established in the proposal pursuant to subclause (A) of clause (i) of subsection (b).

(2) The certification of a life sciences company may be revoked by the center after an independent investigation and determination that representations made by the certified life sciences company in its certification proposal are materially at variance with the conduct of the life sciences company after receiving certification; provided, however, that the center shall review the certified life sciences company at least annually; provided, further, that a project with an actual return on investment that is less than 70 per cent of the return on investment projected in the certification proposal shall be deemed to contain a material variance for a revocation determination. If the center determines not to revoke certification upon a finding that the actual return on investment for the project is less than 70 per cent, the center shall provide its reasons for the decision in writing to the secretary of administration and finance, the commissioner of revenue and the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on revenue and the joint committee on economic development and emerging technologies. The center shall post these reasons on the internet for public access.

(3) Under this subsection, revocation shall take effect on the first day of the tax year in which the center determines that a material variance commenced. The commissioner of revenue shall, as of the effective date of the revocation, disallow any credits, exemptions or other tax benefits allowed by the

original certification of tax benefits under this section. The department shall issue regulations to recapture the value of any credits, exemptions or other tax benefits allowed by the certification under this section; provided, however, that the recapture provisions in subsection (m) of section 6 of chapter 62 and section 38U of chapter 63 shall apply. If the original certification allowed sales and use tax exemptions pursuant to subsection (xx) of section 6 of chapter 64H, the purchaser shall accrue use tax as of the date of revocation on a portion of the sales price on which exemption was claimed that is proportionate to the remaining useful life of the property.

(4) Nothing in this subsection shall limit any legal remedies available to the commonwealth against any certified life sciences company.

(f) Capital funding may be revoked only by the center after an independent investigation and determination that representations made by the life sciences company in its certification proposal are materially at variance with the conduct of the life sciences company after certification; provided, further, that a life sciences company generating less than 70 per cent of the projected new state revenue in the certification proposal shall be deemed to contain a material variance for the purposes of a revocation determination. If the center does not revoke certification despite said material variance, the center shall provide its reasons for the decision in writing to the secretary of administration and finance, the commissioner of revenue and the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on bonding, capital expenditures and state assets and the joint committee on economic development and emerging technologies. A notice of revocation under this subsection shall specify the date on which the revocation is effective, which shall be the date of the notice or the date on which the center determined that the material variance commenced. The secretary of administration and finance shall, as of the effective date of the revocation, disallow any loans, grants or other benefits allowed by the original certification under this section. The department may issue regulations to recapture any grants or loans allowed by the certification under this section.

(g) The center shall revoke the certification of a life sciences company when independent investigations conducted in 2 consecutive years determine that representations made by the life sciences company in its project proposal are deemed materially at variance, pursuant to paragraph (2) of subsection (e) or subsection (f).

(h) The board, in consultation with the executive office of administration and finance and the executive office of housing and economic development, shall promulgate rules, regulations or guidelines necessary to carry out the provisions of this section.

Section 6. (a) There shall be established and placed within the center a fund to be known as the Massachusetts Life Sciences Investment Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds, to finance the activities of the center. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges

imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified investments pursuant to subsection (c); (2) defraying the ordinary and necessary expenses of administration and operation associated with the center; provided, however, that said administrative and operational expenses shall not exceed 15 per cent of the maximum amount authorized to be expended from the fund in a fiscal year; (3) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (4) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (5) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the board, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center, subject to the approval of the board, to make qualified investments, grants, research and other funding and loans designed to advance the following public purposes for the life sciences in the commonwealth: (1) to stimulate increased financing for the expansion of research and development by leveraging private financing for highly productive state-of-the-art research and development facilities, equipment and instrumentation and by providing financing related thereto including, but not limited to, financing for the construction or expansion of such new facilities; (2) to make targeted investments, including research funding, proof of concept funding and funding for the development of devices, drugs or therapeutics and to promote manufacturing activities for new or existing advanced technologies and life sciences research; (3) to make matching grants to colleges, universities, independent research institutions, nonprofit entities, public instrumentalities, companies and other entities in connection with support from the federal government, industry and other grant-funding sources related to the expansion of research and development and to increase and strengthen economic development, employment opportunities and commercial and industrial sectors in the field of life sciences; (4) to provide bridge financing to colleges, universities, independent research institutions, nonprofit entities, public instrumentalities, companies and other entities for the receipt of grants as described in clause (3) awarded or to be awarded by the federal government, industry or other sources; (5) to provide fellowships, co-ops, internships, loans and grants; (6) to provide workforce training grants to prepare individuals for life sciences careers; (7) to provide funding for development, coordination and marketing of higher education programs; (8) to make qualified grants to certified life sciences companies for site remediation, preparation and

ancillary infrastructure improvement projects; and (9) to otherwise further the public purposes set forth herein.

(d) Proceeds of the fund may be used by the center to fund life sciences initiatives including: (1) international trade initiatives; (2) qualified grants to graduate level and doctoral students and post-doctoral fellows for living expenses from the Dr. Judah Folkman Higher Education Grant Fund established by section 8; (3) equity investments from the Dr. Craig C. Mello Small Business Equity Investment Fund established by section 7; (4) joint academic and industrial research and development and commercial business exchanges between the commonwealth and Israel, in collaboration with the Massachusetts international trade council; (5) the Massachusetts Technology Transfer Center, established by section 45 of chapter 75; (6) the Massachusetts Science, Technology Engineering, and Mathematics Grant Fund, established by section 2MMM of chapter 29; or (7) a program to promote the research and development of plant-made pharmaceuticals and industrial products through field trials, in collaboration with the department of agricultural resources.

(e) The center shall make no such qualified investment pursuant to clause (1) of subsection (b) unless: (1) said investment has been approved by a majority vote of the board; (2) the recipient is a certified life sciences company pursuant to section 5 or a project or initiative listed in subsection (d); (3) the center finds, to the extent possible, that a definite benefit to the commonwealth's economy may reasonably be expected from said qualified investment; provided, further, that in evaluating a request or application for funding, the center shall consider the following: (i) the appropriateness of the project; (ii) whether the project has significant potential to expand employment; (iii) the project's potential to enhance technological advancements; (iv) the project's potential to lead to a breakthrough medical treatment for a particular disease or medical condition; (v) the project's potential for leveraging additional funding or attracting resources to the commonwealth; (vi) the project's potential to promote manufacturing in the commonwealth; and (vii) evidence of potential royalty income and contractual means to recapture such income for the purposes of this chapter, as the center considers appropriate; (4) to the extent said investment is a capital investment made pursuant to clause (8) of subsection (c), the investment has been approved by the secretary of the executive office of administration and finance upon request of the center; provided, however, that said request shall be submitted to the secretary in writing and shall, include but not be limited to: (i) a description of the project or program to be funded; (ii) the economic benefits to the commonwealth which can reasonably be expected from said project or program; (iii) a copy of the proposed contract or other document executing the transaction between the center and the recipient of the funds; (iv) a description of the contractual or other legal remedies available to the center upon non-performance of the contract or other document executing the transaction by the recipient including, but not limited to, any provisions for restitution or reimbursement of the funds granted, loaned or otherwise invested in or with the recipient; and (v) any other information as the secretary may determine; and (5) said qualified investment conforms with the rules approved by the board.

Said rules shall set the terms and conditions for investments which shall constitute qualified investments including, but not limited to, loans, guarantees, loan insurance or reinsurance, equity investments, grants awarded pursuant to clause (3) of subsection (c), other financing or credit enhancing devices, as established by the center directly or on its own behalf or in conjunction with

other public instrumentalities, or private institutions or the federal government. Said rules shall provide that qualified investments made pursuant to clauses (1) and (2) of said subsection (c) shall involve a transaction with the participation of at least 1 at-risk private party.

Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities, oversee the progress of qualified investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified investments. Said rules shall provide for negotiated intellectual property agreements between the center and a qualified investment recipient which shall include the terms and conditions by which the fund's support may be reduced or withdrawn.

(f) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal creating a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.

(g) Copies of the approved rules, and any modifications, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(h) Qualified investment transactions made by the center pursuant to this section shall not, except as specified in this chapter, be subject to chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Life Sciences Investment Fund established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.

(i) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.

Section 7. (a) There shall be established and placed within the center a fund to be known as the Dr. Craig C. Mello Small Business Equity Investment Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the

making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified equity investments pursuant to subsection (c); (2) investing funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the board, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center to make qualified equity investments in enterprises seeking to raise seed capital; provided, however, that said qualified equity investments shall not exceed $250,000 in any 1 enterprise. The center shall not make such qualified equity investments unless: (1) said investment has been approved by a majority vote of the board; (2) the recipient is a life sciences company certified pursuant to section 5; and (3) the center finds, to the extent possible, that a definite benefit to the commonwealth's economy may reasonably be expected from said qualified investment. In evaluating a request or application for funding, the center shall consider whether: (i) the proceeds of the equity investment shall only be used to cover the seed capital needs of the enterprise except as hereinafter authorized; (ii) the enterprise has a reasonable chance of success; (iii) the center's participation is necessary to the success of the enterprise because funding for the enterprise is unavailable in the traditional capital markets or contingent upon matching funds, or because funding has been offered on terms that would substantially hinder the success of the enterprise; (iv) the enterprise has reasonable potential to create a substantial amount of primary employment in the commonwealth; (v) the enterprise's principals have made or are prepared to make a substantial financial and time commitment to the enterprise; (vi) the securities to be purchased shall be qualified securities; (vii) there shall be a reasonable possibility that the center shall, at a minimum, recoup its initial investment; (viii) binding commitments have been made to the center by the enterprise for adequate reporting of financial data to the center, which shall include a requirement for an annual or other periodic audit of the books of the enterprise, and for such control on the part of the center as the board shall consider prudent over the management of the enterprise, to protect the investment of the center including the board's right to access, without limitation, financial and other records of the enterprise; and (ix) a reasonable effort has been made to find a professional investor to invest in the enterprise and such effort was unsuccessful; and (4) said qualified equity investment

conforms with the rules approved by the board.
Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities, oversee the progress of qualified equity investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified equity investments. Said rules shall provide that each recipient of a qualified investment shall be required to pay a fee as a condition of such receipt, and said fee may take the form of points, an interest rate premium or a contribution of warrants or other forms of equity or consideration to the fund. Said rules shall provide for negotiated agreements between the center and each recipient of a qualified investment regarding the terms and conditions by which the fund's support thereof could be reduced or withdrawn.
(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.
(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.
(f) Qualified equity investment transactions made by the center pursuant to this section shall not, except as specified in this chapter, be subject to chapter 175, or any successor thereto, and shall be payable solely from the Dr. Craig C. Mello Small Business Equity Investment Fund established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.
(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
Section 8. (a) There shall be established and placed within the center a fund to be known as the Dr. Judah Folkman Higher Education Grant Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the

making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center to make qualified grants to graduate level and doctoral students and post-doctoral fellows studying or employed in the life sciences for living expenses; provided, however, that the center shall make no such qualified grants unless said grant has been approved by a majority vote of the board. Grants awarded from the fund shall, in addition to any restrictions adopted by the center, shall be awarded in $5,000 increments not to exceed $15,000 annually per recipient and further restrictions include: (1) recipients shall be enrolled in a graduate or doctorate level program or shall be working as postdoctoral fellows at a college, university, independent research institution or an academic medical center in the commonwealth; (2) recipients shall be commonwealth residents; and (3) the annual total household income of a recipient shall not exceed 300 per cent of the federal poverty level. The center shall make no such qualified grants pursuant to said clause (1) of said subsection (b) unless such qualified grant conforms with rules approved by the board.

Said rules shall establish the terms and conditions for grants which constitute qualified grants and shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make grant determinations, safeguard the fund, oversee the progress of qualified grants and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified grants.

(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a

proposal creating a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.

(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(f) Qualified grants and investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Dr. Judah Folkman Higher Education Grant Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.

(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.

Section 9. (a) There shall be established and placed within the center the Massachusetts Small Business Matching Grant Fund, hereinafter referred to in this section as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying

binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) Notwithstanding any provision of this chapter to the contrary, a company need not be a certified life sciences company, as established in section 5, to be eligible for matching grants pursuant to this section. The fund shall be held and applied by the center to make qualified loans, grants or other investments to stimulate increased financing for life sciences and high technology research and development, manufacturing and commercialization in the commonwealth by matching grants to public agencies, independent research institutions, nonprofits or to life sciences or high technology companies to increase and strengthen the commonwealth's economic development, employment opportunities and commercial and industrial sectors. The fund shall provide matching grants to commonwealth-based life sciences or high technology companies that receive small business innovation research or small business technology transfer grants from the Small Business Administration, pursuant to 15 U.S.C. section 638, to assist companies that have developed new commercialization-ready technologies to reach production and create manufacturing jobs in the commonwealth. Said matching grants shall be used to create manufacturing jobs and may be used for, without limitation, the creation of, and capital improvements for, production facilities, workforce training, product marketing and purchasing infrastructure for product manufacturing. Said matching grants shall be distributed to eligible companies that have commercialization-ready technologies developed with assistance from the Small Business Administration in the form of $1 in matching funds for every $1 granted from the small business innovation research phase IIB grants, phase III grants and the commercialization pilot project established by 15 U.S.C. section 638. Said matching grants shall be awarded in consultation with the Small Business Association of New England. No such grant to any company shall exceed $500,000 annually and the center shall make no such qualified loan, grant or other investment unless: (1) said loan, grant or investment has been approved by a majority vote of the board; (2) the center finds that, to the extent possible, a definite benefit to the commonwealth's economy may reasonably be expected from said qualified loan, grant or investment; provided, however, that in evaluating a request or application for funding, the center shall consider whether: (i) the loan, grant or investment shall stimulate increased financing for life sciences and high technology research and development, manufacturing and commercialization; (ii) the enterprise has a reasonable chance of success; (iii) center participation is necessary; (iv) the enterprise has the reasonable potential to create a substantial amount of new employment in the commonwealth; (v) the principals of the enterprise have made or are prepared to make a substantial financial and time commitment to the enterprise; (vi) binding commitments have been made to the center by the enterprise for adequate reporting of financial data to the center, which shall include a requirement for an annual or other periodic audit of the books of the enterprise, and for such control on the part of the center as the board shall consider prudent over the management of the company to protect the investment of the center including the board's right to access, without limitation, financial and other records of the enterprise; and (vii) a reasonable effort has been made to find a professional investor to invest in the enterprise and whether such effort was unsuccessful; and (3) said loan, grant or other investment conforms with rules approved by the board.

Said rules shall define life sciences technology and high technology for purposes hereof; provided,

however, that such definition shall include companies engaging in research and development, commercialization or manufacturing in the commonwealth. Said rules shall establish the terms and conditions for investments which constitute qualified investments, and may include, but not be limited to, loans, guarantees, loan insurance or reinsurance, equity investments or other financing or credit enhancing devices, as made by the center directly or on its own behalf or in conjunction with other public instrumentalities, private institutions or the federal government. Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities for the citizens of the commonwealth, oversee the progress of qualified investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified investments. Said rules shall provide that each recipient of a qualified investment shall be required to pay a fee as a condition of such receipt, and said fee may take the form of points, an interest rate premium or a contribution of warrants or other forms of equity or consideration to the fund. Said rules shall provide for negotiated agreements between the center and each recipient of a qualified investment regarding the terms and conditions by which the fund's support thereof could be reduced or withdrawn.

(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund; provided, however, that if the creation or operation of such a separate entity would require additional or clarifying amendments to the enabling act of the center, said proposal shall include proposed statutory language with regard thereto. Any additional clarifying amendments to the enabling act shall be submitted by the center to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(f) Qualified investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Small Business Matching Grant Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.

(g) The center shall not make expenditure from or commitment of the assets of the fund including, but

not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.

(h) The center shall develop a plan ensuring that fund disbursements made pursuant to this section shall be distributed throughout all regions of the commonwealth.

Section 10. (a) There shall be established and placed within the center a fund to be known as the Massachusetts Life Sciences Education Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying binding obligations associated with qualified investments which are secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center to make qualified grants to vocational and technical schools for purchasing or leasing necessary equipment to train students in life sciences technology and research; provided, however, that the center shall make no such qualified grants unless: (1) said grant has been approved by a majority vote of the board; (2) the grant recipient shall be a vocational technical school; provided, however, that if funds remain after consideration of grant applications submitted by vocational technical schools, the center may make qualified grants to community colleges established by chapter 15A or any other general or special law; (3) the grant recipient has identified and properly trained instructors to use the equipment to be purchased or leased; and (4) said qualified grants conform with the rules approved by the board.

Said rules shall set the terms and conditions for grants which constitute qualified grants and shall set

forth the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities for the citizens of the commonwealth, oversee the progress of qualified grants, and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified grants.

(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund as established in the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under terms and conditions established to protect and preserve the assets of the fund.

(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate and shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(f) Qualified grants and investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Life Sciences Education Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.

(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.

Section 11. (a) The center, in consultation with the advisory board established by section 12, shall identify 1 existing life sciences entity with experience facilitating local or regional life science industry sectors to serve as a regional technology and innovation center in each of the following 5 regions: western Massachusetts, central Massachusetts, northeastern Massachusetts, southeastern Massachusetts and metropolitan Boston.

(b) The purpose of each regional technology and innovation center shall include, but shall not be limited to: (i) encouraging and facilitating collaboration between existing organizations dedicated to promoting the regional life science industry; (ii) inputting regional life science industry and educational data, including the documentation of regional lab space, into the life sciences industry database as designed and maintained by the center; (iii) organizing, facilitating and implementing regional workforce development initiatives; (iv) providing business management and resource training, including the dissemination of best business practices; (v) facilitating public and private investment; (vi) reviewing and providing recommendations to the center proposals; (vii) identifying property conducive to regional life science industry expansion; (viii) investigating and identifying specific

regions or municipalities that have the potential to be developed into a life sciences cluster; and (ix) facilitating the regional development and implementation of section 10A of chapter 23A.
(c) The executive director, or his equivalent, of the 5 regional technology and innovation centers shall meet from time to time with the center to exchange information; identify regional needs including, but not limited to, any assistance needed in fulfilling the regional centers' purposes as provided in subsection (b); and advise the center on the effectiveness of programs administered by the center.
(d) Each regional technology and innovation center shall provide an annual report to the center containing such information as may be required by the center to evaluate the progress of each regional center. The center may withdraw a designation as a regional technology and innovation center if a regional center does not satisfactorily meet the purposes of subsection (b), and as provided in any rules, regulations or guidelines established by the center.
Section 12. There shall be an 18-member advisory board to be appointed by the governor to advise the center. The members shall include: 10 of whom shall be active members of the Massachusetts Life Sciences Collaborative, at least 2 of whom shall represent small businesses; 5 of whom shall be the chancellors at the University of Massachusetts at Amherst, Boston, Dartmouth, Lowell and Worcester, or their designees; and 3 of whom shall be patient advocates with significant interaction or experience in the life sciences. The secretary of labor and workforce development or his designee, and the 5 executive directors of the regional technology and innovation centers, established pursuant to section 11, shall serve as ex-officio, non-voting members of the advisory board.
Each member shall serve for a term of 3 years, except that in making his initial appointments, the governor shall appoint 5 members to serve for a term of 1 year, 3 members to serve for a term of 2 years, 5 members for a term of 3 years. Any person appointed to fill a vacancy in the office of a member of the advisory board shall be appointed in a like manner and shall serve for only the unexpired term of the member who vacated. Members shall be eligible for reappointment. Any member may be removed by the governor for cause. The advisory board shall meet at least bi-annually, but shall meet as often as the members shall determine, or at such other intervals as established by the executive director to review recommendations made by the board. The members of the advisory board shall serve without compensation, but each member shall be entitled to reimbursement for his actual and necessary expenses incurred in the performance of his official duties.
The duties of the advisory board shall be to advise the center and the board concerning: research and development in the life sciences; development of products and the effectiveness of public and private initiatives to further product development; manufacturing and commercialization of biotechnology, pharmaceuticals, medical diagnostic products or such other areas within the life sciences; identifying candidates and providing recommendations for the 5 regional technology and innovation centers as established in section 11; and any other area as requested by the board.
The advisory board shall not be a state agency for the purposes of chapter 268A and shall not be subject to section 11A½ of chapter 30A or chapter 66.
Section 13. The center shall develop a comprehensive, internet-based life sciences sector database for the organization of all relevant information, as determined by the center, related to the life sciences

sector in the commonwealth. Access to said database shall be limited at the discretion of the center's executive director. Any documentary materials or data received by the center from any entity, private or public, for the express purpose of adding information to the life science database shall be exempt from section 10 of chapter 66 and the board may hold any discussion or consideration of database materials in executive session closed to the public, notwithstanding the provisions of section 11A½ of chapter 30A, but the purpose of any such executive session shall be set forth in the official minutes of the center and business not directly related to such purpose shall not be transacted nor shall any vote be taken during such executive session.

Section 14. (a) The exercise of the powers granted by this chapter shall be for the benefit of the people of the commonwealth and for the improvement of their health and living conditions; and as the operation of the center shall constitute the performance of essential governmental functions, the center shall not be required to pay any taxes or assessments, except as otherwise provided by this chapter, and the notes or bonds issued under this chapter, their transfer and the income therefrom, including any profit made on the sale thereof, at all times shall be free from taxation by and within the commonwealth.

(b) The lands and tangible personal property of the center shall be deemed to be public property used for essential public and governmental purposes and shall be exempt from taxation and from betterments and special assessments.

Section 15. The center shall annually complete a detailed report setting forth its operations and accomplishments; its receipts and expenditures during such fiscal year; its assets and liabilities at the end of its fiscal year; the anticipated return on investment to the commonwealth from the investment of funds administered by the center during such fiscal year; a complete report detailing all companies classified as a certified life sciences company; a complete list of grants awarded by the center; a list of other funding activities; reports of patents or products resulting from funded activities; the status of construction of any real estate project resulting from certification, including whether construction is on-time and on-budget; and a tracking of job creation as a result of funded projects. The center shall annually submit the report to the governor, the secretary of administration and finance, the state comptroller and the clerks of the house of representatives and senate, who shall forward the same to the house and senate committee on ways and means and the joint committee on economic development and emerging technologies on or before October 1. The report shall be posted on the internet in a manner accessible to the public.

Section 16. The books and records of the center shall be subject to a biennial audit by the auditor of the commonwealth.

Section 17. (1)(a) Notwithstanding the provisions of chapter 32, or of any general or special law to the contrary, the center shall establish 1 or more optional retirement programs that qualify under section 401, 408 or 457 of Internal Revenue Code, as may be amended from time to time, or contracts providing retirement and death benefits may be purchased by employees of the center who elect to participate in the program. The benefits offered to employees of the center in such optional retirement program shall be provided through such custodial accounts or individual or group annuity contracts, which may be fixed or variable in nature, or a combination thereof; provided, that at all times, those annuity contracts issued by licensed insurers under the optional retirement program shall provide the

minimum values and guarantees required by the laws governing such contracts in the commonwealth; and provided, further, that the benefits shall be payable only to employees of the center in the program or their beneficiaries, and such benefits shall be paid only by the selected providers in accordance with the terms of the custodial accounts, annuity contracts or certificates providing coverage to the employee of the center; and provided, further, that such optional retirement program shall not allow an employee of the center to withdraw contributions while an active participant in the center's optional retirement program.

(b) The center shall select at least 2 but no more than 4 providers for the optional retirement program and enter into contracts with them in accordance with the laws governing the procurement of services for executive agencies of the commonwealth, provided, further, that the selected providers shall be authorized to conduct business within the commonwealth, and each and every provider or issuer of annuity contracts under the optional retirement program which is a life insurance company shall hold a certificate of authority to do life insurance business in the commonwealth, maintain the minimum required capital and surplus required for life insurance companies under the laws of the commonwealth, be a member of the commonwealth's life and health insurance guaranty association and be a member of the life and health insurance guaranty associations in any and all jurisdictions where required by law with similar retirement programs funded in whole or in part through the provider's annuities in which employees of the center participating in the optional retirement program may participate upon transfer of employment; and provided, further, that said board shall coordinate the transfer of funds and information between payroll centers, the selected providers and employees of the center participating in the plan.

(2)(a) Participation in the optional retirement program provided by this section shall be limited to employees of the center who are otherwise eligible for membership in the state employees' retirement system as established under the provisions of chapter 32.

(b) Elections to participate in the optional retirement program shall be made as follows:

(i) Any eligible employee of the center who is initially appointed on or after the effective date of the optional retirement program may elect in writing to participate in the optional retirement program within 90 days of the effective date of the appointment. Any such election shall be effective as of the effective date of appointment. If an eligible employee of the center fails to make an election as provided in this paragraph, such employee shall become a member of the state employees' retirement system established under the provisions of said chapter 32.

(ii) Any eligible employee of the center who is a member of any retirement system established by the provisions of said chapter 32 on the effective date of the optional retirement program but who has less than 10 years of creditable service on the effective date of the optional retirement program may elect in writing to participate in the optional retirement program within 90 days after the effective date of the optional retirement program. Any such election shall become effective on the first day of the next pay period following such election, and shall constitute a waiver of all retirement benefits to which the individual may be entitled as an employee under any retirement system established under the provisions of said chapter 32.

(iii) Any employee of the center who is a member of any retirement system established by the provisions of said chapter 32 but who has less than 10 years of creditable service on the date such

employee becomes eligible to participate in the optional retirement program may elect in writing to participate in such optional retirement program within 90 days of the date said employee becomes eligible. Any such election shall become effective on the first day of the next pay period following such election, and shall constitute a waiver of all retirement benefits to which the individual may be entitled as an employee under any retirement system established by the provisions of said chapter 32.

(iv) Any eligible employee of the center electing to participate in the optional retirement program shall be ineligible for membership in the state employees' retirement system while he remains continuously employed by the center; provided, that the election by an eligible employee to participate in the optional retirement program shall be irrevocable while the employee continues to meet the eligibility requirements; provided, however, that if an employee becomes ineligible to continue in the optional retirement program, the employee shall thereafter participate in the state employees' retirement system established in accordance with the provisions of said chapter 32.

(3)(a) Any eligible employee of the center electing to participate in the optional retirement program shall not be required to make contributions to the state employee's retirement system but shall contribute to the optional retirement program an amount equal to the contribution which would have been required had such employee been a member of the state employees' retirement system.

(b) For each eligible employee of the center electing to participate in the optional retirement program, the center shall contribute an amount equal to 5 per cent of each employee's regular compensation, as defined in section 1 of chapter 32, to the optional retirement program and a plan established to provide life and disability benefits to all participants in the program; provided, however, that not more than 1 per cent of said contribution shall be made to the plan established to provide said life and disability benefits; provided, further, that the balance of said contribution shall be remitted to the appropriate provider for application to the participating employee's contract or custodial account, less any monthly fees established by the board in order to cover the reasonably necessary direct costs incurred by the board in establishing and administering the plan.

(c) If any eligible employee of the center is a member of any retirement system established by the provisions of said chapter 32 at the time such employee elects to participate in the optional retirement program, the employee may direct that the amount of the accumulated total deductions, and any interest to which the employee would be entitled under said chapter 32 if the employee withdrew from the system, credited to such employee's account in such retirement system be transferred directly to such employee's account in the optional retirement program. Any such transfer shall be made in the form of a direct trustee-to-trustee transfer in compliance with the requirements of subchapter D of chapter 1 of the Internal Revenue Code.

(d) The funds accumulated under the optional retirement program shall be exempt from taxation. The rights of a participant to a custodial account, an annuity, the annuity contracts or certificates providing coverage to participants, and all right in and to the funds accumulated under the custodial accounts, annuity contracts or certificates shall be exempt from taxation, including income taxes levied under the provisions of said chapter 62. No assignment of any right in or to any funds or annuities under the optional retirement program shall be valid except such assignment as may be made for the purpose of making restitution in the case of dereliction from duty by any participant as established in section 15 of

said chapter 32 if such assignment does not violate the restrictions of the Internal Revenue Code; provided that nothing in this section shall prevent a participant's custodial account or annuity from being attached, taken on execution, assigned, or subject to other process to satisfy a support order under chapters 208, 209, or 273 if such order constitutes a qualified domestic relations order under the terms of the Internal Revenue Code.

(e) Any eligible employee of the center enrolled in the optional retirement program who retires and wishes to retain his group insurance coverage as provided in chapter 32A, or retires and wishes to enroll in group insurance coverage pursuant to said chapter 32A, may do so in the same manner, and subject to the same limitations and requirements as an active employee member of the state employees' retirement system. Any eligible employee of the center enrolled in the optional retirement program who retains or enrolls in the group insurance coverage upon retirement shall be deemed to have authorized his optional retirement program plan provider to deduct from the retired employees account, on a monthly basis, and forward to the group insurance commission, an amount equal to the retired employee's share of the premium as set by said chapter 32A and each annual appropriation act. Each optional retirement program plan provider shall be required to deduct and forward said premium amounts, as determined by the group insurance commission, to the group insurance commission in advance of the month for which the premium is due and in a manner as may be prescribed by the group insurance commission. For group insurance commission purposes employees who were members of the state retirement system when they became eligible to participate in the optional retirement program, and who then enrolled in the optional retirement program, may add their time in the state retirement system to their time in the optional retirement program in determining years of creditable service.

(f) No contribution shall be made under any provision of this section in excess of, or on the basis of compensation in excess of, any limitation that may be imposed pursuant to federal law including, but not limited to, the limitations in 26 U.S.C. sections 401(a)(17), 402(g), 403(b) and 415, to the extent such limitations apply. The center may adopt rules and regulations as it deems necessary to carry out the purposes of this section including, but not limited to, rules or regulations establishing such limitations only when it determines that such limitations are necessary to comply with applicable provisions of the Internal Revenue Code.

**SECTION 14.** Section 5 of said chapter 23I, as appearing in section 14, is hereby amended by striking out subsection (d).

**SECTION 15.** Section 1 of chapter 32 of the General Laws, as appearing in the 2006 Official Edition, is hereby amended by inserting after the word "connector", in line 211, the following words:- , the Massachusetts Life Sciences Center, except those employees of the center opting to participate in an optional retirement plan established by the center pursuant to section 17 of chapter 23I.

**SECTION 16.** Section 2 of chapter 32A of the General Laws is hereby amended by inserting after the word "authority", in line 12, as so appearing, the following words:- , the Massachusetts Life Sciences Center.

**SECTION 17.** Section 6 of chapter 62 of the General Laws, as most recently amended by section 4 of chapter 63 of the acts of 2007, is hereby further amended by adding the following 2 subsections:-
(m) (1) As used in this subsection and in subsection (n), the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Primarily”, more than 50 per cent.
“Research and development costs”, in-house research expenses within the meaning of section 41(b)(2) of the Internal Revenue Code.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapters 62, 63, 64H or 64I.
“User fees”, the monetary amount actually paid by a taxpayer to the U.S.F.D.A. that constitutes the fee due upon the submission of a human drug application or supplement pursuant to 21 U.S.C. section 379h(a)(1) for a human drug, the research and development costs of which, were primarily incurred in the commonwealth.
“U.S.F.D.A.”, the United States Food and Drug Administration.
(2) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, take a credit against the taxes imposed by this chapter in an amount equal to 10 per cent of the cost of qualifying property acquired, constructed, reconstructed or erected during the taxable year and used exclusively in the commonwealth.
Qualifying property shall be tangible personal property and other tangible property including buildings and structural components of buildings acquired by purchase, as defined by section 179(d) of the Internal Revenue Code, as amended and in effect for the taxable year, but not including property that is taxable under chapter 60A; provided, however, that such property shall be depreciable under section 167 of the Internal Revenue Code and have a useful life of 4 years or more. With respect to property which is disposed of or ceases to be in qualified use prior to the end of the taxable year in which the credit is to be taken, the amount of the credit shall be that portion of the credit provided for in this paragraph which represents the ratio which the months of qualified use bear to the months of useful life. If property on which credit has been taken is disposed of or ceases to be in qualified use prior to the end of its useful life, the difference between the credit taken and the credit allowed for actual use must be added back as additional taxes due in the year of disposition; provided, however, if such property is disposed of or ceases to be in qualified use after it has been in qualified use for more than twelve consecutive years, it shall not be necessary to add back the credit, as provided in this paragraph. The amount of credit allowed for actual use shall be determined by multiplying the original

credit by the ratio which the months of qualified use bear to the months of useful life. For the purposes of this paragraph, useful life of property shall be the same as that used by the corporation for depreciation purposes when computing federal income tax liability.

A taxpayer taking a credit allowed under this subsection may not take the credit allowed by subsection (g) except to such extent, not to exceed 2 per cent of the cost of any qualifying property, as may be provided in a certification pursuant to said section 5 of chapter 23I.

Nothing in this section shall limit the authority of the commissioner to make adjustments to a taxpayer's liability upon audit or limit any other legal remedies available to the commissioner or the commonwealth against said taxpayer.

(3) Any taxpayer entitled to a credit under this section for any taxable year may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, carry over and apply to its tax for any 1 or more of the next succeeding 10 taxable years, the portion, as reduced from year to year, of those credits which exceed the tax for the taxable year.

(4) The commissioner in consultation with the Massachusetts Life Sciences Center established by section 3 of chapter 23I, shall promulgate regulations necessary for the administration of this subsection; provided, further, that said regulations may provide the adjustment of intercompany prices and elimination of intercompany transactions to ensure that all amounts upon which the credit is based reasonably reflect fair market value; and provided, further, that said regulations shall include provisions to prevent the generation of multiple credits with respect to the same property.

(5) If a credit allowed under this subsection, or such credit as may be allowed under subsection (g) as limited in this subsection, exceeds the tax otherwise due under chapter 62, 90 per cent of the balance of such credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year in which qualified property giving rise to that credit is placed in service. If such credit balance is refunded to the taxpayer, then the credit carryover provisions of paragraph (3), and paragraph (2) of subsection (g), shall not apply.

(n) (1) Except as otherwise limited by subsection (4), a taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, be allowed a refundable credit against the tax liability imposed under this chapter in an amount equal to 100 per cent of the cost of user fees paid by such taxpayer.

(2) A taxpayer shall claim the credit in the taxable year in which its application for the licensure of an establishment to manufacture the human drug in the commonwealth is approved by the U.S.F.D.A.

(3) If a credit allowed to a taxpayer exceeds the tax otherwise due under chapter 62, 90 per cent of the balance of that credit may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of said chapter 23I, be refundable to the taxpayer for the taxable year in which the credit is claimed.

(4) The deduction from gross income that may be taken with respect to any expenditures qualifying for the credit under this section shall be disallowed to the extent of the credit.

(5) Only user fees paid by a taxpayer to the U.S.F.D.A. on or after the effective date of this section shall be eligible for the credit.

**SECTION 18.** Said section 6 of said chapter 62 is hereby further amended by striking out subsections (m) and (n), inserted by section 17.

**SECTION 19.** Section 30 of chapter 63 of the General Laws, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
17. Notwithstanding the last sentence in subparagraph (b) of paragraph 5, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, losses sustained in any taxable year by a taxpayer engaged in business as a life sciences company as defined by section 2 of chapter 23I may, to the extent approved pursuant to said life sciences tax incentive program, be carried forward for not more than 15 years; provided, however, that said losses shall not be carried back.

**SECTION 20.** Said section 30 of said chapter 63 is hereby further amended by striking out paragraph 17, inserted by section 19.

**SECTION 21.** Said chapter 63 is hereby further amended by inserting after section 31L the following section:-
Section 31M. (a) As used in this section, the following words shall, unless the context otherwise requires, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Primarily”, more than 50 per cent.
“Research and development costs”, in-house research expenses within the meaning of section 41(b)(2) of the Internal Revenue Code.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapters 62, 63, 64H or 64I.
“User fees”, the monetary amount actually paid by a taxpayer to the U.S.F.D.A. that constitutes the fee due upon the submission of a human drug application or supplement pursuant to 21 U.S.C. section 379h(a)(1) for a human drug, the research and development costs of which, were primarily incurred in the commonwealth.
“U.S.F.D.A.”, the United States Food and Drug Administration.
(b) Except as otherwise limited by subsection (e), a taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of chapter 23I, be allowed a refundable credit against the tax liability imposed under this chapter in an amount equal to 100 per

cent of the cost of user fees paid by such company.
(c) A taxpayer shall claim the credit in the taxable year in which its application for the licensure of an establishment to manufacture the human drug in the commonwealth is approved by the U.S.F.D.A.
(d) The credit allowed may reduce the excise due under subsection (b) of section 32, or subsection (b) of section 39. The credit allowed to a taxpayer shall not be subject to the provisions of section 32C. Where such credit allowed to a taxpayer exceeds the excise otherwise due under said subsection (b) of section 32 or subsection (b) of said section 39, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, be refundable to the taxpayer for the taxable year in which the credit is claimed.
If a taxpayer files as a member of a combined group and applies its excess credit against the excise of another group member, then the credit as applied to corporations other than such taxpayer is not subject to section 32C and may reduce to zero the excise due under subsection (b) of section 32, or subsection (b) of section 39 and under any act in addition thereto. Where such credit allowed to a taxpayer that is applied against the excise liability of such other corporations exceeds the excise otherwise due to such corporations under this chapter, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program, be refundable to the taxpayer for the taxable year in which the credit is claimed.
(e) For the purposes of section 30, the deduction from gross income that may be taken with respect to any expenditures qualifying for the credit under this section is disallowed to the extent of the credit.
(f) Only user fees paid by a taxpayer to the U.S.F.D.A. on or after the effective date of this section shall be eligible for the credit.

**SECTION 22.** Section 31M of said chapter 63 is hereby repealed.

**SECTION 23.** Section 38 of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by striking out, in line 162, the word “and”.

**SECTION 24.** Said section 38 of said chapter 63, as so appearing, is hereby further amended by inserting after the word “contracts”, in line 169, the following:- ; and (6) to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, a certified life sciences company, as defined by section 5 of chapter 23I, may be deemed to be taxable in the state of the purchaser if the property of the project is delivered or shipped to a purchaser in another state.

**SECTION 25.** Said section 38 of said chapter 63 is hereby further amended by striking out clause (6), inserted by section 24.

**SECTION 26.** Section 38C of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
To the extent authorized pursuant to the life sciences tax incentive program established by section 5

of chapter 23I, a certified life sciences company may be deemed a research and development corporation for purposes of exemptions under chapters 64H and 64I.

**SECTION 27.** Said section 38C of said chapter 63 is hereby further amended by striking out the fourth paragraph, inserted by section 26.

**SECTION 28.** Section 38M of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following subsection:-
(j)(1) As used in this section, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapter 62, 63, 64H or 64I.
(2) If a credit claimed under this section by a taxpayer exceeds the amount that may otherwise be allowed under this section for a taxable year, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year. If such credit balance is refunded to the taxpayer, then the credit carryover provisions of paragraph (f) shall not apply.

**SECTION 29.** Said section 38M of said chapter 63 is hereby further amended by striking out paragraph (j), added by section 28.

**SECTION 30.** Said chapter 63 is hereby further amended by inserting after section 38T the following 3 sections:-

Section 38U. (a) As used in this section, section 38V and section 38W, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product

pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.

“Person”, a natural person, corporation, association, partnership or other legal entity.

“Taxpayer”, a life sciences company or person subject to the taxes imposed by this chapter or chapter 62, 64H or 64I.

(b) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, take a credit against the taxes imposed by this chapter in an amount equal to 10 per cent of the cost of qualifying property acquired, constructed, reconstructed or erected during the taxable year and used exclusively in the commonwealth.

Qualifying property shall be tangible personal property and other tangible property including buildings and structural components of buildings acquired by purchase, as defined under section 179(d) of the Code, as amended, and in effect for the taxable year, but not including property that is taxable under chapter 60A; provided, however, that such property shall be depreciable under section 167 of the Code and shall have a useful life of 4 years or more.

With respect to property which is disposed of or ceases to be in qualified use prior to the end of the taxable year in which the credit is to be taken, the amount of the credit shall be that portion of the credit provided for in this paragraph which represents the ratio which the months of qualified use bear to the months of useful life. If property on which credit has been taken is disposed of or ceases to be in qualified use prior to the end of its useful life, the difference between the credit taken and the credit allowed for actual use must be added back as additional taxes due in the year of disposition; provided, however, if such property is disposed of or ceases to be in qualified use after it has been in qualified use for more than twelve consecutive years, it shall not be necessary to add back the credit, as provided in this paragraph. The amount of credit allowed for actual use shall be determined by multiplying the original credit by the ratio which the months of qualified use bear to the months of useful life. For the purposes of this paragraph, useful life of property shall be the same as that used by the corporation for depreciation purposes when computing federal income tax liability.

The credit allowed under this section may be taken by an eligible corporation; provided, however, that neither credit allowed by section 31A nor section 31H is taken by such corporation; and provided, further, that the credit allowed by section 38N shall not be taken except to such extent, not to exceed 2 per cent of the cost of any qualifying property.

Nothing in this section shall limit the authority of the commissioner to make adjustments to a taxpayer’s liability upon audit or limit any other legal remedies available to the commissioner or the commonwealth against said taxpayer.

(c) The credit allowed by this section shall not be subject to section 32C.

(d) If a taxpayer that is subject to a minimum excise under this chapter, the amount of the credit allowed by this section shall not reduce the excise to an amount less than such minimum excise.

(e) A taxpayer entitled to a credit under this section for any taxable year may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, carry over and apply to its excise for any 1 or more of the next succeeding 10 taxable years, the portion, as reduced from year to year, of those credits which were not allowed by subsection (c) or which exceed the excise for the taxable year.

(f) For corporations filing a combined return of income under section 32B, a credit generated by an individual member corporation under this section shall first be applied against the separately determined excise attributable to that member, subject to the limitations of subsection (d). A member corporation with an excess credit may apply its excess credit against the excise of another group member, to the extent that such other member corporation may use additional credits under the limitation of paragraph (d). Unused, unexpired credits generated by member corporations shall be carried over from year to year by the individual corporation that generated the credit.
(g) The commissioner shall promulgate regulations necessary to implement this section. Said regulations may provide for the adjustment of intercompany prices and elimination of intercompany transactions to ensure that all amounts upon which the credit is based reasonably reflect fair market value and shall include provisions to prevent the generation of multiple credits with respect to the same property.
(h) If a credit allowed to a taxpayer under this section, or such credit as may be allowed under section 38N of this chapter as limited in this subsection, exceeds the excise otherwise due under this chapter, 90 per cent of the balance of such credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year in which qualified property giving rise to that credit is placed in service. If such credit balance is refunded to the taxpayer, the credit carryover provisions of subsection (e) and said section 38N shall not apply.
Section 38V. A taxpayer which is a certified life sciences company pursuant to section 5 of chapter 23I may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of chapter 23I, be allowed a deduction under paragraph 4 of section 30 for that portion of qualified clinical testing expenses paid or incurred for the taxable year equal to the amount of the credit allowable for the taxable year under section 45C of the Internal Revenue Code and otherwise disallowed as a deduction under section 280C(b) of said Code.
Section 38W. (a) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be allowed a credit against its excise due under this chapter equal to the sum of 10 per cent of the excess, if any, of the qualified research expenses for the taxable year, over the base amount, and 15 per cent of the basic research payments determined pursuant to section 41(e)(1)(A) of the Internal Revenue Code. The terms “qualified research expenses”, “base amount”, “qualified organization base period amount”, “basic research” and any other terms affecting the calculation of the credit shall, unless the context otherwise requires or unless otherwise stated in this section, have the same meanings as under said section 41 of said Code.
In determining the amount of the credit allowable under this section, the commissioner of revenue may aggregate the activities of all corporations that are members of a controlled group of corporations, as defined by 41(f)(1)(A) of said Code, and may aggregate the activities of all entities, whether or not incorporated, that are under common control, as defined in section 41(f)(1)(B) of said Code.
(b) For a qualified life science company, research and development costs, within the meaning of section 41 of said Code, shall include, to the extent they relate to legally mandated clinical trial activities, those qualified research expenditures that are performed both inside and outside of the commonwealth.

(c) For purposes of section 30, the deduction from gross income that may be taken with respect to any expenditures qualifying for a credit under said section 41 of said Code shall be based upon its cost less the credit allowable under this section; provided, however, that section 280C(c) of said Code shall not apply.
(d) The credit allowed hereunder for any taxable year shall not reduce the excise to less than the amount due under subsection (b) of section 32, subsection (b) of section 39, section 67 or under any other general or special law.
(e) The credit allowed under this section shall be limited to 100 per cent of a corporation's first $25,000 of excise, as determined before the allowance of any credits, plus 75 per cent of the corporation's excise, as so determined in excess of $25,000. The commissioner of revenue shall promulgate regulations similar to those authorized under section 38(c)(2)(B) of the Internal Revenue Code for purposes of apportioning the $25,000 amount among members of a controlled group. Nothing in this section shall alter section 32C, as it affects other credits under this chapter.
(f) If a corporation files a combined return of income under section 32B, a credit generated by an individual member corporation under this section shall first be applied against the excise attributable to that company under sections 32 or 39, subject to the limitations of subsections (d) and (e). A member corporation with an excess research and development credit may apply its excess credit against the excise of another group member if such other member corporation may use additional credits under the limitations of said subsections (d) and (e). Unused, unexpired credits generated by a member corporation shall be carried over from year to year by the individual corporation that generated the credit and shall not be refundable. Nothing in this section shall alter subsection (h) of section 31A.
(g) A corporation entitled to a credit under this section for any taxable year may carry over and apply to its excise for any of the next succeeding 15 taxable years that portion, as reduced from year to year, of its credit which exceeds its excise for the taxable year. A corporation may carry over and apply to its excise for any subsequent taxable year that portion, as reduced from year to year, of those credits which were not allowed by subsection (f).
(h) The commissioner of revenue shall promulgate regulations necessary to carry out this section.

**SECTION 31.** Sections 38U, 38V and 38W of said chapter 63 are hereby repealed.

**SECTION 32.** Section 42B of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
To the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, a certified life sciences company may be deemed a research and development corporation for purposes of exemptions under chapters 64H and 64I.

**SECTION 33.** Said section 42B of said chapter 63 is hereby further amended by striking out the last paragraph, added by section 32.

**SECTION 34.** Section 6 of chapter 64H of the General Laws, as amended by section 12 of chapter 63

of the acts of 2007, is hereby further amended by adding the following paragraph:-

(xx) (1) Sales of tangible personal property purchased for a certified life sciences company, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, for use in connection with the construction, alteration, remodeling, repair or remediation of research, development or manufacturing facilities and utility support systems. Only purchases made on or after the effective date of this section shall be eligible for this exemption.
(2) As used in this section, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Life sciences company”, a business corporation, partnership, firm, unincorporated association or other entity engaged in life sciences research, development, manufacturing or commercialization in the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under this chapter.
“Utility support systems”, all areas of utility support systems including, but not limited to, site, civil, mechanical, electrical and plumbing systems.

**SECTION 35.** Said section 6 of said chapter 64H is hereby further amended by striking out paragraph (xx), added by section 34.

**SECTION 36.** Notwithstanding any general or special law to the contrary, the University of Massachusetts at Dartmouth shall acquire from the Massachusetts Development Finance Agency the land and improvements thereon located at 151 Martine street in the city of Fall River together with the accessory parking lot owned by the Massachusetts Development Finance Agency located on the north side of Martine street, hereinafter collectively referred to as the Advanced Technology Manufacturing Center, for an amount not to exceed $11,400,000 and pursuant to such other terms as the parties may mutually agree; provided, however, that said conveyance shall be approved by the board of trustees of the University of Massachusetts and the board of directors of Massachusetts Development Finance Agency. The conveyance shall be subject to a restrictive covenant prohibiting the University of Massachusetts at Dartmouth from occupying more than 60 per cent of the total square footage of the Advanced Technology Manufacturing Center at any time. The University of Massachusetts at Dartmouth shall retain any rent, license fees, appropriations, grants, fees, or such other monies earned in connection with owning and operating the Advanced Technology Manufacturing Center and shall apply such revenues solely to offset the costs associated with owning, operating, improving, leasing, licensing, managing and maintaining the land and improvements that constitute the Advanced

Technology Manufacturing Center.

**SECTION 37.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, in collaboration with the Massachusetts International Trade Council shall, subject to appropriation, facilitate and support joint academic and industrial research and development and commercial business exchanges between the commonwealth and Israel in the area of life sciences; provided, further, that subject to appropriation, there shall be established a trade and incubator facility in Israel and a trade and incubator facility in Massachusetts facilitated by the Massachusetts International Trade Council in consultation with the Massachusetts office of international trade and investment, established by section 24 of chapter 23A of the General Laws, for collaborative, joint and pilot projects with the Government of the State of Israel, the Boston Haifa International Life Sciences Institute and other organizations working with Israel.

**SECTION 38.** Notwithstanding any general or special law to the contrary, the term of any member appointed prior to the effective date of this act to the board of directors of the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall expire upon the effective date of this act; provided, however, that any appointed board member whose term has expired pursuant to this section shall be eligible for reappointment to the board. Such appointments shall be made in accordance with section 3 of chapter 23I of the General Laws.

**SECTION 39.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws, in consultation with the department of agricultural resources, shall, subject to appropriation, establish a program to promote the research and development of plant-made pharmaceuticals and industrial products through field trials approved under a permit or approved notification by the Biotechnology Regulatory Service of the Animal and Plant Health Inspection Service of the United States Department of Agriculture.

**SECTION 40.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws, in conjunction with the office of the state treasurer, shall conduct an investigation and study of the feasibility of vetting and bundling life sciences enterprises for the purpose of securitization of enterprises to create investment opportunities to provide seed capital for enterprises. For the purposes of this study, “enterprise” shall be defined as a small business, as defined in chapter 40F of the General Laws, with its principal place of business in the commonwealth and which is, or proposes to be, engaged in manufacturing or research and development in the area of life sciences. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before March 31, 2009.

**SECTION 41.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall conduct an investigation and study the feasibility of increasing the number of clinical trials conducted or expediting the process of conducting clinical trials in the commonwealth, by life sciences companies in the commonwealth. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate who shall forward the same to the house of representatives and the senate committees on ways and means, the joint committee on economic development and emerging technologies, the joint committee on public health and the joint committee on health care financing on or before March 31, 2009.

**SECTION 42.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall conduct an investigation and study of ways to enhance coordination between the angel investor community, so-called, and the life science industry. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before March 31, 2009.

**SECTION 43.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, in conjunction with the appropriate state agencies, shall conduct an investigation and study to assess the feasibility of developing and implementing a program to engage and train community college students in the area of life sciences. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the joint committee on economic development and emerging technologies, the joint committee on education and the joint committee on labor and workforce development on or before June 30, 2009.

**SECTION 44.** Notwithstanding any general or special law to the contrary, the total administrative and operational expenses of the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws shall not exceed $3,750,000 for fiscal year 2009; provided, further that said center shall conduct an investigation and study the center’s annual operating expenses including, but not limited to, lease payments, payroll and contracted costs, to be used by the legislature to calculate annual operating expenses for future fiscal years. Said center shall report to the general court the

results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before December 31, 2008.

**SECTION 45.** Notwithstanding any general or special law to the contrary, the department of revenue shall conduct an investigation and study including a detailed description and a numerical accounting of all tax incentives awarded to life sciences companies certified by section 5 of chapter 23I of the General Laws, including the value of tax incentives authorized pursuant to the life sciences tax incentive program, as established by said section 5 of said chapter 23I, for each year for which the project was certified, and the value of tax incentives actually used as a result of the project. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on economic development and emerging technologies and the joint committee on revenue annually on or before June 30. Such report shall be posted on the internet in a manner accessible to the public.

**SECTION 46.** To meet the expenditures necessary in carrying out the provisions of section 2B, the state treasurer shall, upon receipt of a request by the governor, issue and sell bonds of the commonwealth in an amount to be specified by the governor from time to time, but not exceeding, in the aggregate, $500,000,000. All bonds issued by the commonwealth, as aforesaid, shall be designated on their face, Life Sciences Center Capital Improvement Loan Act of 2008, and shall be issued for a maximum term of years, not exceeding 20 years, as the governor may recommend to the general court pursuant to Section 3 of Article LXII of the Amendments to the Constitution; provided, however, that all such bonds shall be payable not later than June 30, 2033. All interest and payments on account of principal on such obligations shall be payable from the General Fund. Bonds and interest thereon issued under the authority of this section shall, notwithstanding any other provisions of this act, be general obligations of the commonwealth.

**SECTION 47.** Notwithstanding any general or special law to the contrary, only certified life sciences projects authorized under section 5 of chapter 23I of the General Laws shall be eligible for the available capital funding provided in item 7002-0015 in section 2B.

**SECTION 48.** Notwithstanding any general or special law to the contrary, a private entity engaged in a construction, development, renovation, remodeling, reconstruction, rehabilitation or redevelopment project receiving funds pursuant to this act shall properly classify individuals employed on the project and shall comply with all laws concerning workers' compensation insurance coverage, unemployment insurance, social security taxes and income taxes with respect to all such employees. All construction contractors engaged by an entity on any such project shall furnish documentation to the appointing

authority showing that all employees employed on the project have hospitalization and medical benefits that meet the minimum requirements of the connector board established in chapter 176Q of the General Laws.

**SECTION 49.** The value of any tax incentive award under the life sciences tax incentive program established in subsection (d) of section 5 of chapter 23I of the General Laws which extends beyond December 31, 2018, including carry-forwards of losses or credits, shall be taken into account during the year awarded and the full amount of such tax benefits potentially realized in periods after December 31, 2018 shall be counted against the annual ceilings for years ending prior to January 1, 2019. Tax incentives authorized pursuant to the life sciences tax incentive program shall count toward this $25,000,000 annual ceiling only if they are not otherwise available to a taxpayer.

**SECTION 50.** Notwithstanding any general or special law to the contrary, the sales tax exemption in paragraph (xx) in section 6 of chapter 64H of the General Laws shall apply to sales of tangible personal property purchased for a certified life sciences company established in section 5 of chapter 23I of the General Laws on or after the effective date of this act.

**SECTION 51.** Notwithstanding any general or special law to the contrary, eligibility for a tax credit on user fees under paragraph (2) of subsection (n) of section 6 of chapter 62 of the General Laws and under subsection (f) of section 31M of chapter 63 of the General Laws shall apply to user fees paid on or after the effective date of this act.

**SECTION 52.** Subsection (d) of section 5 of chapter 23I of the General Laws, as appearing in section 14, shall take effect on January 1, 2009.

**SECTION 53.** Sections 17, 19, 21, 24, 26, 28, 30, 32, and 34 shall take effect on January 1, 2009.

**SECTION 54.** Sections 18, 20, 22, 23, 25, 27, 29, 31, 33, and 35 shall take effect on December 31, 2018.

*Approved June 16, 2008*

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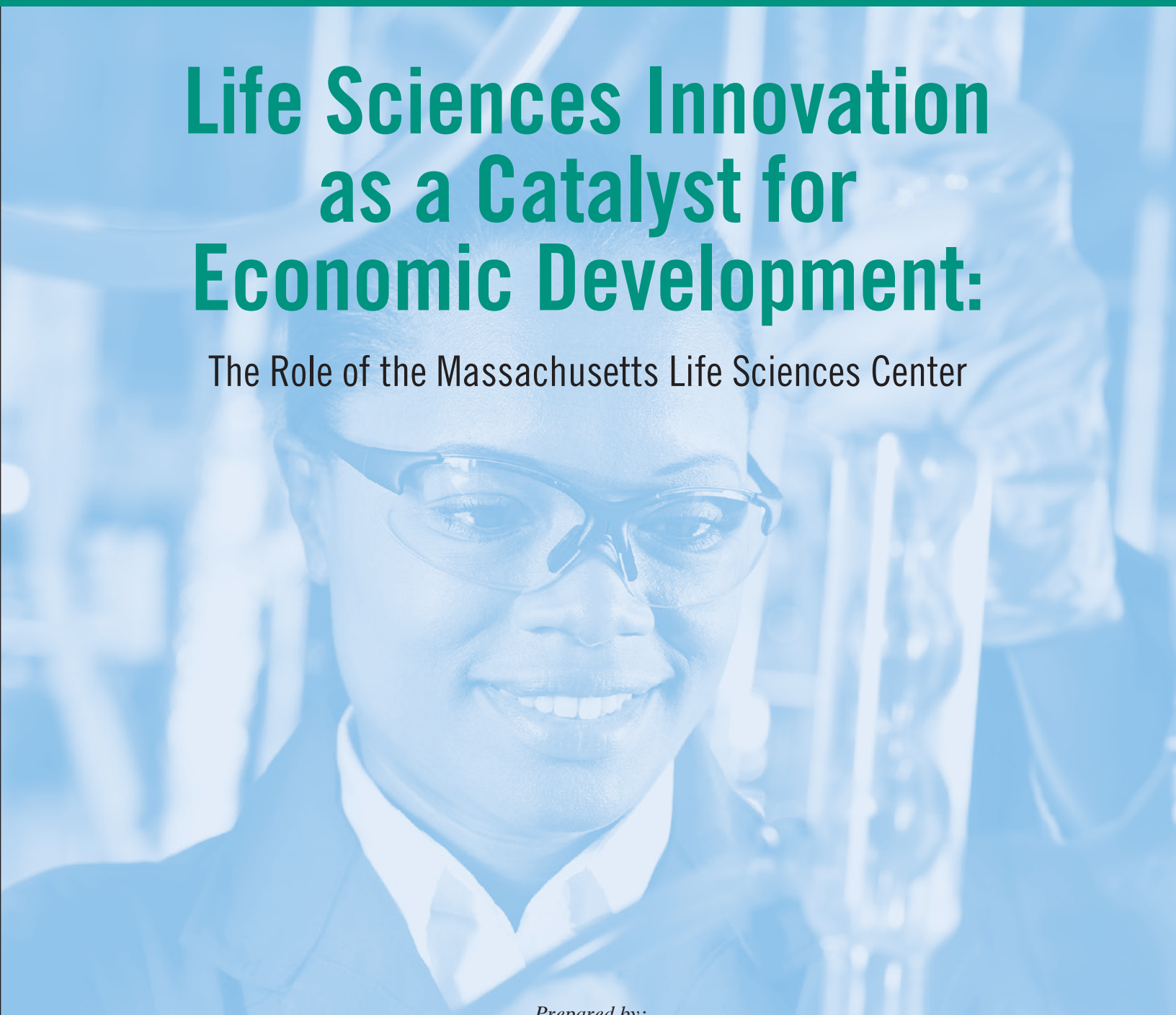
# Appendix C:
## Independent Reports and Documents

# Life Sciences Innovation as a Catalyst for Economic Development:

## The Role of the Massachusetts Life Sciences Center



*Prepared by:*

**The Kitty and Michael Dukakis Center for Urban and Regional Policy at Northeastern University**

Northeastern University
*Kitty and Michael Dukakis Center for Urban and Regional Policy*

**The Boston Foundation**

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The Boston Foundation, Greater Boston's community foundation, is one of the oldest and largest community foundations in the nation, with net assets of more than $800 million. In 2012, the Foundation and its donors made $88 million in grants to nonprofit organizations and received gifts of close to $60 million. The Foundation is a partner in philanthropy, with some 900 separate charitable funds established by donors either for the general benefit of the community or for special purposes. The Boston Foundation also serves as a major civic leader, provider of information, convener and sponsor of special initiatives that address the region's most pressing challenges. The Philanthropic Initiative (TPI), an operating unit of the Foundation, designs and implements custom philanthropic strategies for families, foundations and corporations around the globe. Through its consulting and field-advancing efforts, TPI has influenced billions of dollars in giving worldwide. For more information about the Boston Foundation and TPI, visit www.tbf.org or call 617-338-1700.

## About the Kitty and Michael Dukakis Center for Urban and Regional Policy

The Kitty and Michael Dukakis Center for Urban and Regional Policy at Northeastern University conducts interdisciplinary research, in collaboration with civic leaders and scholars both within and beyond Northeastern University, to identify and implement real solutions to the critical challenges facing urban areas throughout Greater Boston, the Commonwealth of Massachusetts, and the nation. Founded in 1999 as a "think and do" tank, the Dukakis Center's collaborative research and problem-solving model applies powerful data analysis, a bevy of multidisciplinary research and evaluation techniques, and a policy-driven perspective to address a wide range of issues facing cities and towns. These include affordable housing, local economic development, workforce development, transportation, public finance, and environmental sustainability. The staff of the Dukakis Center works to catalyze broad-based efforts to solve urban problems, acting as both a convener and a trusted and committed partner to local, state, and national agencies and organizations. The Center is housed within Northeastern University's innovative School of Public Policy and Urban Affairs.

## About the Authors

**Barry Bluestone** is a Founding Director of the Kitty and Michael Dukakis Center for Urban and Regional Policy and former Dean of the School of Public Policy and Urban Affairs at Northeastern University, where he is also the Stearns Trustee Professor of Political Economy. Previously, Professor Bluestone spent 12 years at the University of Massachusetts at Boston and 15 years at Boston College, where he directed the University's Social Welfare Research Institute. At the Dukakis Center, he has led research projects on housing, local economic development, state and local public finance, and the manufacturing sector in Massachusetts. He regularly consults with trade unions, business leaders, and serves on Gov. Deval Patrick's Economic Development Strategy Council. Professor Bluestone was raised in Detroit and attended the University of Michigan, where he received his Ph.D. in economics.

**Alan Clayton-Matthews** is an Associate Professor in Northeastern University's School of Policy Studies and Urban Affairs and in the Department of Economics. He is a contributing editor of *Massachusetts Benchmarks*, a joint publication of the University of Massachusetts and the Federal Reserve Bank of Boston that presents timely information and analysis about the performance of the Massachusetts economy. He is also a Director of the New England Economic Partnership (NEEP), a group of economists and managers from academia, business, and government who study and forecast the regional economy. He serves as the Massachusetts forecast manager for NEEP. Professor Clayton-Matthews also is currently serving on Governor Deval Patrick's Council of Economic Advisors. His applied research interests include analyzing the Massachusetts economy, including its structure, development, and short and long-run growth trends. His academic research includes the development of statistical procedures and tools for economic index construction and forecasting, and the relationship between higher education and economic development. Professor Clayton-Matthews holds a Ph.D. in economics from Boston College.

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# Life Sciences Innovation as a Catalyst for Economic Development:

## The Role of the Massachusetts Life Sciences Center

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March 2013

# Preface

In 2003, a distinguished group of university leaders, educators and business representatives came together for a unique and unprecedented summit, spearheaded by Harvard Business School professor Michael Porter and hosted by the presidents of MIT and Harvard, Susan Hockfield and Drew Gilpin Faust. This was the same year those two universities played a major role in the international team that cracked the human genome.

The summit's purpose was to discuss the state's life sciences "super cluster," meaning all of the many sectors that are involved in the life sciences. Everyone attending agreed that strengthening the life sciences was not only smart and played to our state's strengths, it was crucial to our future global competitiveness. It could mean jobs for hundreds of thousands and billions added to the Massachusetts economy.

While the summit was stimulating, there was no established vehicle to build on the momentum that it generated. And so, in 2005, the Boston Foundation provided a grant of $125,000 to create the Massachusetts Life Sciences Collaborative. The Organizing Committee for the new group included the leaders of all of the Boston area's major universities, teaching hospitals, life-sciences companies and venture-capital firms.

In March of 2007, Governor Deval Patrick spoke at one of the Collaborative's meetings about the importance of the life sciences to the Commonwealth. He previewed an announcement he would make publicly later that year about the creation of a new Massachusetts Life Sciences Initiative, which represented a 10-year, $1 billion investment to enhance and strengthen the state's leadership in the life sciences.

The Boston Foundation was honored to play a major convening role in bringing together the stakeholders for those early discussions. And now we are proud to publish this first report on the Massachusetts Life Sciences Initiative and the work of the quasi-public agency charged with carrying out its mission.

We have published many reports researched by the lead author of this report, Barry Bluestone, Director of the Kitty and Michael Dukakis Center for Urban Affairs at Northeastern. Reports from the Dukakis Center are always thorough and compelling, but not all of them carry good news. This one does, especially when it comes to economic impact. The $56.6 million Massachusetts awarded in tax incentives to life sciences firms between 2009 and 2011 has created 2,500 jobs, which should generate more than $266 million in wages and salaries during the next five years. In fact, the Commonwealth's life sciences super cluster has risen to number one in the nation in terms of per capita employment, with close to 14,300 jobs for every one million residents.

These jobs are not just for workers with advanced degrees: at least one in five require no more than a two-year associate's degree and another 48 percent require just a bachelor's degree. For the Boston Foundation, this confirms our deep investment in supporting the full education pipeline and the importance of preparing college students for well-paying jobs in a field that will only grow.

Estimating the economic impact of this life sciences super cluster is within our grasp. Evaluating its broader value to society is daunting because of the almost limitless potential it has for improving the lives and well-being of people here in Massachusetts and around the world.

Paul S. Grogan
President & CEO

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# Executive Summary

This report provides an up-to-date, independent evaluation of the $1 billion, 10-year Massachusetts Life Sciences Initiative and the Massachusetts Life Sciences Center (MLSC) charged with the responsibility of carrying out its mission. The initiative was established in July 2008 by Governor Deval Patrick's Administration and the Legislature to encourage the growth of discovery and production in the life sciences, including biotechnology, pharmaceuticals, medical diagnostics, medical devices and bioinformatics in the Commonwealth. Based on the region's existing comparative advantage in life sciences research and development (R&D) emanating from the laboratories of its leading universities and medical institutions, this substantial infusion of public funds was undertaken with the ambitious goal of making this cluster of industry sectors the most successful in the world.

This evaluation comes at a propitious time, given the state of fiscal affairs in the Commonwealth and the nation. Virtually every unit of government is scrutinizing the use of each tax dollar to ensure that public revenue is being spent effectively and efficiently. Put simply, our goal in this evaluation was to gather as much data as possible to assess whether the Commonwealth's sizeable commitment of public resources is paying off in the form of a life sciences "super cluster" capable of attracting massive amounts of investment dollars, generating well-paying jobs for Massachusetts residents and yielding additional tax revenue for the Commonwealth.

## The Life Sciences Super Cluster and the MLSC

After it was created, the MLSC sought to develop as a key element of its strategy the creation of a collaborative "ecosystem" encompassing all aspects of the state's life sciences. It would do this by encouraging the development of a dense, highly connected community of scholars, entrepreneurs, industry leaders, venture capitalists and government officials who were all dedicated to the success of this sector. Unlike many narrowly focused state economic development initiatives, the Center has chosen to guide its investments with a broad range of strategic priorities geared to enhance all aspects of the life sciences cluster. These include:

- funding translational research that converts new discoveries into marketable products and services
- investing in promising new technologies
- ensuring worker skill acquisition that aligns with the needs of life sciences industries
- creating new infrastructure with shared resources to accelerate life sciences innovation
- building partnerships among segments of the local and international life sciences communities

To accomplish these goals, the Center relies on a portfolio of seven distinct programs. These include:

**Cooperative Research Grants** to support industry-sponsored research at universities in order to facilitate scientific discoveries that lead to medical applications. These grants match industry contributions dollar for dollar.

**Internship Challenge Program** to provide funds for interns working at start-up and smaller Massachusetts life sciences companies.

**New Investigator Grants** to spur innovative research and advance the careers of new investigators working on cutting-edge research at academic research centers in Massachusetts.

**Life Sciences Accelerator Loan Program** to make loans available to early-stage companies and help leverage additional sources of capital.

**Small Business Matching Grant (SBMG) Program** to provide matching support to firms on the verge of commercializing new technologies developed with Phase II or Post-Phase II federal Small Business Innovation Research (SBIR) awards or federal Small Business Technology Transfer (STTR) grants.

**Life Sciences Tax Incentive Program** to offer a combination of 10 competitively awarded tax incentives available to companies that meet specified hiring goals.

TABLE 1
**Distribution of MLSC Investments by Dollar Amount (June 2008–June 2012)**

| | |
|---|---|
| Capital Projects (12) | $186,950,000 |
| Company Grants and Accelerator Loans (31) | $22,907,000 |
| Academic Research Grants (35) | $23,346,344 |
| Tax Incentives (56) | $56,595,093 |
| Interns Funded for Workforce Development (884) | $6,903,164 |
| Equipment and Supply Grants for Schools (32) | $3,333,675 |
| Other Grants/Business Plan Competitions | $1,540,000 |
| **TOTAL** | $301,575,276 |

Source: Massachusetts Life Sciences Center, 2013

**Capital Projects Fund** to provide capital for equipment and supplies for high schools in Gateway Cities, vocational/technical schools, and community colleges; and for capital projects at academic/research institutions, business incubators, and other not-for-profit organizations.

Between 2008 and June 30, 2012, the Center directly invested or committed more than $300 million in state funds that have leveraged more than $1 billion in third-party investments by private businesses, the federal government and foundations, according to the MLSC *FY2012 Report*. **Table 1** provides a breakdown of these investments.

## Special Features of the Massachusetts Life Sciences Center

Our analysis revealed that, aside from its extraordinarily broad mandate, there are other factors that make the MLSC quite different from most government subsidy programs.

First, the MLSC operates under a Board of Directors that includes state government officials, but also industry CEOs, leaders from academia and medicine, bioscience researchers and others who have great knowledge of the life sciences.

Second, MLSC accelerator loans and other investments are reviewed by a panel of more than 200 specialists who advise the Center's Scientific Advisory Board (SAB), which itself is dominated by academic researchers, industry scientists, and private venture-capital experts who together can judge both the scientific and economic potential of an MLSC investment. Accelerator loans are also reviewed by private venture-capital experts who can assess the economic potential of recipient firms.

And third, the Center insists on accountability in terms of private sector investment matches. The Center also retains the power (and has utilized it) to "claw back" tax incentives if and when specific job creation goals are not reached by grant recipients.

We discovered from our interviews with life sciences executives, trade association leaders and members of the MSLC Scientific Advisory Board that the high level of professionalism associated with the Center's expert-based review process has resulted in MLSC investments that appear to have a high rate of return for the Commonwealth. We will return to this point, but must first touch upon a finding even more important than the measured rates of return to specific MLSC programs.

## New vs. Old Growth Theory

To properly assess the value of the Life Sciences Initiative and the MLSC, it is useful to place its activities in the context of economic growth theory. What is now known as the "old growth theory" suggests that economic prosperity springs from the accumulation of ever greater stocks of the fundamental ingredients of production: capital, labor and natural resources. Those countries that find ways of increasing investment in plant and equipment, adding to labor supply and extracting more natural resources are the ones that will become more affluent.

While not completely discounting this approach to growth, a "new growth theory" has evolved that places technological progress at the very epicenter of growth dynamics—even more important than capital, labor and resource inputs. Advances in technology and interdependencies between new ideas and new investment provide the basis for entire new industries and products that generate additional wealth and raise living standards.

Innovation-based growth is so powerful because it avoids the classic problem of diminishing returns on any given investment. With this type of growth, once the fixed cost of creating a new technology has been incurred, the formula can be used over and over again at little or no cost. As such, there can be increasing returns paying enormous dividends to society.

Moreover, the new innovation-based growth theory

posits a strong reciprocity among the rate of skill acquisition by workers, investments in new capital and new inventions. Thus, programs that combine incentives for innovation along with resources to augment human capital should fuel rapid economic growth more than anything else society can do to promote prosperity.

What is special about the Massachusetts Life Sciences Initiative is that it focuses explicitly on increasing the rate of innovation by encouraging more research and development (R&D) in the life sciences and helping small firms in this super cluster convert basic research into marketable products and services. New growth theory posits that this activity is the very fountain of economic growth.

## Has the MLSC Been Successful?

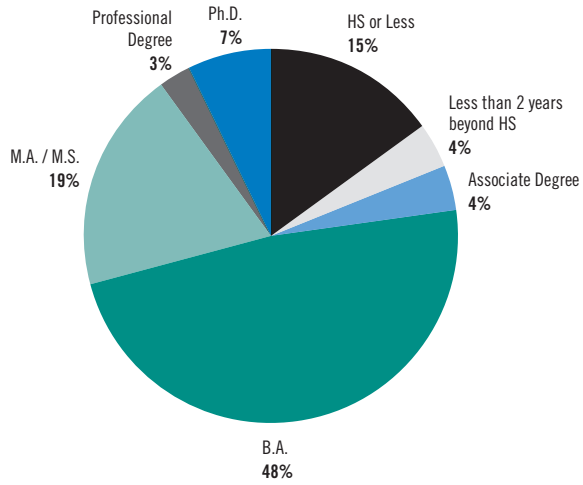
Unfortunately, keeping score on the success of innovation is difficult. Instead of a more-or-less certain return to a given infusion of capital under the old growth theory, under the new growth theory, innovation tends to deliver stronger long-term growth but it is "lumpy, discontinuous, and nonlinear." There can be a long gap between the time a new innovation is first incorporated into production and the time that it pays off in terms of increased productivity, output and jobs. In the short term, it can be discouraging, as investments in fundamental innovation usually have little immediate payoff. It will take decades to realize the full benefits to humanity and the economy from the advances now being made in drug discovery, medical diagnostics and medical devices.

What we can do is measure the short-term direct benefits of MLSC investments and consider the views of experts as to whether the Center has indeed played a critical role in creating a life sciences "ecosystem" that attracts investment and generates jobs in this sector.

### Short-Term Benefits

As for the short-term benefits, we conducted a cost-benefit analysis of the Center's tax incentive program. According to our analysis based on MLSC data, the total value of tax incentives outstanding to Massachusetts life sciences firms as of June 30, 2012 was $56.6 million. Our best estimate is that a little over 2,500 jobs were created as a result of these incentives. Given the average $105,000 salary of these jobs, we predict they will generate more than $266 million in wages and salaries during the next five years. If our analysis proves correct, these workers will pay more than $93 million in state personal income and sales taxes during that period. As such, assuming all of these jobs were directly related to the tax incentives and that these jobs last at least five years, every dollar of tax incentive will repay $1.66 to state coffers, as **Table 2** reveals. This is an outstanding rate of return.

FIGURE 1
**Education Distribution of New Hires by 2010 MLSC Tax Incentive Awardees**




Source: Dukakis Center for Urban and Regional Policy

What is more, our analysis suggests that these jobs will go to a broad array of workers, not just those with advanced degrees. As **Figure 1** reveals, more than one in five jobs in life sciences firms require no more than a two-year associate's degree and nearly another half (48%) require no more than a bachelor's degree. Thus, the short-term benefits of MLSC tax incentives seem to have heavily outweighed the costs and the job benefits are broadly shared.

## The Unique Growth Pattern of Regional Life Sciences Clusters

The most important benefits stemming from MLSC activities, however, will come in the future. This is due to the unique growth pattern of highly innovative sectors like the life sciences. The regional concentration of life-sciences companies happens in a very different manner than in other industries. In the case of traditional industrial sectors such as auto, aircraft engine, financial services and the like,

TABLE 2

## Economic Return on the MLSC Tax Incentive Program

| | Program Year 2009 | Program Year 2010 | Program Year 2011 | 3 Years of Incentives |
|---|---|---|---|---|
| Total Value of MLSC Tax Incentives ($) Outstanding | $15,245,500 | $20,672,638 | $20,340,884 | $56,259,022 |
| Net New Jobs Created | 901 | 721 | 915 | 2,537 |
| Tax Incentive per Job ($) | | | | $22,175 |
| Annual Tax Incentive per 5-year job ($) | | | | $4,435 |
| Average Salary per Job ($) | | | | $105,037 |
| Total Salaries Generated per Year ($) | | | | $266,479,399 |
| State Income Tax Revenue per Job per year ($) | | | | $4,937 |
| Total State Income Tax per year ($) | | | | $12,524,532 |
| Average Sales Tax per Job ($) | | | | $2,404 |
| Total State Sale Tax per year ($) | | | | $6,099,447 |
| Total Income+Sales Taxes per year ($) | | | | $18,623,979 |
| Average Income+Sales Tax/Job per year | | | | $7,341 |
| Total Income+Sales Taxes per 5-year Job | | | | $36,705 |
| Total Income+Sales Taxes over 5 years | | | | **$93,120,585** |
| **Tax Revenue/Incentive Ratio over 5 years** | | | | **1.66** |
| | **Pharma** | **Medical Devices** | **Scientific Research** | **Total** |
| Jobs | 1,843 | 481 | 213 | 2,537 |
| Average Salary ($) | $115,222 | $66,913 | $103,009 | $105,037 |
| Total Salary ($) | $212,353,256 | $32,185,280 | $21,940,863 | $266,479,399 |
| Share of Salary | 0.7969 | 0.1208 | 0.0823 | 1.0000 |
| State Income Tax By Sector ($) | $9,980,603 | $1,512,708 | $1,031,221 | $12,524,532 |
| Sales Tax by Sector ($) | $4,860,554 | $736,689 | $502,204 | $6,099,447 |

Source: Dukakis Center for Urban and Regional Policy

a region becomes dominant in a particular cluster once a large anchor enterprise or a small number of them establish operations in that locale. Once the anchor enterprise is established, an array of smaller firms is attracted to that region to serve as part of the supply chain for the large anchor enterprise(s). Essentially, the small firms in the industry are dependent on the large ones.

For the life sciences and other highly innovative sectors, the reverse is true. The large companies that depend on the development of breakthrough innovations and sophisticated medical devices prosper by being near a concentration of small start-up firms. Even the largest of the life sciences companies, with substantial research budgets, do not have the resources to generate more than a handful of breakthroughs in the biosciences, genomics and similar fields. These big firms grow and prosper by carefully monitoring the scientific discoveries under way in university research laboratories and in the translational research carried out by small start-ups.

Those few start-ups that develop potential blockbuster drugs or devices become prime targets for acquisition by the larger firms. The secret to success in the acquisition process is being where the small firms are located. This permits the large companies to closely monitor the progress of smaller firms and buy the most promising ones before "Big Pharma" competitors or other medical device manufacturers can make a bid. To use a metaphor from nature, the large, globally important life sciences firms want to feed in the waters where the minnows are swimming.

Because Massachusetts has so many small life sciences firms, nine of the world's ten major drug companies have now set up shop in the Commonwealth. They are

investing billions in plant and equipment and creating thousands of additional jobs. These include Pfizer, Novartis, Johnson & Johnson, GlaxoSmithKline, Sanofi (which absorbed Genzyme), AstraZeneca, Abbott Laboratories, Merck and Bristol-Myers Squibb.

And here is the key to understanding the central role of the MLSC: While the large firms can easily exist without the MLSC's direct investments, the small life-sciences ventures need the Center to provide them with accelerator loans, research and development funds, and interns who can help them translate their ideas into commercially viable products. While the private venture capital market may provide some funds for this purpose, venture capitalists often demand a quicker return than can be obtained from this sector, which often has long lag times between initial research, proof of concept and a final product approved by the U.S. Food and Drug Administration.

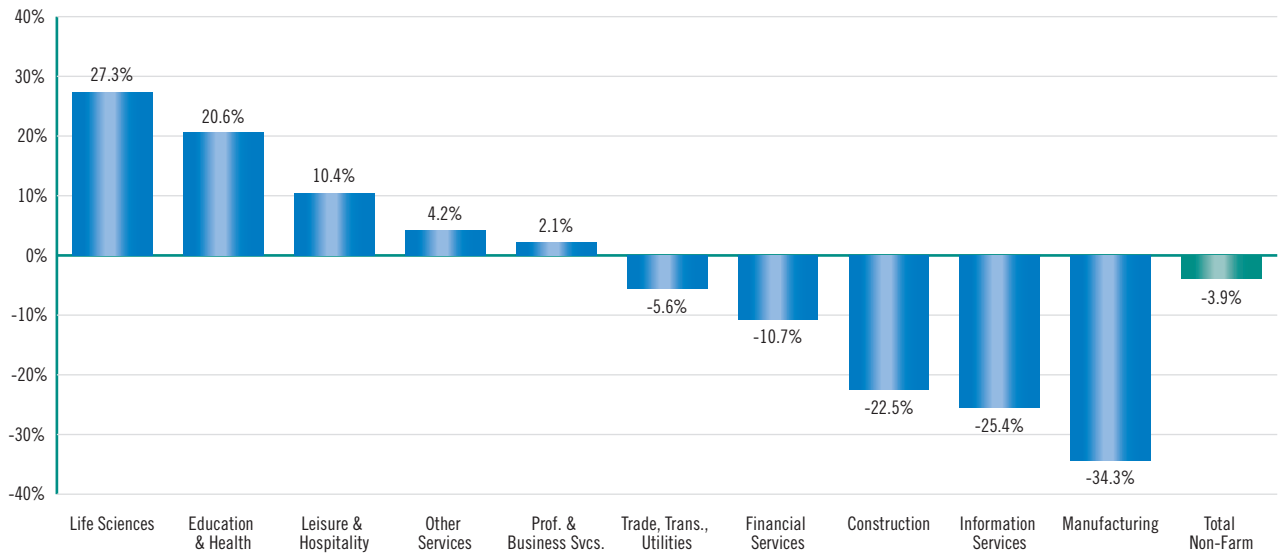
In this environment, the MLSC has become an important investment partner for smaller life sciences firms that grow out of local research universities and medical centers. By providing funds for translational research and development, the MLSC can help keep these growing companies in the Commonwealth instead of losing them to investment funds in other regions. To revert to metaphor again, it's because these minnows stay here that Big Pharma has come to swim in this pond. In addition, Big Pharma benefits from the Center's investments in workforce development, shared infrastructure resources and cooperative research projects between industry and academia. The result has been extraordinary output and employment growth.

## The Massachusetts Life Sciences: A Record of Output and Employment Growth

The numbers are, indeed, impressive. As of 2012, according to the Massachusetts Biotechnology Council (MassBio), 1,198 life sciences companies were operating in New England and employing 103,006 workers. More than half of these firms are located in Massachusetts. Of all the Massachusetts firms listed in the 2012 MassBio directory, about half (514) are medical device companies; 232 are drug development firms; 147 are contract research and manufacturing enterprises and 146 produce research products and instrumentation for the life sciences.

The rapid growth in employment in the life sciences in Massachusetts provides a strong indication of how rapidly this sector is expanding. As **Figure 2** reveals, the life sciences far outpaced all other industry sectors between 2001 and 2011.

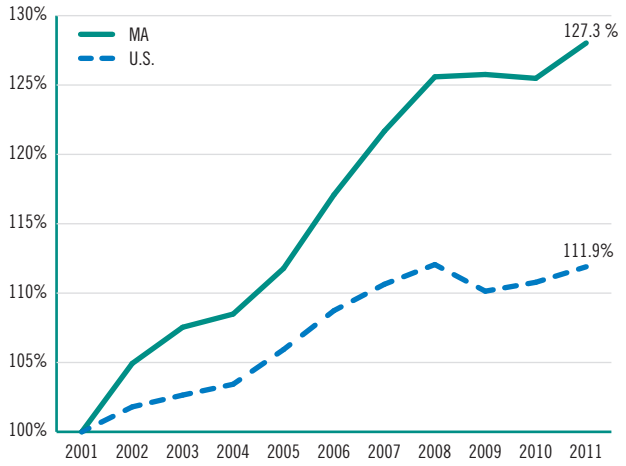
FIGURE 2
**Massachusetts Employment Growth by Industry Sector 2001–2011**




Source: BLS, Author's Analysis

FIGURE 3

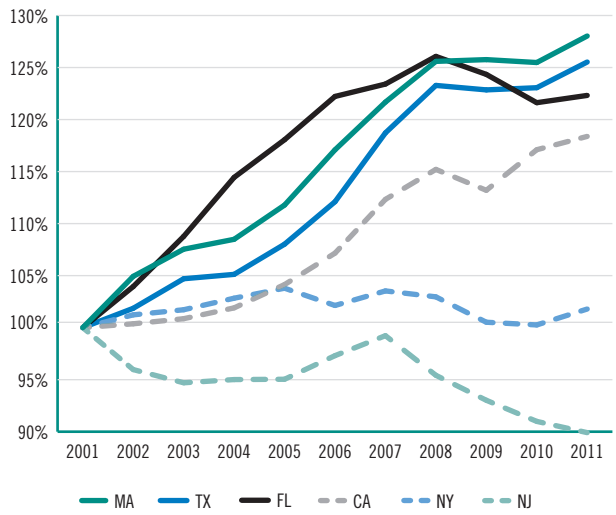
### Employment in Life Sciences Indexed to 2001, Massachusetts vs. the U.S.




Source: Author's Analysis from BLS data

FIGURE 4

### Employment in Life Sciences Indexed to 2001, Massachusetts vs. Big Competitor States




Source: Author's Analysis from U.S. Bureau of Labor Statistics (BLS) data

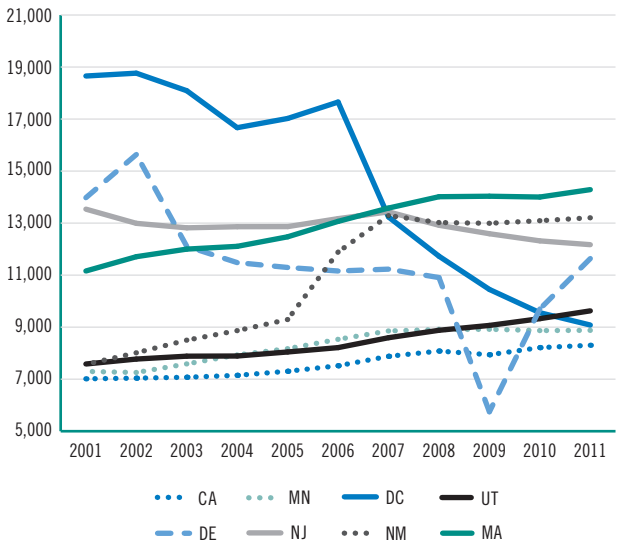
Even more impressive is the Boston-area super cluster's performance relative to the United States as a whole and to other states vying for supremacy in this rapidly evolving cluster of industries. The Commonwealth has indeed overtaken the rest of the nation in terms of employment growth in the life sciences, fulfilling an initial goal of the MLSC. **Figure 3** reveals the trend in life sciences employment in Massachusetts compared to that of the United States as a whole between 2001 and 2011. During this period, Massachusetts life sciences employment growth outperformed the nation by a factor of better than 2-to-1—growing by 27.3 percent vs. 11.9 percent for the nation.

The Commonwealth's main competitors in the life sciences are California, New Jersey, New York, Florida and Texas. But as **Figure 4** demonstrates, after 2008, the Commonwealth overtook all of these states in terms of the 2001-2011 employment growth rate.

Moreover, when we control for population size, Massachusetts is the clear winner for the entire life sciences cluster of industries. In **Figure 5**, we have controlled for the size of population of each state by measuring the number of life sciences jobs per 1 million residents. By 2011, given its rapid growth rate, the Massachusetts cluster had risen to #1 in terms of per-capita life sciences employment. With nearly 14,300 life sciences jobs for every 1 million residents, Massachusetts eclipsed all other states on this measure.

FIGURE 5

### Life Sciences Jobs per 1 Million 2010 Population Top 8 States in 2011, by Year




Source: Author's Analysis from BLS data

With this growth dynamic at work, Massachusetts appears well positioned to continue to attract new investment in the life sciences super cluster. In a 2011 analysis of the established life sciences clusters worldwide, the commercial developer Jones Lang LaSalle concluded that Boston had become the #1 region for the life sciences. The report noted the Boston area's concentration of high-tech research and hospital/medical employment, its many science and engineering graduate students, its plentiful funding from the National Institutes of Health and venture capitalists, its investment in R&D as a percentage of state GDP and its research facilities. Boston had a composite score of 7, ranking it #1 overall. New York/New Jersey was #2 with a composite score of 24, followed by the Bay Area and Los Angeles in California, each with a score of 25. Boston remained #1 in the developer's 2012 report, while San Diego, the San Francisco Bay area, Raleigh-Durham, N.C., and Philadelphia overtook New York/New Jersey and Los Angeles.

## Why Has the MLSC Been So Successful at Building the Life Sciences Ecosystem?

According to our interviews, the Center's successful record of investments in the life sciences is grounded in its reliance on a Scientific Advisory Board (SAB) along with a large panel of experts to guide the Center's Board of Directors in determining which firms show the greatest promise. This approach to distributing public funds has created credibility within the super cluster and its ecosystem. Over and over again, we heard adjectives like "rigorous" and "diligent" when our informants described the processes MLSC uses in selecting awardees and providing a platform for collaboration.

The interviews we carried out also suggested that the Center itself is being run quite effectively and efficiently and in a highly professional manner. Virtually all of our informants praised the management team and expressed special appreciation for the leadership's refusal to permit political considerations to trump scientific merit. Because the Scientific Advisory Board (SAB) selects awardees, "There is not an ounce of boondoggle in this agency," one informant told us. Another observed that the MLSC has "lots of moving parts" and all of them are working well. Several of the interviewees observed that the Center remains responsive to industry needs, meets its deadlines and stays focused on its mission. In its report on creating fiscally sound state tax incentives, the Pew Center on the States singled out the Massachusetts Life Sciences Tax Incentive Program for its focus on annual cost controls and its reliance on scientific merit in making awards.

Still another informant noted that the MLSC is successful because its leadership is committed to working "at the speed of business" and therefore has become a valued partner in the expansion of the industry.

## Conclusions

All of our research suggests that the state will benefit from fully funding the remaining five years of the initiative in order to maintain the lead the life sciences super cluster has established in the Commonwealth. This is particularly important as other states ramp up their investments in hopes of creating their own life sciences ecosystems to entice the small and large firms Massachusetts has successfully attracted. California, Maryland, New Jersey, New York, Minnesota and Florida are not resting on their laurels, but continue to spend state funds on their own life sciences industries.

Over time, it should be possible for the Center to reach out to the private sector to help fund more of its initiatives, as it has done with the newly established Massachusetts Neuroscience Consortium. This consortium, established in September 2012, combines the efforts of the MLSC with seven global biopharmaceutical companies to jointly fund pre-clinical neuroscience research at Massachusetts academic and research institutions. Based on this model and with the plethora of larger, profitable firms coming to the state to expand their operations, one could imagine the Center funding more of its internships with private funds and having for-profit companies contribute to other programs (STEM: science, technology, engineering and math education, for example), allowing the Center to focus even more of its resources on accelerator loans and tax incentives for firms undertaking translational research.

We should also note that the success of the MLSC has lessons for other quasi-public entities in the Commonwealth. We can mention five of them here:

1. Long-term success in the use of tax incentives and business loans is most likely to occur when funds are focused on a cluster of firms and a set of technologies in a given industry, helping to create an industrial ecosystem which can attract new companies to the state.

2. The use of expert panels to determine the awarding of loans assures that these funds will be well utilized. "Claw-back" provisions protect the taxpayers by requiring firms to repay funds advanced by the Commonwealth if they fail to meet hiring goals.
3. A focus on encouraging firms in their early stage innovation activity is central to promoting economic growth and prosperity.
4. Helping fund workforce development efforts for critical industries as part of the mandate of the quasi-public entity helps ensure a pipeline of skilled workers for the industry and this itself helps attract new firms to the region.
5. Taking a "portfolio" approach to the entire range of activities in the life sciences—from investments in small innovative firms to helping train the future workforce to underwriting infrastructure—helps sustain the "ecosystem," undergirding a virtuous cycle of discovery, innovation, investment, and employment opportunity.

In the end, we applaud the Governor and the Legislature for their foresight in creating the Massachusetts Life Sciences Center and the $1 billion Life Sciences Initiative and we tip our hat to the MLSC for carrying out its public responsibilities in a most effective and efficient manner. The programs in place are fulfilling the goals set out in the original legislation and the Center's leadership has ensured that these programs work to the full benefit of the Commonwealth and its residents.

# Introduction

The Massachusetts Life Sciences Initiative, conceived by Governor Deval Patrick's Administration and passed into law by the Massachusetts Legislature in July 2008, is a bold 10-year, $1 billion investment in the future of the state's economy. Based on the region's existing comparative advantage in the life sciences emanating from the laboratories of its leading universities and medical institutions, this substantial infusion of public funds was squarely aimed at making this cluster of industry sectors—including biotechnology, pharmaceuticals, medical diagnostics, medical devices, and bioinformatics—the most successful in the world. The Massachusetts Life Sciences Center (MLSC), founded two years earlier, was charged with the responsibility of implementing this bold experiment in public-private sector collaboration. If effective, the initiative was expected to boost investment and jobs in this evolving industrial sector, generating increased household income and tax revenue for the state.

In 2012, at the near halfway point of that 10-year initiative, the Dukakis Center for Urban and Regional Policy at Northeastern University was invited by the MLSC to measure the progress of the life sciences sector in Massachusetts and to carry out an evaluation of the Center's activities. We agreed to conduct such a study, but only under the condition that we would have full access to MLSC records, that our investigation would not be censored in any way by the MLSC staff, and that the staff of the Dukakis Center would have absolute control over the content of the final evaluation report. As a result, this report is being published by the Boston Foundation as part of its *Understanding Boston* series.

For the past year, Barry Bluestone, Director, and Alan Clayton-Matthews, Senior Research Associate at the Northeastern center, have carried out this evaluation. Both of us are economists who have extensive experience in industry studies and in program evaluation. Neither of us, however, was an expert on the life sciences sector when this evaluation project was first launched.

In the course of this research, we immersed ourselves in literature about the components of the life sciences industry cluster and about the role of public investment in innovation and economic growth. We analyzed existing employment data on each of the life sciences industries in the state; reviewed all of the annual reports of the MLSC; attended meetings of the MLSC Board of Directors where decisions over tax incentives and awards were made; and conducted lengthy interviews with leading executives of life sciences companies located in the state, industry trade association leaders, and members of the MLSC Scientific Advisory Board. This report is based on all of the data gathered over the year.

We began this research fully agnostic about what we might ultimately find, given the checkered record across the country of state industrial policy aimed at assisting other industries. But what we have found, based on our research, is that the Commonwealth's life sciences initiative is meeting, if not exceeding, the goals first established in 2008 by the Governor and the Legislature. Moreover, our interviews with key informants led us to the conclusion that the Massachusetts Life Sciences Center is executing its responsibilities in an effective, efficient, and professional manner. The initiative and the MLSC has performed exceptionally well in creating an *ecosystem* within which the cluster has prospered.

Moreover, we have concluded that the Center's mission, administration, and performance provide important lessons that can be applied to other state agencies charged with encouraging economic development.

This research could not have been carried out without the assistance of the staff of the MLSC and the many industry executives and experts who provided us with data and candid answers to our probing questions. We thank them all for their time and the information they afforded us.

CHAPTER ONE

# About the Massachusetts Life Sciences Center

In June 2006, the Massachusetts Legislature created a new quasi-public agency, the Massachusetts Life Sciences Center (MLSC), to promote the life sciences within the Commonwealth. It was tasked with "investing in life sciences research and economic development . . . by making financial investments in public and private institutions."[1] Its mandate was broad: to encourage basic research, development, and commercialization in the biosciences; ensure the preparation of a skilled workforce to meet the needs of the state's bioscience industry cluster, and build stronger collaboration between the sectors of the local and international life sciences community.[2]

A year later, in May 2007, Governor Deval Patrick revealed an ambitious plan for a 10-year, $1 billion public initiative to enhance the Commonwealth's existing competitive advantage in this rapidly evolving and critically important sector of the U.S. economy. This would provide the funding for a major expansion in the activities of the Life Sciences Center. In June 2008, the legislature enacted the Governor's Massachusetts Life Sciences Initiative with the aspiration of building on the existing strengths of the state's research universities, its world-renowned health care sector, and its emerging private sector life sciences firms to promote the Commonwealth as the foremost center for the life sciences in the world.

*With such a large commitment of state resources, how close has the Center come to meeting this goal? Has it helped attract life sciences companies to the Commonwealth, boosted R&D in the private life sciences arena, created job opportunities for Massachusetts workers and increased the state's revenue base by boosting employment, household income, and corporate profits?*

This analysis of the MLSC comes at a propitious time. Massachusetts, along with most of its cities and towns—not to mention the nation as a whole—faces growing fiscal constraints. The economic recession that officially began in late 2007 and officially ended in 2009 has given way to an extended period of sluggish economic growth. This has diminished tax revenue just when the swelling cost of health care and public pensions is generating structural deficits.[3] Without additional tax revenue from more vigorous growth, these potential deficits will require either raising taxes or cutting public services, or both.

In this new economic environment, virtually every unit of government is being forced to husband its resources and scrutinize its spending to assure that every tax dollar is spent effectively and efficiently. As such, it is not surprising that the nation, the Commonwealth, and most of its municipalities are considering ways to cut "unnecessary" or "wasteful" spending. At the same time, they want to preserve essential public programs that meet critical social needs and improve the targeting of incentives to the private sector to accelerate economic growth.

A prime target in this new era of public scrutiny is the extensive set of "subsidies" and "tax expenditures" that governments have traditionally used to encourage specific types of consumption or investment. Every tax dollar that a government agency transfers to a private business or individual in the form of a *subsidy* means a dollar less that can be used in the short-term for other purposes. Every dollar that a business or individual saves on its taxes is an "uncollected" dollar—a *tax expenditure*—that could have been used to pay for one or another public service.[4] Because of the short-run "opportunity costs" attached to every dollar spent, there is a growing demand to ensure that public dollars are not being wasted on programs that have little payoff. Each program must be judged on whether the *long-term* gain from issuing a tax incentive, government grant, loan guarantee, or subsidy outweighs the *short-term* cost to the treasury.

Adding to the demand for more accountability has been a recent series of high-profile cases of "failed" government incentive programs. Solyndra, a manufacturer of solar photovoltaic systems, became the poster child for "misspent" federal funds during the last presidential campaign when it filed for bankruptcy after receiving

$535 million in U.S. Energy Department loan guarantees.[5] The same was true when A123, a manufacturer of lithium ion batteries for electric cars, went bankrupt after receiving a $130 million federal grant to build a plant in Michigan. It was, according to a series of *Washington Post* reports, the fifth clean-energy firm the current Washington administration subsidized with loans or grants that filed for bankruptcy protection. During the campaign, Republicans claimed both Solyndra and A123 were prime examples of "cronyism" in President Obama's stimulus program.[6]

Closer to home was the failure of Curt Shilling's 38 Studios video-game firm. It closed its doors and laid off all of its employees after Rhode Island lured it from Massachusetts with a $75 million loan guarantee. This case raised anew an old question. Under what circumstances should states use tax abatements, subsidies, and other inducements to encourage investment and create jobs in the private sector?[7]

As the Massachusetts Life Sciences Initiative approaches the halfway mark in its 10-year legislative life, it is altogether appropriate that this report attempt to ascertain whether, and to what extent, the Massachusetts Life Sciences Initiative has already produced tangible positive gains for the Commonwealth, and whether maintaining the initiative will likely produce even greater long-term benefits for the state's residents and taxpayers.

For the purposes of this report, we define the Life Sciences cluster as consisting of sixteen (16) specific 6-digit NAICS industry sectors as shown in **Table 1**.[8] These include two research and development industries, two laboratory industries, two medical distribution

TABLE 1
**Life Sciences Sectors**

| Group | NAICS | Title |
|---|---|---|
| 1 | 325411 | Medicinal and Botanical Manufacturing |
| 1 | 325412 | Pharmaceutical Preparation Manufacturing |
| 1 | 325413 | In-Vitro Diagnostic Substance Manufacturing |
| 1 | 325414 | Biological Product (except Diagnostic) Manufacturing |
| | | |
| 2 | 334510 | Electromedical and Electrotherapeutic Apparatus Manufacturing |
| 2 | 334516 | Analytical Laboratory Instrument Manufacturing |
| 2 | 334517 | Irradiation Apparatus Manufacturing |
| | | |
| 3 | 339112 | Surgical and Medical Instrument Manufacturing |
| 3 | 339113 | Surgical Appliance and Supplies Manufacturing |
| 3 | 339114 | Dental Equipment and Supplies Manufacturing |
| | | |
| 4 | 423450 | Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers |
| 4 | 424210 | Drugs and Druggists' Sundries Merchant Wholesalers |
| | | |
| 5 | 541711 | Research and Development in Biotechnology |
| 5 | 541712 | Research and Development in Physical, Engineering, and Life Sciences (except Biotechnology) |
| | | |
| 6 | 541380 | Testing Laboratories |
| 6 | 621511 | Medical Laboratories |

Source: Battelle and the Biotechnology Industry Organization (June 2012)

sectors, and ten different manufacturing industries.[9] The cluster also includes the life sciences departments in universities and medical institutions in the Commonwealth.[10]

As of 2012, according to the Massachusetts Biotechnology Council (MassBio), there were 1,198 life sciences companies operating in New England employing 103,006 workers, the vast majority of these firms located in Massachusetts. More than one-third of these New England firms were founded after 2004 and 80 percent are relatively small with sales under $100 million a year. More than two out of five of these firms (43%) have annual sales of less than $5 million. Of all the Massachusetts firms listed in the 2012 MassBio directory, about half (514) are medical device companies; 232 are drug development firms; 147 are contract research and manufacturing enterprises; and 146 produce research products and instrumentation for the life sciences.[11]

CHAPTER TWO

# The Size and Scope of Public Tax Expenditures and Public Subsidies

To begin our assessment, it is useful to put the Commonwealth's $1 billion investment in the life sciences into perspective. According to the Congressional Research Service, at the federal level there are over 200 separate tax expenditures which taken altogether are projected to cost the U.S. Treasury more than $1.1 trillion in FY2014.[12] The bulk of these take the form of exemptions, deductions, and exclusions from the personal income tax such as the mortgage interest deduction. These tax provisions are intended to encourage such "virtuous" behavior as home ownership, charitable contributions, and family saving.[13]

While paling in comparison to these personal tax expenditures, federal corporate subsidies cost the Treasury almost $100 billion a year, according to research conducted by the Cato Institute.[14] A full quarter of these go to farmers in the form of agricultural subsidies and crop insurance, but other subsidies underwrite applied research and development under way at defense contractors, energy companies, housing developers, airlines, AMTRAK, universities and research labs, the National Institutes of Health, NASA, and small businesses.[15] In searching for ways in 2013 to cut federal spending in order to reduce federal deficits, one can be certain that some, if not many, of these tax expenditures and subsidies will be reviewed for possible modification or elimination.

States and municipalities have also provided the private sector with billions in tax expenditures and subsidies. In a recent series of articles, a trio of *New York Times* investigative reporters found that across the nation, states, counties, and cities dole out over $80 billion in "business incentives" each year.[16] The key industries receiving such tax preferences and subsidies are manufacturing; agriculture; the oil, gas, and mining industries; and the film industry. Technology companies like Twitter and Facebook, according to the *Times* report, are not far behind.

The *Times* analysts collected data on all 50 states. In their review of Massachusetts, they found 48 state programs that provide nearly 1,500 grants or incentive packages to specific companies. The total annual cost to state and municipal governments for these programs was reported to be at least $2.26 billion, equal to seven percent of the state budget or $345 per capita. Of this total, more than a third ($786 million) take the form of corporation income tax credits, rebates, or reductions. Another $130 million is paid out by the state treasury in the form of cash grants, loans, or loan guarantees.

The *Times* reporters listed a group of 94 Massachusetts companies that received nearly $165 million in grants, tax incentives, and subsidies between 1994 and 2011. Of this total, 26 were life sciences companies accounting for $48.7 million or nearly 30 percent of the total. Among the companies receiving these funds were Vertex Pharmaceuticals, Organogenesis, Shire Human Genetics Therapies, Sanofi, and Cubist Pharmaceuticals. The company receiving the largest state subsidy, however, was Liberty Mutual, an insurance company. Between 2006 and 2009 alone, the Massachusetts Film Office doled out nearly $150 million in tax credits to film companies.[17]

States like Alaska, West Virginia, Texas, and Michigan spend two to three times as much per capita as Massachusetts on such business incentives, but other states including New Hampshire ($30), North Carolina ($69), California ($112), South Carolina ($194), New York ($210), Florida ($212), Oregon ($226), Connecticut ($241), and Ohio ($281) spend less.

Obviously, in a time of tight fiscal budgets, such expenditures of tax revenue need to be carefully evaluated as elements of what is known as "industrial policy"—government support of private business.

*To assure that this assessment of the Massachusetts Life Sciences Center is placed in proper context, we need to begin by considering the ways in which government can encourage private sector economic development in an efficient and effective way. In doing this, we need to pay particular attention to understanding the role of government-induced innovation in spurring economic growth.*This foray into these theoretical issues will provide us with guidance as to what types of government tax expenditures and subsidies are more likely to yield positive benefits for society and thereby help us to assess the value of the MLSC.

CHAPTER THREE

# Industrial Policy: Pros and Cons

For decades, economists have debated the role of government in the promotion of private industry. At various times in our history, the federal government has helped to establish industries that went on to be central to our economy. The growth of the nation's aircraft industry was aided by the U.S. Post Office, which subsidized airlines with lucrative air-mail contracts in the early days of air travel. In the aftermath of Sputnik, the federal government invested billions of research dollars into perfecting solid state guidance systems and software for rockets and missiles, helping to create what today is our high-tech universe of cell phones, the Internet, iPads, GPS devices, and a dizzying array of gadgets based on the integrated circuit and the software that runs them.

Yet, as a recent Center for Economic and Policy Research working paper put it, "For the past generation, the dominant view among economists was that giving businesses a free hand—that is, little regulation and low taxes—was the most important contribution governments could make to encourage productive investments. The corollary to this view was that, as much as possible, overall investments in the economy should be undertaken by the private sector, as opposed to any sort of government entity."[18]

The argument *against* a public "industrial policy" is that governments are not capable of "picking winners" and therefore too often waste tax dollars. The conservative Cato Institute claims that government subsidies inevitably distort economic activity and "create even larger failures than might have existed in the marketplace."[19] By aiding some businesses, others are placed at a disadvantage either by reason of having to pay higher taxes or having to compete with subsidized firms. Hence, diverting resources from businesses preferred by the market to those preferred by policy makers leads to losses for the overall economy."[20]

The argument *for* public investment in the private sector is that rather than "crowding out" private capital, public investments actually "crowd in" private investment and can be used to "incubate new technologies and help private businesses bring these innovations to the stage where they can be effective in the marketplace."[21] In brief, well-placed public funds in the private sector can yield large long-term gains at relatively modest short-term cost.

But what makes for "well-placed" public funds? A good part of the answer lies in whether the funds contribute significantly to a growing economy and increasing numbers of jobs.

## New vs. Old Growth Theory

In economics, there are two fundamentally different views about what contributes most to growth. What is now known as the "old growth theory" suggested that economic prosperity emanates from the accumulation of ever greater stocks of the fundamental ingredients of production: capital, labor, and natural resources. Those countries that find ways of increasing investment in plant and equipment, adding to labor supply, and extracting more natural resources are the ones that will become more affluent. Just consider the United States or Saudi Arabia versus poor countries in Africa or Southeast Asia. Clearly, without capital, labor, and natural resources, output cannot be produced.

While not completely discounting this approach to growth, a "new growth theory" has evolved that "places technological progress at the very epicenter of growth dynamics, rather than capital investment per se."[22] Advances in technology and interdependencies between new ideas and new investment provide the basis for entire new industries and products that create new wealth and raise living standards. "In the new model, technology provides the engine for sustained growth in the face of the diminishing productivity associated with additions to the stock of physical and human capital."[23]

In addition to avoiding diminishing returns, innovation-based growth has an additional salutary feature relative to other ingredients in the growth equation: Once the fixed cost of creating a technology has been incurred,

the formula can be used over and over again at little or no cost. Indeed, this *spillover* property is taken to be the defining characteristic of technology. As Paul Romer, one of the founders of new growth theory puts it, "The idea behind the transistor, the principles behind internal combustion, the organizational structure of the modern corporation, the concepts of double-entry bookkeeping—all these pieces of information and many more like them have the property that it is technologically possible for everybody and every firm to make use of them at the same time without additional costs."[24] As such, instead of diminishing returns to investment, there can be increasing returns.

Moreover, the new growth theory posits a strong reciprocity between the rate of skill acquisition among workers and the growth dividend society obtains from new capital and new inventions. *Thus, programs that combine incentives for innovation along with resources to augment human capital should, according to this theory, fuel rapid economic growth more than anything else society can do to promote prosperity.*

But here is the rub. Keeping score on the success of innovation is difficult. Instead of a more or less certain return to a given infusion of capital under the old growth theory, innovation under the new growth theory tends to deliver faster and stronger long-term growth, but it is "lumpy, discontinuous, and nonlinear."[25] There can be long lags between the time a new innovation is first incorporated into production and the time that it pays off in terms of increased productivity, output, and jobs. The introduction of the steam engine in the mid-18th century did not pay off in terms of improved productivity until the early 19th century.[26] In the short term, it can be discouraging, as investments in fundamental innovation usually have little immediate payoff.

To be productive, innovation needs to be perfected and diffused, and this takes time. According to a study of 265 major and minor innovations over the past couple of centuries, it took a typical new innovation forty-one years, on average, to move from the 10 percent to the 90 percent diffusion level.[27] The diesel locomotive, for example, was clearly superior to the steam locomotive, yet twenty years after the first diesel was introduced in 1925, there were still nearly ten steam locomotives in service for every diesel-powered engine. The first integrated computer circuits were introduced in the 1960s, but it was not until the 1990s that the full productivity premium of the computer generation was finally realized.[28] It will take decades to realize the full benefits to humanity and the economy from the advances now being made in drug discovery, medical diagnostics, and medical devices.

Unfortunately, in an era of intense concern over short-term deficits, it is often hard to marshall the patience needed to invest sufficiently in technological innovation or the firms that create it. As a corollary, investments made today in research and development (R&D) are often risky propositions from the perspective of the short-term balance sheet. Yet without massive infusions in R&D, continuous breakthrough innovation cannot occur. Nowhere is this truer than in the life sciences.

## Public Investment in R&D

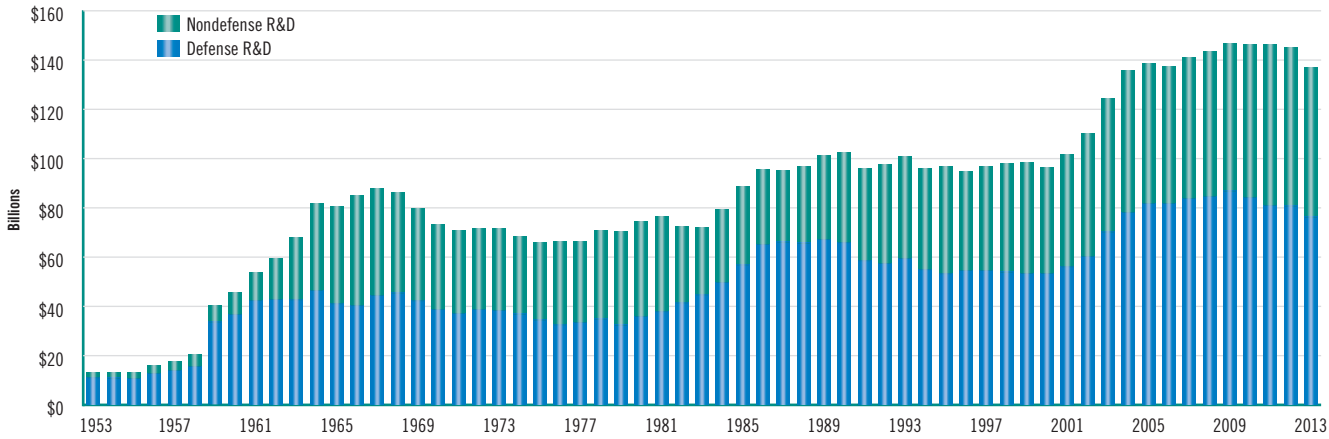
Worldwide, no country spends more than the United States on R&D, and this investment has played an important role in the nation's economic development, at least since World War II.[29] According to the Battelle Institute, total R&D spending in the U.S. reached $436 billion in 2012, of which about 29 percent ($126 billion) was supplied by the federal government while 64 percent ($280 billion) was provided by private industry. The remainder came from foundations and other non-profits ($14.5 billion), university-owned funds ($12.3 billion), and a tiny amount from state and local governments ($3.8 billion).[30]

Despite its smaller share of overall R&D funding relative to the private sector, the importance of the federal government in spurring innovation should not be underestimated. Without government investment, it is likely that private firms would underinvest in R&D, particularly basic research. The reason is that the social rate of return to investment in basic research often exceeds the private rate. Unlike investments in tangible capital such as machinery, the ideas flowing from R&D are, in the words of economists, "nonrival" and not fully "appropriable." *Nonrival* means that my learning of a new innovation does not prevent you from using it. When returns are not fully *appropriable*, the original innovator cannot gain all the profit that flows from the eventual application, especially the commercialization, of the new process or product.[31] In this case, firms will often wait for others to do the innovating. As Federal Reserve Bank Chair-

FIGURE 1

**Federal Spending on Defense and Nondefense R&D**

Outlays for the conduct of R&D, FY 1953–2013, billions of constant FY 2012 dollars




Source: American Association for the Advancement of Science

man Ben Bernanke recently reminded an audience at a Washington, D.C. conference, "James Watson and Francis Crick received a minute fraction of the economic benefits that have followed from their discovery of the structure of DNA."[32] Without government-sponsored basic research, society loses out on innovation.

Public sector R&D also encourages private sector R&D spending. Research reveals that there is a strong positive correlation between the trajectory of private R&D spending in a given year following public expenditures a year earlier.[33]

## The Trend in Federal R&D Spending

Given (1) the importance of innovation as the prime driver of economic prosperity, (2) the role of R&D in promoting innovation, and (3) the fact that without public funding of R&D total research investment would be suboptimal because of the inability of private investors to fully appropriate its monetary benefit, how much has the federal government invested in this vital factor?

As **Figure 1** reveals, federal spending on defense and nondefense R&D (in inflation-adjusted FY2012 dollars) rose sharply between 1953 and 1965 from less than $15 billion to more than $80 billion before dipping back to just over $60 billion in 1976. Spending was back to more than $100 billion by 1989 and remained flat through 2001. It rose sharply after that, increasing to over $140 billion by 2009. In FY 2013, under pressure to reduce federal spending, total federal R&D spending once again declined.[34]

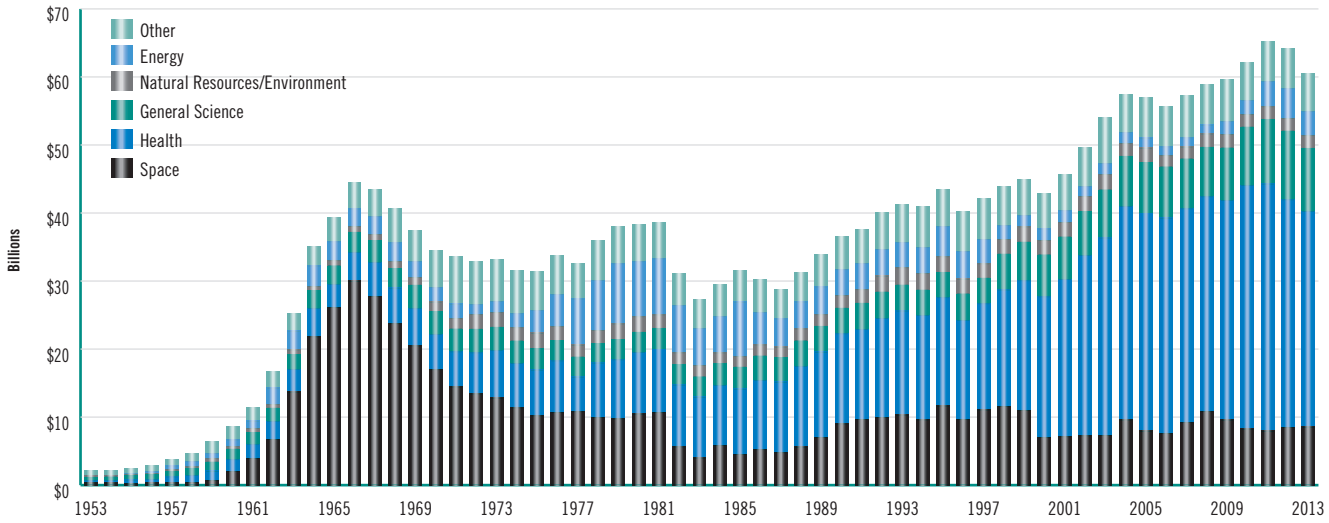
As **Figure 2** demonstrates, virtually *all* of this growth in non-defense federal R&D spending has been in the health field, mainly through the National Institutes of Health. While federally sponsored health research only accounted for about seven percent of total non-defense federal R&D spending in 1965, by 2013 it accounted for more than half (52%). Much of this basic public investment is going into the life sciences, and of all fifty states, Massachusetts trails only California in NIH funding. In 2011, California institutions received $3.5 billion in NIH funding; those in Massachusetts received $2.5 billion.[35] Yet, on a per capita basis, the Commonwealth swamps all other states in NIH funding, obtaining four times as much as the Golden State.

This growth in federally sponsored R&D seems impressive, but as a share of the nation's Gross Domestic Product (GDP), the federal government's role is roughly half of what it was in the early 1960s (**see Figure 3**). Spending rose rapidly in the 1950s and 1960s, surpassing 1.9 percent of GDP in 1964, up from just 0.7 percent in the early 1950s.[36] Much of this was in direct response to the Soviet Union's launching of Sputnik and President John F. Kennedy's goal of sending a man to the moon before 1970. After reaching its nadir of just 0.67 percent in 2000, it has slowly climbed back to 0.85 percent today.[37]

FIGURE 2

**Trends in Nondefense R&D by Function, FY 1953–2013**

Outlays for the conduct of R&D, billions of constant FY 2012 dollars




Source: American Association for the Advancement of Science

As we have seen, new growth theory suggests that our nation's prosperity is intimately tied to the rate of innovative activity. If innovation slows down, growth will suffer. Hence, the big question is whether the United States can maintain its rate of innovation activity into the future and thereby sustain economic prosperity and full employment.

## The Role of R&D Investment at the State Level

As noted above, states have historically played a minor role in funding research and development. Their $3.8 billion spent in FY2012 amounted to less than 1 percent of total spending on R&D and no more than 3 percent of government-sponsored R&D. Indeed, given that the full benefits from basic research cannot be easily appropriated by the funder, it might seem foolish that an individual state would spend its own revenue on investments that can be appropriated by entities in other states.

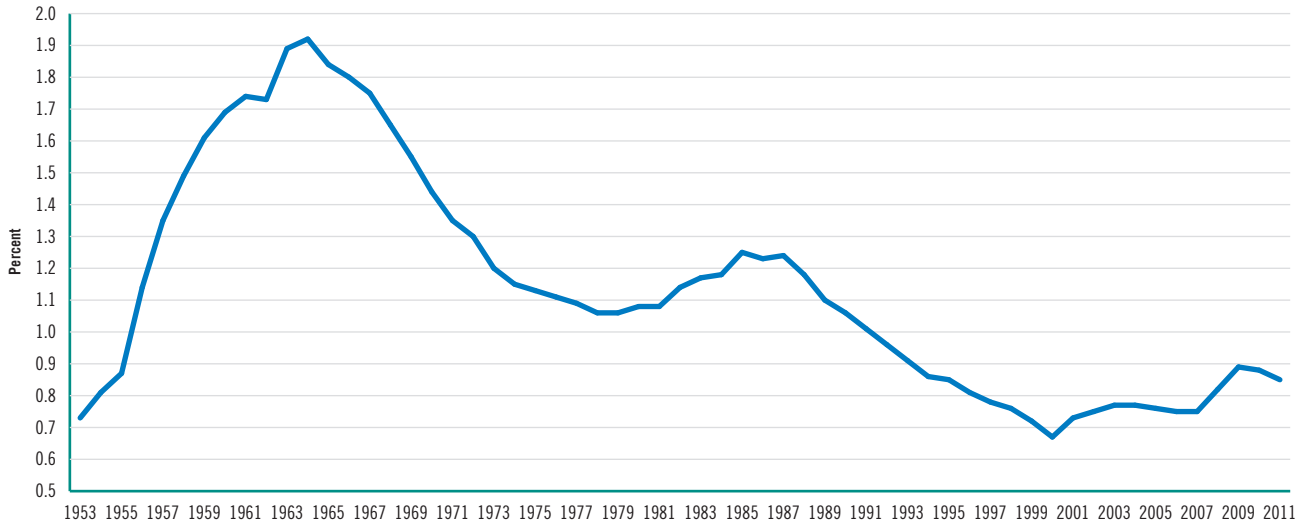
*So why should a state invest anything in R&D?*

Invested in the appropriate industries, public funds can help encourage the growth of an industrial cluster in a given region that, once incubated, can maintain a self-sustaining locational advantage that provides a magnet for new private investment in the region's cluster. Such locational advantages are called *agglomeration economies* and refer to the benefits, savings, or cost reductions resulting from the clustering of economic activities.[38] The clustering of such industries can give rise to an "industrial climate" or "ecosystem" that is self-perpetuating as the result of a regional congregation of specialized facilities, labor pools, education and training institutions, and specialized legal, accounting, and financial services.

Such agglomeration economies explain the economic success of most metropolitan areas. In New York City, for example, the cluster of financial industries and advertising is responsible for much of the growth in wealth. The birth of the early auto industry in and around Detroit in the early part of the 20th century would ultimately allow Detroit to take advantage of agglomeration economies and blossom into the world's "Motor City" by the end of World War II. By 1949, the median family income of Detroiters was higher than that of any other city in America except Chicago (whose residents enjoyed a 1949 median family income exactly one dollar higher), and 29 percent above the national figure.[39] Chicago's prosperity was built on being the transportation hub for America. Seattle became the center for jet aircraft production.

In the postwar period, the most successful new indus-

FIGURE 3
**Federal Spending on R&D as Percent of GDP**
**FY1953–FY2012**




Source: National Science Foundation "Science and Engineering Indicators 2012"

trial cluster was built in Silicon Valley in and around Palo Alto, California. Beginning in 1939 with the founding of Hewlett-Packard— the brainchild of two Stanford graduate students—the valley would attract a host of firms that would ultimately build the modern computer industry and make this region one of the wealthiest in the world.[40]

In the case of Detroit, local, state, and the federal governments essentially subsidized the auto industry through the public provision of streets, roads, and highways. Chicago's prosperity was underwritten by public subsidies to the railroads. Seattle's aircraft industry has benefited not only from the early airmail contracts but from massive defense spending that provided most of the resources needed to develop both military and then commercial jet airframes and jet engines.[41] While private venture capital has played a major role in the success of Silicon Valley, the federal government has played a significant role as well. From less than $10 million in 1960, federal research funding of computer science climbed to almost $1 billion by 1995, while the U.S. expenditure on research in electrical engineering (which includes semiconductor and communications technologies) has fluctuated between $800 million and $1 billion since the 1970s. According to the National Research Council, such funding "has constituted a significant fraction of all research funds in the computing field, particularly underwriting academic research. Federal support has constituted roughly 70 percent of total university research funding in computer science and electrical engineering since 1976."[42]

*The lesson is that the prosperity of many metropolitan areas has been stimulated in large measure by public investments in particular industry clusters. Given an early start in an industry, public funds can help build the agglomeration economies that in turn cement a single region's leadership in that industry nationally and globally. The Massachusetts Life Sciences Center was established precisely to this end. How successful has it been?*

CHAPTER FOUR

# The Emergence of the Massachusetts Biotechnology Super Cluster

In 2010, four scholars at the Massachusetts Institute of Technology (MIT) developed a schematic to explore the complement of elements needed to produce a successful American biotechnology cluster.[43] This schematic is summed up in **Table 2**. The schematic includes three innovation stages and four critical factors. Based on this matrix, the team was able to describe all of the aspects of what they called the Massachusetts Biotechnology Super Cluster.

A thriving science-based cluster must take basic research and transition it into commercial products and services. To do this requires funding, skilled labor, a legal framework that protects intellectual property (IP), and a diverse set of industries that includes both new innovative firms as well as established ones. As the authors suggest, "inadequacies in any area can threaten the cluster."[44]

As a whole, the U.S. biotechnology cluster benefits from access to both public and private sources of funding. These include, on the public side, NIH, the Department of Defense (DOD), Small Business Innovation Rewards (SBIR) to support basic research; foundation support from private nonprofits; and, on the for-profit side, angel and venture capital (VC) investors who provide funds for translating basic research into new products and services. The cluster is also supported by public and private customers for its end products, which at times are subsidized through tax expenditures and subsidies.

The talent pool for this sector ranges from creators and craftspeople who play the role of principal investigators on research grants and contracts, entrepreneurs who form new firms to commercialize the output of the sector and workers who range from those with just a high school diploma to those with Ph.Ds.

To be successful, the cluster must also enjoy a legal system that protects intellectual property through patents and licenses and IP enforcement in the courts.

Long-term success for the cluster also requires a diverse set of "tradable agglomerating" companies comprised of new innovative enterprises that can power future

TABLE 2
**The Prototypical American Biotechnology Cluster**

| Critical Factors | | Innovation Stages | | |
|---|---|---|---|---|
| | | Basic Research | Translation | Commercialization |
| Funding | Public | NIH | DOD, SBIR | Payers, Tax Policy |
| | Private | Foundations | Angel, VC, Industry | Customers |
| Talent | Creators | PIs | Entrepreneurs | Senior Execs |
| | Craftspeople | Grad Students | BA/MS/PhD | HS - PhD |
| Laws & Norms | Intellectual Property | Bayh-Dole | Patentability & Scope | IP Enforcement |
| | Experimentation | New Field Encouragement | Independence Over Security | Reinvention |
| Diversity | Tradable Agglomerating | Stem Cells | RNA, Interventional Imaging | Biologics |
| | Tradable Converging | Bio-processing | Molecular Diagnostics | Biomanufacturing |
| | Local Sustaining | Medical Centers | Science Parks | |

Source: Trusheim, Berndt, Murray, and Stern, 2010

growth through the development of breakthrough products, "tradable converging" firms which remain globally competitive in existing products, and a set of local entities including medical centers and science parks that provide local services to the cluster.

A good deal of this requires a collaborative form of industrial policy with both the federal and state government playing major roles in the emergence of the cluster. In the 1950s, the federal government continued its funding of R&D in the biosciences as part of its Cold War strategy. The VC model was invented and the first high-tech firms founded. In the 1970s, the federal government declared a "War on Cancer" with NIH funding, while the first recombinant DNA experiments were undertaken in university laboratories and private research firms.

In 1980, the Bayh-Dole Act was adopted, giving universities IP ownership of the output from federally funded research while the first recombinant DNA products hit the market. In the Commonwealth, the Massachusetts Biotechnology Council was created in 1985, one of the first in the nation. In the 1990s, the first genomics companies were founded, led initially by Millennium Pharmaceuticals (established by a former Genentech executive).

Much of this early work came to fruition in the first decade of the 21st Century. During this period, the human genome was sequenced and the George W. Bush administration committed itself to doubling the NIH budget.

Here in the Commonwealth, a final piece of the cluster puzzle was put in place with the founding of the MLSC, followed by the state's funding of the Life Sciences Initiative to help cement the region's lead in this important cluster and maintain that lead into the future. With all of the other parts of the matrix in place in Massachusetts, the state became a magnet for Big Pharma.

By the end of the first decade of the 21st Century, Massachusetts was home to 9 of the top 10 major drug companies in America, surpassing New Jersey. Pfizer, Novartis, GlaxoSmithKline, Genzyme's successor Sanofi, AstraZeneca, Abbot Laboratories, Merck and Bristol-Myers Squibb had all committed to operations in the Bay State. The largest of these big firms, in order of employment, are Genzyme (Sanofi), Pfizer, Biogen Idec, Novartis, Shire, Thermo Fisher Scientific, EMD Millipore, Vertex, Parexel International, and Hologic.[45] Only the Swiss pharmaceutical giant, Roche—the world's third-largest biopharma firm—has not moved into Massachusetts.[46]

According to a separate comprehensive analysis of the global life sciences cluster completed in 2011, the commercial developer Jones Lang LaSalle concluded that Boston had become the #1 region for the biosciences based on its concentration of high tech research and hospital/medical employment, its number of scientific and engineering graduate students, its level of NIH and venture-capital funding, its investment in R&D as a percentage of state GDP, and its thousands of square feet of academic and research institute facilities. Boston had a composite score of 7 ranking it #1 overall. New York/New Jersey was #2 with a composite score of 24, followed by the Bay Area and Los Angeles each with a score of 25.[47]

CHAPTER FIVE

# The Massachusetts Life Sciences Center

What role does the MLSC play in the MIT schematic? Beginning with its creation, the MLSC took as its strategic mission the role of pulling together all of the parts of the matrix into a life sciences ecosystem, creating a dense, highly connected community of scholars, entrepreneurs, industry leaders, venture capitalists, and government officials dedicated to the success of the life sciences super cluster in the Commonwealth. Unlike many state economic development initiatives, the Center has a broad range of strategic priorities geared to enhance all aspects of the life sciences cluster. These include:

- funding translational research—research that converts basic research into marketable products and services
- investing in promising new technologies
- ensuring worker skill acquisition that aligns with the needs of the life sciences industries
- creating new infrastructure from shared resources that accelerates innovation
- building partnerships between sectors of the local and international life sciences communities

To accomplish these goals, the Center relies on a portfolio of seven distinct programs.[48] These include:

**Cooperative Research Grants**—Supports industry-sponsored research at universities and facilitates scientific discoveries that lead to medical applications. These grants of $250,000 per year for up to two years match industry contributions dollar for dollar.

**Internship Challenge Program**—Provides up to $7,200 in funds for interns working at Massachusetts companies with fewer than 100 employees and fewer than 250 globally.

**New Investigator Grants**—Spurs innovative research and advances the careers of new investigators who are working on cutting-edge research at Massachusetts academic research centers with grants of $100,000 per year for up to three years.

**Life Sciences Accelerator Program**—Provides financing of up to $1 million for early-stage companies to help leverage additional sources of capital.

**Small Business Matching Grant (SBMG) Program**—Provides matching support capped at $500,000 per company to firms on the verge of commercializing new technologies developed using Phase II or Post-Phase II Small Business Innovation Research (SBIR) awards or Small Business Technology Transfer (STTR) grants from the federal government.

**Life Sciences Tax-Incentive Program**—Issues a combination of 10 competitively awarded tax incentives available to companies that meet specified hiring goals. These include:

- A refundable 10% investment tax credit[49]
- A refundable in-state research tax credit
- A refundable job creation tax credit (50+ jobs)
- A refundable FDA user fee credit
- Extension of net operating losses to 15 years
- Deduction of orphan drug clinical testing
- Elimination of the sales factor throwback provision
- Special sales tax exemption
- Life sciences research credit for out-of-state costs
- Construction sales tax exemption

**Capital Projects Fund**—Provides capital for equipment and supplies for high schools in Gateway Cities, vocational/technical schools, and community colleges; and for capital projects in academic/research institutions, business incubators, and other not-for-profit organizations in the Commonwealth.

Between 2008 and June 30, 2012, the Center had directly invested or committed over $300 million that has leveraged more than $1 billion in third-party investment, according to the MLSC's report for fiscal year 2012. If none of that investment would have been made in Massachusetts in the absence of the MLSC commit-

ments, each dollar of taxpayer money spent by the Center resulted in the attraction of $3.40 in additional, outside investment creating a public-private investment fund of more than $1.3 billion.[50]

There are four factors that make the MLSC quite different from most government subsidy programs:

- Instead of simply providing tax benefits to a few private firms to lure them to the Commonwealth, the MLSC has a portfolio of investment tools that include direct investments in life sciences companies; grants to academic organizations and medical centers and grants for "shovel ready" public and non-profit sector capital projects that help influence the location decisions of life sciences companies.
- The MLSC operates under a Board of Directors that includes state government officials, industry CEOs, leaders from academia and medicine, bioscience researchers and others who have great knowledge of the life sciences.
- Investments are reviewed by a panel of more than 200 experts who send their recommendations to the Center's Scientific Advisory Board, which itself is dominated by academic researchers, industry scientists and private venture capital experts who together can judge the scientific and economic potential of an MLSC investment.
- The Center insists on accountability in terms of private sector investment matches and specific job creation goals and retains the power to "claw back" tax incentives and other investments when these goals are not reached by grant recipients.[51]

In the four-year period between June 2008 and June 2012, the Center invested nearly $190 million in 12 capital projects, provided 31 company grants and loans worth nearly $23 million, issued 35 academic research grants with a value in excess of $23 million and 56 tax incentives (still outstanding) valued at close to $57 million, invested $7 million to fund 884 interns as part of the Center's mission to help develop the life sciences workforce, provided more than $3.3 million in equipment and supply grants to schools and spent $1.5 million on other grants including the funding of business plan competitions. As of June 30, 2012 the Center was managing a portfolio of approximately 200 grants, loans, and tax incentives.[52]

Examples of *infrastructure activity* as listed in MLSC's FY2012 report include:

- $5 million in support of the construction of the Joslin Center's Translational Center for the Cure of Diabetes
- $10 million to the Dana Farber Cancer Institute to support the expansion of its $20 million Molecular Cancer Imaging Facility
- $5 million to the Boston Museum of Science for the construction of its "Hall of Human Life," which helped leverage $11 million in private financing
- $14.6 million to the University of Massachusetts Dartmouth to build its new Massachusetts Biomanufacturing Center in Fall River
- $10 million to UMass Lowell to equip laboratories within its new Emerging Technologies and Innovation Center
- $14.3 million to help build the Framingham Wastewater and Pumping Station that will allow bioscience firms to operate in that community

Examples of accelerator loans awarded in FY2012 to provide working capital to early stage life sciences companies include:

- $750,000 to Allurion of Wellesley for developing a novel medical device for inducing weight loss in obese patients
- $750,000 to Alcyone Lifesciences, Inc. for the development of a micro-catheter for treating neurological conditions
- $245,000 to Strohl Medical for the creation of a medical device for accelerating the treatment of stroke victims

Subsequent to receiving accelerator loans, early stage firm recipients have raised more than $100 million in either private or public funding to grow their firms or in acquisition proceeds. Already six firms that have received accelerator loans have paid them off early, permitting the MLSC to construct a revolving fund, thus expanding the resources the Center has for this purpose.

In addition to the accelerator loans, the MLSC has begun a Small Business Matching Grant Program (SBMG), which complements funds received by firms from NIH, the National Science Foundation (NSF), and DOD. In 2012, the Center awarded a $500,000 grant to Firefly BioWorks, Inc. of Cambridge after full review by the

MLSC Scientific Advisory Board. The company has already been able to launch its first commercially viable product for help in diagnosing cancer, neurological disorders, and other diseases.

Examples of matching grants for academic research include:

- $5.1 million in grants to early career investigators working in research institutions within the Commonwealth which have in turn helped generate over $13 million in federal government, foundation, and private company research grants
- $4.8 million in cooperative research grants (between 2008 and 2011) to encourage industry-sponsored research at Massachusetts institutions, resulting in more than $8.6 million in research grants from other sources

Examples of the $20.6 million in 2011 program tax incentives to 26 life sciences companies include $3 million to Shire HGT, Inc.; $2.45 million to Vertex; $2.3 million to AVEO Pharmaceuticals; and $1.84 million to Biogen Idec MA, Inc. Smaller tax incentives of less than $500,000 went to such firms as Blueprint Medicines Corporation in Cambridge and T2 Biosystems, Inc. in Lexington. Under the Life Sciences Act, the Department of Revenue has the authority to "claw back" incentives from companies that the Center determines have not met the minimum job creation thresholds in their tax-incentive agreements.

In addition, the MLSC Internship Challenge Program has placed more than 1,000 interns in more than 290 companies across the state where host companies provide dedicated mentors to help expand the pool of prospective life sciences workers for the future. Those college students receiving MLSC internships are majoring in biology, engineering, chemistry, business, computer science and physics and end up interning in companies that produce medical devices, pharmaceutical products, diagnostic services, and biotechnology research. In FY2012, the Center also awarded $180,000 to four programs to encourage science, technology, engineering and math (STEM) education, especially for women and minorities.

**Table 3** provides a summary of the investments made by the MLSC between June 2008, when the Life Sciences Initiative funding first became available, and June 2012.

TABLE 3

**Distribution of MLSC Investments by Dollar Amount June 2008–June 2012**

| | |
|---|---|
| Capital Projects (12) | $186,950,000 |
| Company Grants and Accelerator Loans (31) | $22,907,000 |
| Academic Research Grants (35) | $23,346,344 |
| Tax Incentives (56) | $56,595,093 |
| Interns Funded for Workforce Development (884) | $6,903,164 |
| Equipment and Supply Grants or Schools (32) | $3,333,675 |
| Other Grants/Business Plan Competitions | $1,540,000 |
| **Total** | **$301,575,276** |

Source: Massachusetts Life Sciences Center, 2013

This comprehensive approach to an entire industry cluster differs significantly from other federal, state, and local incentive programs that target a single company or, at best, a single industry.

We can now ask: "*Has this approach, and the investments made through the MLSC, paid off?*"

We begin to answer this question by tracking output and employment in the life sciences cluster and consider the results in terms of the creation of the Center in 2006.

But given what we have learned about the role of innovation in spurring economic growth, we can ask a more fundamental question. "Has the creation of the Center and the Life Sciences Initiative paid off in terms of nurturing a rich 'ecosystem' within which the entire life sciences super cluster can flourish now and in the future, providing a platform for further growth in economic opportunity for Massachusetts residents?"

CHAPTER SIX

# Output and Employment in the Massachusetts Life Sciences Super Cluster

The life sciences super cluster began to benefit the Commonwealth by the middle of the last decade, even before the MLSC was established. By 2006, publicly traded companies in Massachusetts were already generating $30 billion in sales, an increase of nearly 50 percent in just four years. With $7.5 billion in exports, the Massachusetts life sciences sector accounted for 30 percent of total state exports.[53] Between 2001 and 2006, employment in Massachusetts life sciences industries increased by 13,000—more than 16 percent. The life sciences were generating jobs during a period when total non-farm employment in Massachusetts was actually *declining* by 2.8 percent. While total employment in the life sciences in 2006 accounted for just 26 out of every 1,000 jobs in the state, this sector was growing faster than any other, including education and health services (See **Figure 4**).

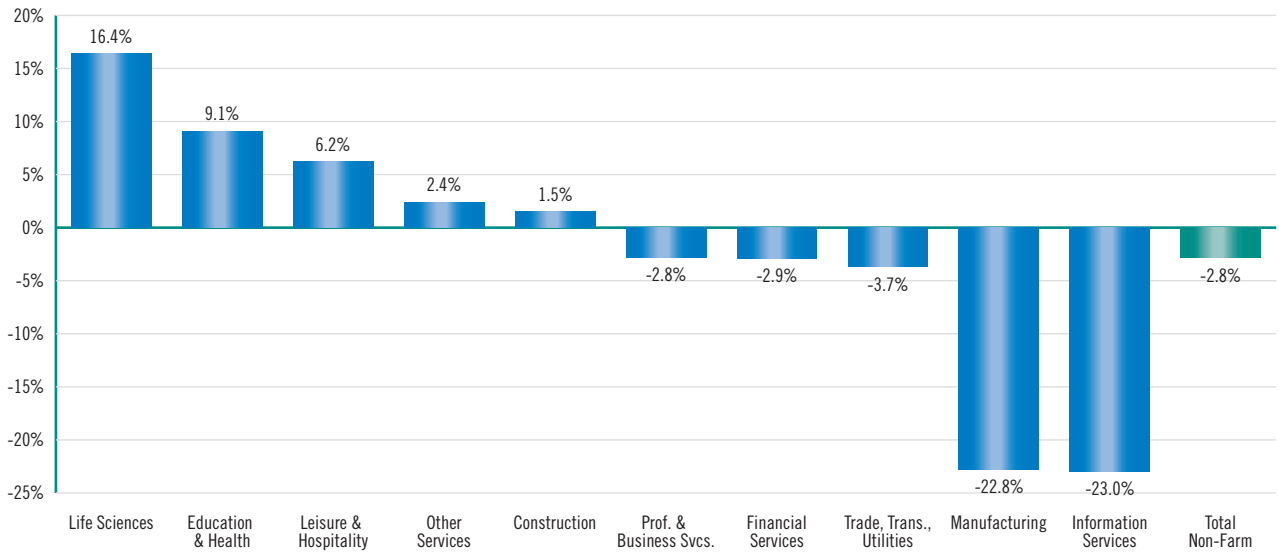
As **Figure 5** reveals, the life sciences cluster continued to generate jobs between 2006 and 2011, but not quite as rapidly as during the previous five years. However, it was still faster than every other sector save education and health services. The national recession that began at the end of 2007 weighed on the life sciences sector, as it did most other industries. Life sciences remained a small sector in terms of overall non-farm state employment, but given its faster growth, accounted for nearly 30 jobs out of every 1,000 in the Commonwealth by 2011.

Taking the entire decade (2001–2011) as a whole, the life sciences far outpaced all other industry sectors in terms of its employment growth rate as shown in **Figure 6**.

*Within* the cluster, however, the growth in employment has varied greatly across individual industry segments as shown in **Table 4**. During the entire period between 2001 and 2011, employment in research, testing, and medical laboratories increased by more than 50 percent, nearly twice as fast as the life sciences cluster as a whole (and 2½ times as fast as education and health services). Yet the production of medical devices—the

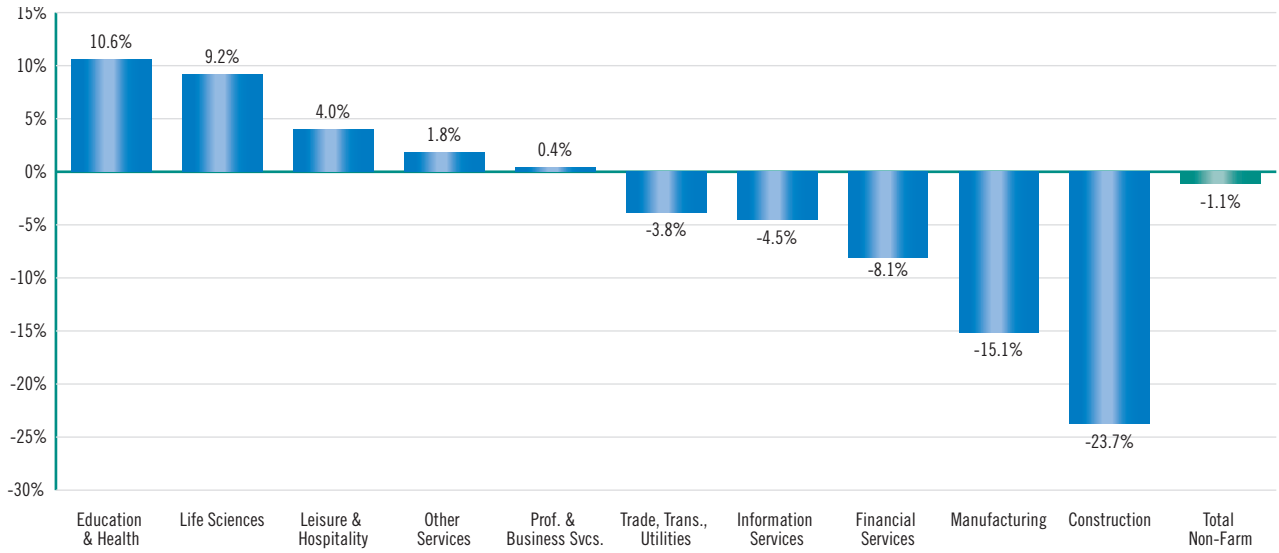
FIGURE 4

**Massachusetts Employment Growth by Industry Sector 2001–2006**



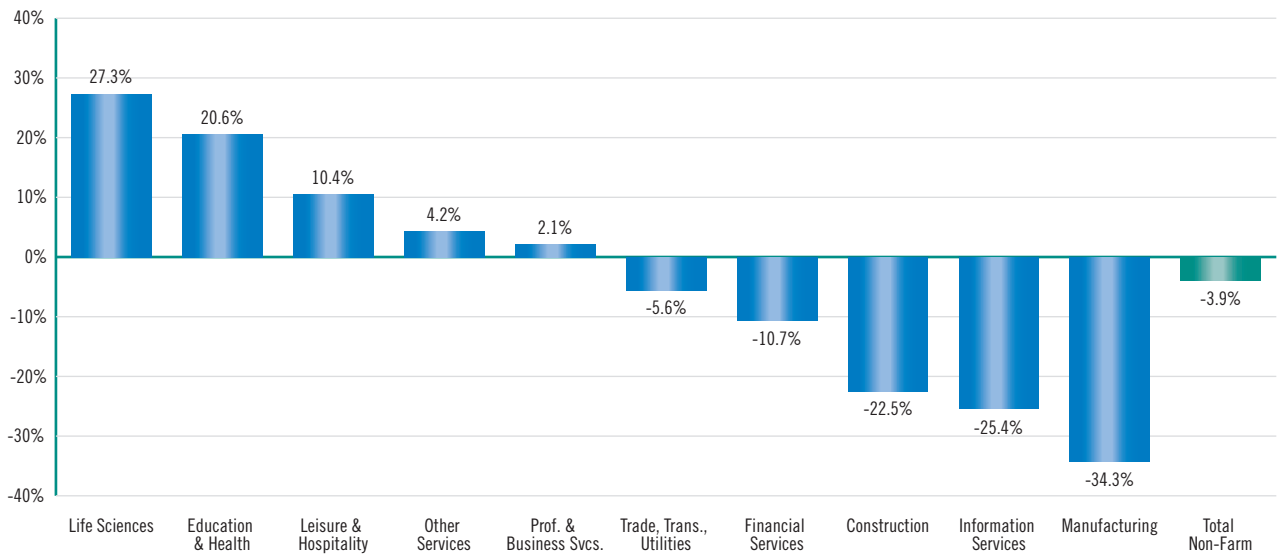

Source: Bureau of Labor Statistics, Author's Analysis

FIGURE 5
**Masssachusetts Employment Growth by Industry Sector 2006–2011**




Source: Bureau of Labor Statistics, Author's Analysis

FIGURE 6
**Massachusetts Employment Growth by Industry Sector 2001–2011**




Source: Bureau of Labor Statistics, Author's Analysis

key *manufacturing* segment of the life sciences cluster —remained nearly constant over this period, increasing by just 0.2 percent.

What is notable, however, is that the employment growth rate actually *increased* in the second period (2006–2011) for both the pharmaceutical industry and

TABLE 4
**Employment Change by Life Sciences Cluster Segment**

| | 2001 | 2006 | 2011 | % Δ2001–2006 | % Δ2006–2011 | % Δ2001–2011 |
|---|---|---|---|---|---|---|
| Drugs & Pharma | 7,794 | 7,944 | 8,537 | 1.9% | 7.5% | 9.5% |
| Medical Devices & Equipment | 22,835 | 21,645 | 22,882 | –5.2% | 5.7% | 0.2% |
| Research, Testing, & Medical Labs | 34,849 | 47,072 | 52,819 | 35.1% | 12.2% | 51.6% |
| Bioscience-Related Distribution | 9,607 | 10,877 | 11,377 | 13.2% | 4.6% | 18.4% |
| **Total** | **75,085** | **87,538** | **95,615** | **16.6%** | **9.2%** | **27.3%** |

Source: Bureau of Labor Statistics, Author's Analysis

medical device manufacturing, despite recession conditions nationally and regionally. Indeed, all four sectors in **Table 4** exhibited increased employment during this difficult economic period.

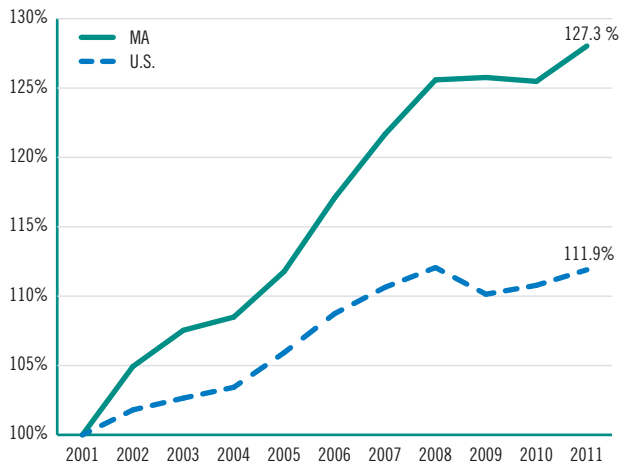
## Life Sciences Employment Trends: Massachusetts vs. the United States

The capacity of the Commonwealth's life sciences to create jobs at a faster pace during the past decade than all other major Massachusetts industries is one indicator of the successful development of this sector. Even more important is how the state's life sciences have performed relative to the country as a whole and other states vying for supremacy in this rapidly evolving cluster of industries. The data we have gathered on employment trends reveal that the Commonwealth has indeed overtaken the rest of the nation in terms of employment growth in the life sciences, fulfilling the initial goal of the MLSC.

**Figure 7** reveals the trend in life sciences employment in Massachusetts compared to that of the nation as a whole between 2001 and 2011. During this period, Massachusetts life sciences employment growth outperformed the nation by a factor of better than 2-to-1—growing by 27.3 percent vs. 11.9 percent for the nation.

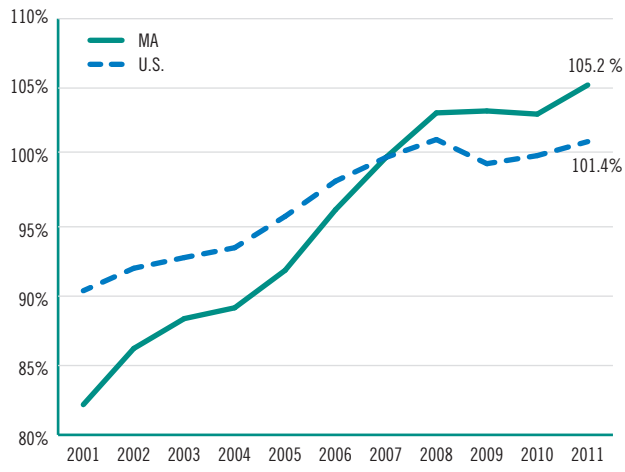
**Figure 8**, which indexes employment growth to 2007, reveals how the Commonwealth's life sciences cluster grew at a faster clip than the nation's, surpassing the nation and now remaining firmly ahead of it in terms of employment growth.

FIGURE 7
**Employment in Life Sciences Indexed to 2001, Massachusetts vs. the U.S.**




Source: Author's Analysis from BLS data

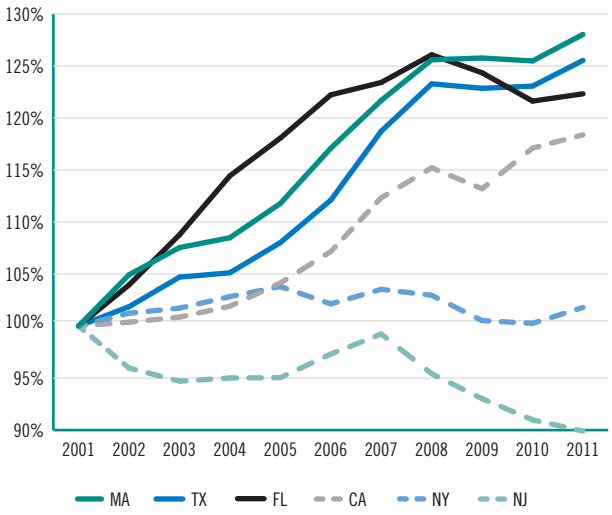
FIGURE 8
**Employment in Life Sciences Indexed to 2007, Massachusetts vs. the U.S.**




Source: Author's Analysis from BLS data

FIGURE 9

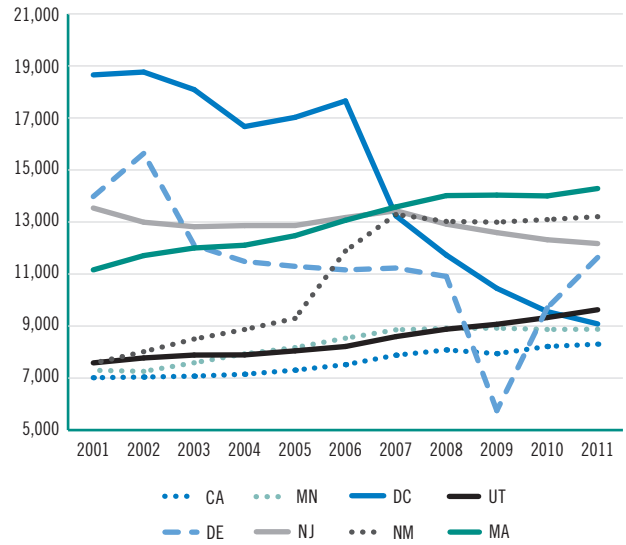
**Employment in Life Sciences Indexed to 2001, Massachusetts vs. Big Competitor States**




Source: Author's Analysis from BLS data

FIGURE 10

**Life Sciences Jobs per 1 Million 2010 Population Top 8 States in 2011, by Year**




Source: Author's Analysis from BLS data

The Commonwealth's main competitors in the life sciences include California, New Jersey, New York, Florida, and Texas. But as **Figure 9** demonstrates, after 2008 the Commonwealth overtook all of these states in terms of its 2001–2011 employment growth rate. Florida's nascent life sciences sector had been growing faster, but has fallen behind the Bay State during the past four years. Texas has been trying to catch up, but still trails Massachusetts. Over the decade, California's life sciences employment grew by just 18.4 percent compared with the Commonwealth's 27.3 percent. The growth rate in New York has been anemic, adding only 2 percent to its life sciences workforce while New Jersey, once the pharmaceutical capital of the nation, has seen its life sciences cluster decline sharply since 2007.

Even with Massachusetts's #1 position in the life sciences employment growth rate, it is not surprising that other states still have a larger absolute number of life sciences jobs. Of the top six states, Massachusetts ranked 5th in 2011, as **Table 5** reveals. California leads the pack with nearly 310,000 life sciences jobs.

Yet even as a much smaller state in total population, Massachusetts now leads all other states in the number of jobs in the vital biotechnology R&D sector within the life sciences super cluster. In 2011, the Commonwealth boasted more than 28,000 jobs, exceeding second place California (22,600) and third place Pennsylvania (11,200).[54] Since 2007, this particular sector grew faster in the Commonwealth than in any other state, adding more than 3,500 jobs.

When we control for population size, Massachusetts is the clear winner for the entire life sciences cluster of industries. In **Figure 10**, we have controlled for the size of population of each state by measuring the number of life sciences jobs per 1 million residents. In 2001, the District of Columbia actually had the highest per capita number of life sciences jobs, presumably because of the physical presence of the National Institutes of Health. Delaware ranked second followed by New Jersey. California actually lagged Minnesota, Utah, and New Mexico on this measure. Massachusetts ranked #4.

But by 2011, given its rapid growth rate, the Massachusetts cluster had risen to #1 in terms of per capita life sciences employment. With nearly 14,300 life sciences jobs per 1 million people, Massachusetts had eclipsed New Jersey (12,171) and continued to far outstrip California (8,300).

TABLE 5

**States with Largest Life Sciences Employment (2011)**

| | |
|---|---|
| California | 309,344 |
| New York | 109,750 |
| New Jersey | 107,007 |
| Texas | 96,969 |
| Massachusetts | 95,615 |
| Florida | 83,836 |

Source: Author's Analysis from BLS data

Clearly, the life sciences cluster has enjoyed stellar growth in the Commonwealth over the past decade, and it appears that after the MLSC was created, the pace of growth outdistanced all of Massachusetts's rivals.

Clearly, the life sciences are flourishing in Massachusetts and the timing of the sector's employment growth suggests at least a correlation between the creation of the MLSC and the ability of the state's life sciences super cluster to overtake the rest of the nation.

*But what evidence do we have of causation rather than simply correlation? What role has the MLSC played in the stellar growth of this set of industries? Here we find the interviews we conducted with key informants provided additional information on the role MLSC has played in this 21st-Century story of industrial success.*

CHAPTER SEVEN

# The Key Role of the MLSC: What We Learned from the Interview Data

To obtain a firsthand view of what part the MLSC may have played in the emergence of the Commonwealth's life sciences ecosystem, we conducted a series of "key informant interviews" with executives in the industry, with leaders of related trade associations, and with a number of scientists who have an intimate knowledge of the range of activities of the Center. In order to obtain an honest and unbiased assessment of the $1 billion initiative itself and the functioning of the Center, we assured each of our informants strict confidentiality. Interviews were carried out with executives in both large and small companies in the industry, with those mostly devoted to research and development, and with those whose companies are now involved with the manufacture of scientific and medical products.

While we probed on many fronts, we asked each informant to consider a fundamental "counterfactual": *Would the life sciences in Massachusetts be much different from what they are today if the MLSC had never been created and the state had not committed long-term funding to assist the array of universities, research institutes, and companies that make up the life sciences super cluster?* What we learned provided us with a vital and deeper understanding of the critical role the MLSC has played.

Here are our key findings.

## The Development of the Life Sciences "Ecosystem"

The leaders of large firms told us that given the scale of their operations, the MLSC plays at best a *minor direct role* in their own development, but an *immense indirect role* that helped to attract them to Massachusetts. The term that surfaced in virtually all of our interviews is "ecosystem," and that the MLSC has been central to the creation of the life sciences ecosystem that has made the Commonwealth more attractive than competing regions.

According to our interviews, the MLSC has indeed been instrumental in bringing together a tight-knit community of life sciences institutions including universities, research hospitals, small start-up bioscience firms, medical device manufacturers, and Big Pharma. These stakeholders all interact on a regular basis to assist each other in the promotion of their activities. The ecosystem includes the nurturing of small firms through the MLSC's accelerator-loan and tax-incentive programs, assistance to the life sciences research labs in the state's public higher education system, the provision of funds for student interns in relevant fields, and countless opportunities for executives, scientists, and industry employees to meet and explore opportunities for expanding the life sciences super cluster in the Commonwealth. The Center has been critical, according to our key informants, in helping to build a "platform" for the entire sector and cultivate a "collaborative gene" among all of its separate parts.

As one recent example of this role, the MLSC helped create the Massachusetts Neuroscience Consortium, announced at the 2012 BIO International Convention in Boston. With charter sponsors including Abbott Labs, Biogen Idec, EMD Serono, Janssen Research & Development LLC, Merck, Pfizer, and Sunovion Pharmaceuticals, Inc., the consortium provides an arrangement whereby companies that normally compete with each other collaborate on funding preclinical neuroscience research under way at academic and research institutions throughout the state. With leadership provided by the MLSC, each of the founding sponsors has pledged $250,000 toward this effort, and the Center will administer the funds.[55] The research results will be shared with all participants and all companies and academic researchers will have access to any tools developed as a result of these investigations. Without the Center playing this convening role, it is unlikely that such a consortium would have come into existence.

The Center has also been responsible for helping to nurture international cooperation among life sciences firms and academic institutions. The Center provided a $300,000 grant to the Northern Ireland Massachusetts Connection (NIMAC) for a new multinational research

study on non-invasive procedures to detect pre-malignant lesions. Finland and Catalonia have joined NIMAC as well. MLSC is also helping to develop alliances between Massachusetts companies and Israeli firms through the Massachusetts-Israel Innovation Partnership (MIIP). The Center has contributed $300,000 to this effort so far, funding two Massachusetts firms working in partnership with Israeli firms. A second round of funding for this program is pending.

All of these efforts are part of building an ever larger life sciences ecosystem based in the Commonwealth.

## The Unique Growth Pattern of Regional Life Sciences Clusters

The most important lesson we derived from our interviews, however, was the unique growth pattern of the life sciences cluster. The regional concentration of life-sciences companies happens in a very different manner than in other industries. In the case of traditional industrial sectors such as auto, aircraft engine, financial services and the like, a region becomes dominant in a particular cluster once a large anchor enterprise or a small number of them establish operations in that locale. Once the anchor enterprise is established, an array of smaller firms is attracted to that region to serve as part of the supply chain for the large anchor enterprise(s).

Once Detroit became home to Henry Ford's car company and General Motors and Chrysler built huge auto assembly facilities in Michigan, hundreds of small parts plants, design studios, and small engineering facilities opened their doors nearby in order to easily serve the industry's "Big Three." The same is true of the aircraft engine industry in New England dominated by Pratt & Whitney in East Hartford, Connecticut, and General Electric's Aircraft Engine facility in Lynn-Everett, Massachusetts. These massive facilities attracted hundreds of aircraft engine parts suppliers to New England, making the region one of the core jet-engine manufacturing centers in the United States. *Essentially, the small firms in the industry are dependent on the large ones.*

For the life sciences, the reverse is true. For companies that crucially depend on the development of breakthrough innovations and sophisticated medical devices, *the large firms prosper by reason of being proximate to a panoply of small start-up firms*. The reason for this is that despite their substantial research budgets, even the largest of the life sciences companies do not have the resources to generate more than a handful of breakthrough innovations in the biosciences, genomics, and other sophisticated fields. These large firms grow and prosper by carefully monitoring the scientific discoveries under way in university research laboratories and in the translational research carried out by small start-up firms. Those few start-ups that end up with potential blockbuster drugs or devices become prime targets for acquisition by the larger firms. Only a fraction of the long-term revenue generated by Big Pharma and the largest biotech and medical device companies has its origin in their own research labs. The majority comes from the absorption of successful smaller firms.

The secret to success in the acquisition process is being where the small firms are located. This permits the large firms to closely monitor the progress of smaller firms and buy the most promising ones before other Big Pharma or other competitors can make a bid. To use a metaphor from nature, the large, globally important life sciences firms want to feed in the waters where the minnows are swimming.

Pfizer, for one, has moved operations into Cambridge from other locations for this purpose.[56] In 2010, it announced that Cambridge would become one of Pfizer's worldwide research and development hubs, and it relocated approximately half of the current employees from its BioTherapeutics R&D organization to Kendall Square. A year later, Pfizer announced plans to move two existing research units, Cardiovascular Medicine (CVMed) and Neuroscience from Groton, Connecticut, to Cambridge, leasing 180,000 square feet of lab and office space from MIT to house these two research units.

In June 2011, Pfizer opened the Boston Centers for Therapeutic Innovation (CTI), an entrepreneurial network of partnerships with leading academic medical centers. According to the company, "these partnerships reduce the time and cost of drug discovery and development by accessing leading translational researchers."[57] Boston is also the global headquarters for the CTI network, which has established partnerships in New York City and San Francisco. The richness of the Massachusetts life sciences ecosystem prompted Pfizer to expand still further in the Commonwealth, with the company's newest building in Cambridge scheduled to be completed in 2013.

Over the past three years, Massachusetts is the only state where Pfizer has added jobs, not California, Connecticut, New Jersey, or New York. As an executive of this company told us in one interview, "Innovation between the big, the small, and the in-between is what makes the industry succeed." Another Pfizer executive noted that while his company has not taken a dollar from the MLSC, the Center has helped the firm by creating a "mentality" about the life sciences that has permeated the state right down to the local level, making it possible to speed local permitting and rezoning where necessary.

Executives at Sanofi-Aventis SA, which acquired Genzyme in 2011 in a $20 billion deal, have relied on the MLSC to "act as a bridge" between the company and such research institutions as the Cummings School of Veterinary Medicine at Tufts University and the University of Massachusetts Medical Complex in Worcester. Like Pfizer, Sanofi is expanding in Cambridge in order to have a "front row seat" for acquisitions.[58]

And here is the key to understanding the central role of the MLSC. *While the large firms can easily exist without the MLSC, the small life sciences firms need the Center to provide them with accelerator loans, research and development funds, and interns who can help them translate their ideas into what could be commercially viable products. While the private venture capital market may provide some funds for this purpose, venture capital often requires a quicker return than can be obtained from this industry, which often has long lag times between initial research, proof of concept, and a final FDA-approved product.*

In 2012, according to data gathered by PricewaterhouseCoopers, venture capital investments in biotech and health-care startups fell to their lowest level since 1995.[59] Investment in biotech firms in the Boston area dropped to $869 million in 2012, a 24 percent reduction from 2011 levels. Regulatory uncertainty facing the health-care industry is making this "a more challenging time for life sciences companies to raise money," according to Terry McGuire, general partner of Polaris Venture Partners, a Waltham-based VC firm with about half its portfolio invested in health-care companies.[60] Another reason biotech investments may be dwindling is that new software companies are on the rise and the return on investments in these firms tends to be much more "capital-efficient," paying off relatively rapidly.

The lack of easy access to VC funds has worried small life sciences firms about the "valley of death"—the gap in funding needed to move basic research into commercial products. In this environment, the MLSC has become an important investment partner for smaller life sciences firms, providing them with funds for translational research and development. These smaller firms may grow out of local research universities and medical complexes, but they can then turn to the MLSC for investment assistance. This tends to help keep them in the Commonwealth instead of losing them to investment funds in other regions.

In a number of cases, we found that smaller companies were being lured to relocate to other states, but according to their executives, the MLSC moved quickly to narrow the interregional cost differential and keep these firms in the Commonwealth. They did this through tax incentives and investment credits. And because these "minnows" stay here, Big Pharma has come from all over the world to swim in this pond. By helping to attract small life sciences companies to Massachusetts as well as incubating new ones begun in the state, the MLSC has created a well-stocked fishing ground for Big Pharma. In 2012 alone, a large array of small- and medium-sized domestic and international firms chose to establish operations in Massachusetts, including Era7 Bioinformatics, Algeta U.S., QServe, Scivax USA, ReproCELL, Inc., Human Metabolome Technologies, Inc., Alacrita, Arrayjet, ARGO Medical Technologies, BioAxone, BioSurplus, Promedior, and KeraFAST.

By the end of 2012, nine of the ten major drug companies in the world had set up shop in Massachusetts.[61] To house these firms, 3.4 million square feet of biotech-related office and laboratory space is now under construction across Massachusetts with massive buildings now being completed for Pfizer and Novartis. This adds to the 2.4 million square feet of commercial lab space erected between 2007 and 2011.[62] The other Big Pharma firms with major investments in Massachusetts are Johnson & Johnson, GlaxoSmithKline, Sanofi (which absorbed Genzyme), AstraZeneca, Abbott Laboratories, Merck, and Bristol-Myers Squibb. A decade ago, none of these global firms had a significant presence or any presence at all in the state, according to Mass Bio, the state's life sciences trade group.[63] Only Roche, the Swiss company and third largest biopharmaceutical firm in the world, has yet to establish a presence in the Commonwealth.

With this growth dynamic at work, Massachusetts appears well positioned to continue to attract new investment in the life sciences cluster.

## The MLSC "Modus Operandi"

In the course of this study, many of those interviewed commented on the protocols that the MLSC follows in carrying out its activities. According to these sources, the Center's success in funding firms is grounded in its reliance on a Scientific Advisory Board (SAB) to guide the Center's Board of Directors in determining which firms show the greatest promise of economic and scientific success. The Center has established a competitive process for securing assistance and the SAB has made certain that the process is transparent. Over and over again, we heard in our interviews words like "rigorous" and "diligent" when describing the processes MLSC uses in selecting awardees.

It should be noted that other states that have created similar life sciences initiatives have had a less-than-stellar record of maintaining a process free of political considerations. In early 2013, the Texas Legislature essentially defunded the state's Cancer Prevention and Research Institute (CPRIT), which had been established by referendum in 2007. This followed the resignation of the agency's chief scientific officer, along with many of the institute's high-profile grant reviewers, in protest over how the independent peer review system had been disrespected.[64] According to the chair of the MLSC's Scientific Advisory Board, here in the Commonwealth the Center has been scrupulous in following the recommendations of the Center's Board of Directors and the SAB.

This has apparently contributed to the Center's exceptional record of assisting firms that ultimately succeed and grow. Accountability measures implemented by the Center have also contributed to the success of the Center's tax program. As **Table 6** reveals, the Center had

TABLE 6

**Firms Receiving Tax Incentive Funding (Program Years 2009-2011)—Active Awards**

| | | Hiring Goal | Hiring Actual | % of Goal | Hiring Potential |
|---|---|---|---|---|---|
| 2009 | Shire | 150 | 153 | 102% | 153 |
| 2009 | Cubist | 58 | 60 | 103% | 60 |
| 2009 | Biogen | 50 | 235 | 470% | 235 |
| 2009 | Merrimack | 50 | 53 | 106% | 53 |
| 2009 | Lightlab | 29 | 32 | 110% | 32 |
| 2009 | Constellation | 26 | 21 | 81% | 26 |
| 2009 | Sepracor | 25 | 108 | 432% | 108 |
| 2009 | InfraReDX | 21 | 25 | 119% | 25 |
| 2009 | OmniGuide | 18 | 10 | 56% | 18 |
| 2009 | Organogenesis | 15 | 26 | 73% | 26 |
| 2009 | Dyax | 15 | 23 | 153% | 23 |
| 2009 | Still River | 10 | 18 | 180% | 18 |
| 2009 | Nova | 10 | 25 | 250% | 25 |
| 2009 | Infinity | 18 | 14 | 78% | 18 |
| 2009 | STD Med | 10 | 54 | 540% | 54 |
| 2010 | Shire | 150 | 141 | 94% | 150 |
| 2010 | Sanofil | 100 | 101 | 101% | 101 |
| 2010 | Vertex | 90 | 136 | 151% | 136 |
| 2010 | NX Stage | 50 | 27 | 54% | 50 |
| 2010 | Merrimack | 50 | 37 | 74% | 50 |

TABLE 6

## Firms Receiving Tax Incentive Funding (Program Years 2009-2011)—Active Awards *(continued)*

| | | Hiring Goal | Hiring Actual | % of Goal | Hiring Potential |
|---|---|---|---|---|---|
| 2010 | Ironwood | 37 | 56 | 151% | 56 |
| 2010 | Instrumentation Laboratory | 30 | 30 | 100% | 30 |
| 2010 | Valeritas | 18 | 10 | 56% | 18 |
| 2010 | Organogenesis | 17 | 44 | 259% | 44 |
| 2010 | Bluebird | 10 | 13 | 130% | 13 |
| 2010 | Bind | 10 | 8 | 80% | 10 |
| 2010 | NormOxys | 10 | –5 | –50% | 10 |
| 2010 | LeMaitre | 19 | 43 | 226% | 43 |
| 2010 | Foundation Medicine | 40 | 25 | 63% | 40 |
| 2010 | Lightlab | 14 | 45 | 321% | 45 |
| 2010 | Nova | 10 | 10 | 100% | 10 |
| 2011 | Shire | 100 | | | 100 |
| 2011 | Vertex | 100 | | | 100 |
| 2011 | AVEO Pharma | 94 | | | 94 |
| 2011 | Biogen Idec | 75 | | | 75 |
| 2011 | Ironwood | 75 | | | 75 |
| 2011 | DePuy Othopaedics | 50 | | | 50 |
| 2011 | Momenta Pharma | 50 | | | 50 |
| 2011 | PerkinElmer | 50 | | | 50 |
| 2011 | Organogenesis | 35 | | | 35 |
| 2011 | Aegerion Pharma | 27 | | | 27 |
| 2011 | Lightlab | 26 | | | 26 |
| 2011 | Cell Signaling Tech | 20 | | | 20 |
| 2011 | Quanterix Corp | 19 | | | 19 |
| 2011 | NinePoint Medical | 15 | | | 15 |
| 2011 | Pharmalucence | 12 | | | 12 |
| 2011 | Metamark Genetics | 11 | | | 11 |
| 2011 | New England Biolabs | 10 | | | 10 |
| 2011 | Nova | 10 | | | 10 |
| 2011 | T2Biosystems | 10 | | | 10 |
| 2011 | Boston Heart Diagnostics | 31 | | | 31 |
| 2011 | Ra Pharma | 10 | | | 10 |
| 2011 | Blueprint Medicines | 15 | | | 15 |
| 2011 | PAREXEL International | 32 | | | 32 |
| 2011 | Moderna Therapeutics | 13 | | | 13 |
| 2011 | Courtagen Life Sciences | 13 | | | 13 |
| 2011 | Knome | 12 | | | 12 |
| | **2009–2011 Awardees** | **1,160** | **1,578** | **136%*** | **2,639**** |

Source: Massachusetts Life Sciences Center

* Proportion of hiring goal for 2009–2010 active awardees only; no data available on 2011 awardees at this time

** Minimum total jobs created if, on average, all firms meet or exceed hiring

31 outstanding tax incentive packages from the 2009 and 2010 programs as of June 30, 2012.

In a number of cases, hiring targets were exceeded by a factor of four or greater. In only one case did a firm receiving an award actually reduce its staff. As of June 30, 2012, the currently active 31 awards from the 2009/2010 program have produced 1,578 new jobs, exceeding the aggregate hiring goal of 1,160 by 36 percent. Adding in the 2011 program awards for which we do not yet have data on hiring, the potential number of new hires could exceed 2,600 if all firms, on average, meet or exceed hiring goals.

As noted above, the accelerator loan program is also meeting with success, with six of the 20 firms that received such loans already repaying them in full.

**Table 7** provides additional data on the outstanding awards to firms from the 2009 program, the first year of the program. The outstanding amount of the tax incentive awards as of June 30, 2012 amounts to $15.25 million. Fifteen firms received tax incentive awards in that year totaling $15.25 million. They ranged in size from $6.3 million to Shire Human Genetic Therapies to $121,000 to STD Med, Inc. In 2009, these firms had a base headcount of 5,427. The target headcount associated with these awards was 5,932—an increase of 505 hires. By the end of 2011, 12 of these firms had met or exceeded their hiring targets.

What adds to the efficiency of these awards is a "claw-back" feature requiring firms that fail to meet their approved hiring goals to return to the Center the funds they were provided. A number of firms have done just that when they were unable to meet their specified minimum job-creation targets.

TABLE 7

## Annual Report: 2009 Tax Incentive Program Results—for annual reporting period ending December 31, 2011

| | | | Per Agreement | | | Actual | 2011 | Actual | |
|---|---|---|---|---|---|---|---|---|---|
| | | $ Award Provided | Base Hdct | Adds | Targeted | 12/31/2011 Hdct | Actual Growth (from base) | % of Adds (from base) | Achieved or exceeded target |
| | **COMPANY** | | | | | | | | |
| | **Active awards** | | | | | | | | |
| 1 | Shire Human Genetic Therapies, Inc. | $6,277,057 | 986 | 150 | 1136 | 1280 | 294 | 196% | Yes |
| 2 | Cubist Pharmaceuticals, Inc. | $1,740,000 | 355 | 58 | 413 | 415 | 60 | 103% | Yes |
| 3 | Biogen Idec MA, Inc. | $1,500,000 | 1899 | 50 | 1949 | 2134 | 235 | 470% | Yes |
| 4 | Merrimack Pharmaceuticals, Inc. | $1,500,000 | 124 | 50 | 174 | 214 | 90 | 180% | Yes |
| 5 | LightLab Imaging, Inc. | $188,951 | 64 | 29 | 93 | 141 | 77 | 266% | Yes |
| 6 | Constellation Pharmaceuticals, Inc. | $513,252 | 41 | 26 | 67 | 62 | 21 | 81% | No |
| 7 | Sepracor Inc. / Sunovion | $750,000 | 601 | 25 | 626 | 709 | 108 | 432% | Yes |
| 8 | Infraredx, Inc. | $630,000 | 60 | 21 | 81 | 85 | 25 | 119% | Yes |
| 9 | OmniGuide, Inc. | $ 540,000 | 62 | 18 | 80 | 72 | 10 | 56% | No |
| 10 | Infinity Pharmaceuticals, Inc. | $ 540,000 | 172 | 18 | 190 | 186 | 14 | 78% | No |
| 11 | Organogenesis Inc. | $ 245,240 | 241 | 15 | 256 | 311 | 70 | 467% | Yes |
| 12 | Dyax Corp. | $ 100,000 | 94 | 15 | 109 | 117 | 23 | 153% | Yes |
| 13 | Mevion (formerly Still River Systems), Inc. | $ 300,000 | 73 | 10 | 83 | 91 | 18 | 180% | Yes |
| 14 | Nova Biomedical Corporation | $ 300,000 | 498 | 10 | 508 | 533 | 35 | 350% | Yes |
| 15 | STD Med, Inc. | $ 121,000 | 157 | 10 | 167 | 211 | 54 | 540% | Yes |
| | **TOTALS** | $ 15,245,500 | 5427 | 505 | 5932 | 6,561 | 1,134 | | |

Source: Massachusetts Life Sciences Center

Based on wage and salary data from the companies receiving tax-incentive awards between 2009 and 2011, we carried out an economic analysis of the cost and benefit of this MLSC program. The results are found in **Table 8**. Our analysis suggests that as of June 30, 2012, the Center had $56.3 million in outstanding tax incentives. Altogether, the firms receiving these incentives added more than 2,500 jobs by 2012. The vast majority (1,843) of these were in pharmaceutical firms with the remainder generated by medical device companies (481) and scientific research enterprises (213). The average annual salary of these jobs exceeded $105,000. As such, these new jobs generated a total of over $266 million in wages and salaries each year.

Based on estimates from the Massachusetts Department of Revenue, we estimate that, on average, the added workers employed by these firms paid more than $4,900 in income taxes to the Commonwealth and $2,400 in sales taxes.[65] Assuming that each of these jobs lasts on average just five years, the added state revenue generated by these workers over that period is close to $37,000 per worker or a total of $93 million in tax revenue.

*Compared with the total cost of the incentive program, each dollar in awards will generate $1.66 to the state in added tax revenue*. This represents an extraordinary rate of return on this public investment.

TABLE 8
## Economic Return on the MLSC Tax Incentive Program

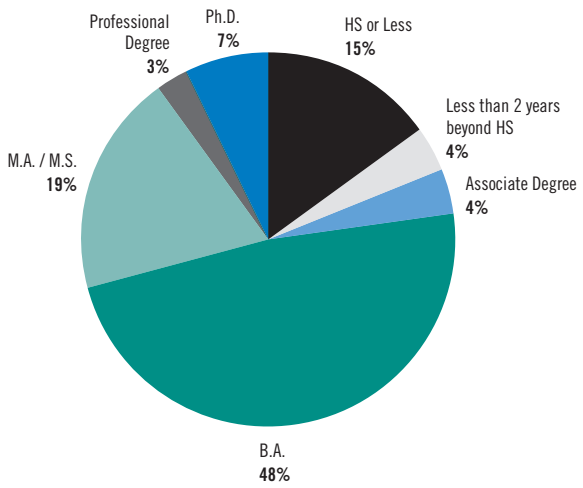
| | Program Year 2009 | Program Year 2010 | Program Year 2011 | 3 Years of Incentives |
|---|---|---|---|---|
| Total Value of MLSC Tax Incentives ($) | $15,245,500 | $20,672,638 | $20,340,884 | $56,259,022 |
| Net New Jobs Created | 901 | 721 | 915 | 2,537 |
| Tax Incentive per Job ($) | | | | $22,175 |
| Annual Tax Incentive per 5-year job ($) | | | | $4,435 |
| Average Salary per Job ($) | | | | $105,037 |
| Total Salaries Generated per Year ($) | | | | $266,479,399 |
| State Income Tax Revenue per Job per year ($) | | | | $4,937 |
| Total State Income Tax per year ($) | | | | $12,524,532 |
| Average Sales Tax per Job ($) | | | | $2,404 |
| Total State Sale Tax per year ($) | | | | $6,099,447 |
| Total Income+Sales Taxes per year ($) | | | | $18,623,979 |
| Average Income+Sales Tax/Job per year | | | | $7,341 |
| Total Income+Sales Taxes per 5-year Job | | | | $36,705 |
| Total Income+Sales Taxes over 5 years | | | | $93,120,585 |
| Net State Revenue Gain (5 years) ($) | | | | $36,860,872 |
| Ratio of Tax Revenue/Incentive over 5 years | | | | 1.66 |

| | Pharma | Medical Devices | Scientific Research | Total |
|---|---|---|---|---|
| Jobs | 1,843 | 481 | 213 | 2,537 |
| Average Salary ($) | $115,222 | $66,913 | $103,009 | $105,037 |
| Total Salary ($) | $212,353,256 | $32,185,280 | $21,940,863 | $266,479,399 |
| Share of Salary | 0.7969 | 0.1208 | 0.0823 | 1.0000 |
| State Income Tax By Sector ($) | $9,980,603 | $1,512,708 | $1,031,221 | $12,524,532 |
| Sales Tax by Sector ($) | $4,860,554 | $736,689 | $502,204 | $6,099,447 |

Source: Dukakis Center for Urban and Regional Policy

FIGURE 11

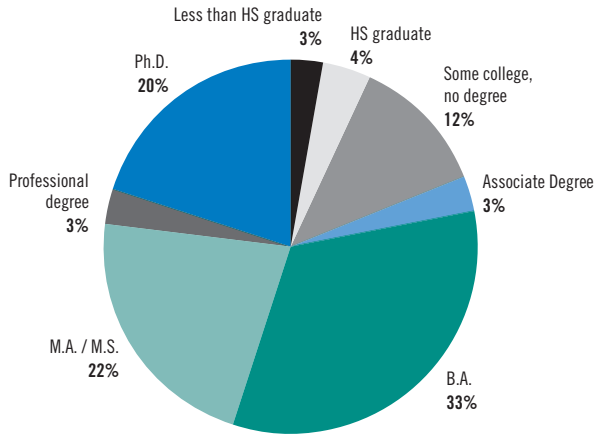
## Education Distribution of New Hires by 2010 MLSC Tax Incentive Awardees




Source: Dukakis Center for Urban and Regional Policy

FIGURE 12

## Education Distribution—Pharma

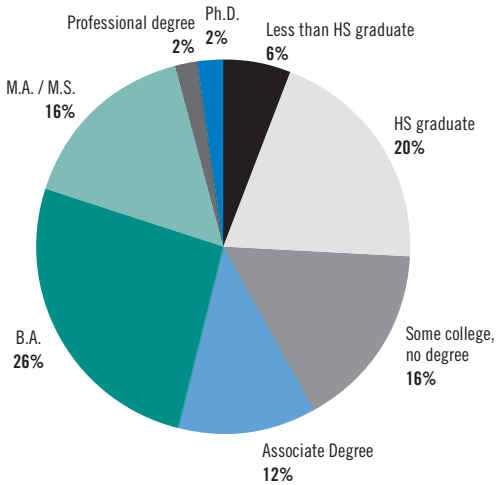



**Less than B.A.: 22%**

Source: Dukakis Center for Urban and Regional Policy

FIGURE 13

## Education Distribution—Medical Devices

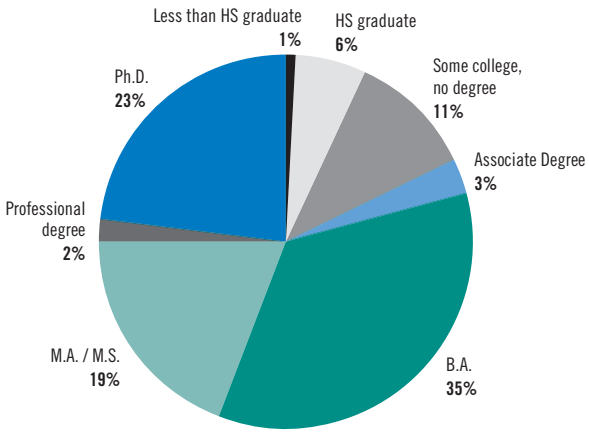



**Less than B.A.: 54%**

Source: Dukakis Center for Urban and Regional Policy

FIGURE 14

## Education Distribution—Diagnostics, Tools, and Related Products and Services



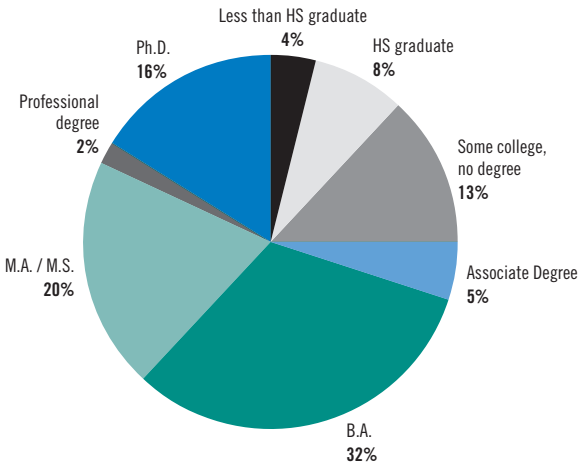

**Less than B.A.: 21%**

Source: Dukakis Center for Urban and Regional Policy

Of course, it is possible that these firms would have generated some or perhaps even many of these jobs without the MLSC award. But given the importance of the life-sciences ecosystem created in the Commonwealth, at least partly as a result of Center activity, it is reasonable to suggest that many of these jobs and their associated tax revenue would not have been created without the help of the Center. Moreover, our estimates do not consider any "multiplier" effects. The added spending of these new hires in the Commonwealth helped generate additional jobs as these workers spent money in the state, creating jobs in a wide range of industries.

FIGURE 15

**Education Distribution—Life Sciences Cluster Pharma/Medical Devices/Diagnostics, Tools, and Related Products and Services**




Less than B.A.: 30%

Source: Dukakis Center for Urban and Regional Policy

A concern that one might have about the employment generated by the life sciences super cluster is that the jobs created all go to the most educated workers in the state, leaving behind those who have not had the benefit of a college degree or post-graduate education. But based on the hiring records of a number of firms in the industry, it turns out that like other industries, life sciences firms need to hire workers who have a range of skills. In addition to Ph.D. scientists and other highly educated workers, these firms need laboratory technicians and clerical staff, and they employ a range of other workers in occupations that require a good deal less education. **Figure 11**, based on these hiring data, reveals that less than a third (29%) of those working in the life sciences have a Master's degree, professional degree, or Ph.D. Nearly half (48%) have the B.A. or B.S. as their highest level of education, while nearly a quarter (23%) of the workforce has no more than an associate's degree, often from a community college.

Using national data from the 2010 *American Community Survey* (ACS) available from the U.S. Census Bureau, we were able to estimate the education distribution for the individual sectors within the life sciences super cluster. As **Figures 12–15** demonstrate, the proportion of workers in each of the cluster segments needing less than a B.A. (or B.S.) ranges from 21 percent in diagnostics, tools, and related products and services and 22 percent in pharmaceutical firms to more than half in medical devices. According to these national estimates, the total workforce in the super cluster requiring less than a 4-year college degree is 30 percent, a bit higher than the 23 percent in Massachusetts. Essentially, with such a highly educated workforce in the Commonwealth, firms here are able to insist on somewhat higher educational credentials for their employees.

What adds to the value of the life sciences labor market in the Commonwealth are the high wages paid in this sector. As **Table 9** reveals, based on an analysis of Census data, the average annual wage in the state's

TABLE 9

**Estimated Annual Earnings for Life Sciences Workers (2006–2010)**

| | Pharma | Medical Devices | Scientific R&D | Total |
|---|---|---|---|---|
| Less than High School graduate | | $35,142 | $51,685 | $36,702 |
| HS graduate | $42,966 | $33,250 | $71,418 | $44,225 |
| Some college, no degree | $62,745 | $46,684 | $61,816 | $55,386 |
| Associate's degree | $96,171 | $61,400 | $53,712 | $61,285 |
| Bachelor's | $95,147 | $98,853 | $85,080 | $92,033 |
| Master's | $102,851 | $114,019 | $102,045 | $105,143 |
| Professional school degree | $150,264 | $118,399 | $182,999 | $161,195 |
| Doctorate | $171,596 | $249,332 | $112,626 | $134,195 |
| **Total** | $102,961 | $78,498 | $96,379 | $91,805 |

Source: Dukakis Center Analysis of American Community Survey (Census) data

life sciences varies from $78,500 in medical devices to nearly $103,000 in the pharmaceutical industry.[66] Those with a Ph.D. earn, on average, nearly $250,000 in the medical-device sector and well over $100,000 in other sectors within the cluster. But even those who have not completed high school average nearly $37,000 a year, the equivalent of more than $18.00 an hour. High school graduates average more than $44,000 and those with an associate's degree, more than $61,000.

Compared with other industries, the life sciences provide some of the highest paying jobs in the Commonwealth. With an average annual salary of nearly $92,000, this sector rewards its workforce with higher pay than those who work in manufacturing as a whole, construction, real estate, education, government, health care, and transportation. The average salary in the life sciences industries in the Commonwealth exceeds the all-industry Massachusetts average by 68 percent.[67]

## The Long-Term Impact of the Commonwealth's Life Sciences Initiative

Based on all of the data we collected about the MLSC and its activities, the analysis we conducted on the expansion of the life sciences industries in the Commonwealth, and the information we gleaned from the interviews, our overall conclusion is that because of its unique comprehensive approach to an entire industry super cluster and its reliance on scientific peer-reviewed procedures for awarding grants, the Commonwealth has reaped a substantial return on its life sciences initiative investment. Moreover, given the number of firms that have been attracted to the state, in large measure because of the ecosystem the Center has helped nurture, the benefits from the state's investment in this initiative are likely to pay off bountifully in the years to come.

Many of our informants for this report noted that by 2018, when the $1 billion Life Sciences Initiative sunsets, the state will still need an agency that encourages innovation among smaller life sciences firms. Innovation, they note, must be a continuous process for the region to remain prosperous. This will be particularly important as China, India, Singapore, and other foreign countries compete for a share of this expanding super cluster by offering massive incentives to life sciences start-ups.

The big question is whether Massachusetts can continue to lead the nation in the evolution of this critical industry or whether other regions of the country will be able to capture this industry and the jobs that go with it. Massachusetts was once the premier textile center of the nation until the south captured much of the industry in the early part of the 20th century. The Commonwealth led in the development of the commercial computer industry in the 1970s and 1980s with the growth of Digital Equipment Corporation (DEC), Data General, Prime Computer, and Wang, but lost out to Silicon Valley in California and companies like Dell in Texas. Today, other states including New Jersey, California, New Mexico, Utah, and Minnesota are all vying to expand their life sciences clusters.The state's concentration of globally prominent "eds and meds" has clearly been critical to the evolution of the life sciences in the Commonwealth.

One area where the MLSC might wish to pay more attention in the years to come is the medical-device industry. As noted earlier in this report, employment in this component of the life sciences cluster has been stagnant. According to our interviews, other states including Indiana, Michigan and Minnesota are targeting this sector with state funding. Unlike Big Pharma, which can be more patient in the marketplace and worry less about cost pressures, medical-device firms need to move quickly in the market to commercialize their products and they need to be vigilant about reducing costs. To the extent that the MLSC can assist these firms, Massachusetts could remain a center for this sector and employment growth could ensue.

But overall, based on the state's continued commitment to the life sciences, we fully expect to see further growth in the size of private-sector investments in the state's life sciences industries and further increases in employment opportunity.

## Assessment of the MLSC Staff

The interviews we carried out also suggested that the Center itself is being run quite effectively and efficiently and in a highly professional manner. Virtually all of our informants praised the management team and especially appreciated the leadership's reliance on peer review and its refusal to permit political considerations to trump scientific merit. As one expert informant noted, the MLSC has "lots of moving parts" and all of them are working well and the Center remains responsive to

industry needs, meeting deadlines, and staying focused on its mission. As another informant put it, with the reliance on the Scientific Advisory Board (SAB) to select awardees, "there is not an ounce of boondoggle in this agency." In its report on creating fiscally sound state tax incentives, the Pew Center on the States singled out the Massachusetts Life Sciences Tax Incentive Program for its focus on annual cost controls and its reliance on scientific merit in making awards.[68]

Still another informant noted that the MLSC is successful because its leadership is committed to working "at the speed of business" and therefore has become a valued partner in the expansion of the industry.

# Conclusions

All of our research suggests that the state will benefit from fully funding the remaining five years of the initiative in order to maintain the lead the life sciences have established in the Commonwealth. This is particularly important as other states ramp up their investments in hopes of creating their own life-sciences ecosystems to entice the small and large firms Massachusetts has successfully attracted. California, Maryland, New Jersey, New York, Minnesota, and Florida are not resting on their laurels, but continue to spend state funds on their own life-sciences industries.

Over time, it should be possible for the Center to reach out to the private sector to help fund more of its initiatives, as it has done with the Massachusetts Neuroscience Consortium. With the plethora of larger, profitable firms coming to the state to expand their operations, one could imagine the Center funding more of its internships with private funds and having private firms contribute to other programs (STEM education, for example), allowing the Center to focus even more of its funding on accelerator loans and tax incentives for firms undertaking translational research.

We should also note that the success of the MLSC has lessons for other quasi-public entities in the Commonwealth. We can mention five of them here:

1. Long-term success in the use of tax incentives and business loans is most likely to occur when funds are focused on a cluster of firms and a set of technologies in a given industry, helping to create an industrial ecosystem which can attract new companies to the state.
2. The use of expert panels to determine the awarding of loans assures that these funds will be well utilized. "Claw-back" provisions protect the taxpayers by requiring firms to repay funds advanced by the Commonwealth if they fail to meet hiring goals.
3. The focus on encouraging firms in their early-stage innovation activity is central to promoting economic growth and prosperity.
4. Helping fund workforce development efforts for critical industries as part of the mandate of the quasi-public helps assure a pipeline of skilled workers for the industry and this itself helps attract new firms to the region.
5. Taking a "portfolio" approach to the entire range of activities in the life sciences—from investments in small innovative firms to helping train the future workforce to underwriting infrastructure—helps sustain the "ecosystem," undergirding a virtuous cycle of discovery, innovation, investment, and employment opportunity.

In the end, we applaud the Governor and the Legislature for their foresight in creating the Massachusetts Life Sciences Center and the $1 billion Life Sciences Initiative. The structure put in place is fulfilling the goals set out in the original legislation and the Center's leadership has continually assured that the structure works effectively and efficiently.

# Endnotes

## Chapter One

1. The Massachusetts Life Sciences Center, "About the Center," www.masslifesciences.com/mission.html.

2. Massachusetts Life Sciences Center, *Fiscal Year (FY) 2012 Annual Report*, "Outpacing the Competition," Cover Letter, September 28, 2012.

3. According to an analysis prepared by the Massachusetts Budget and Policy Center, the Commonwealth faces at least a $1.2 billion deficit in FY2014. This is based on current tax rates and expected spending. See Massachusetts Budget and Policy Center, "A Preview of the FY2014 Budget," January 10, 2013.

4. Following on the early work of Stanley Surrey who served as Assistant Secretary of the U.S. Treasury for Tax Policy, the Congressional Budget and Impoundment Act of 1974 (CBA) defines *tax expenditures* as "those revenue losses attributable to provisions of the Federal tax laws which allow a special credit, a preferential rate of tax, or a deferral of tax liability." See Stanley Surrey, Pathways to Tax Reform: The Concept of Tax Expenditures (Cambridge, MA.: Harvard University Press, 1974); U.S. Congress, Congressional Budget Act of 1974.

5. Joe Stephens and Carol D. Leonnig, "Solyndra: Politics Infused Obama Energy Program," *Washington Post*, December 25, 2011.

6. Carol D. Leonnig, "Battery Firm backed by Federal Stimulus Money files for Bankruptcy," *Washington Post*, October 16, 2012.

7. Jason Schwartz, "End Game," *Boston Magazine*, August 2012.

8. The specific life sciences industry sectors used in this report are based on the non-agricultural 6-digit NAICS (North American Industry Classification System) as reported in the *Battelle/Bio State Bioscience Industry Development 2012 Report* produced jointly by the Battelle Institute, the Biotechnology Industry Organization (BIO), and MPM Public Affairs Consulting, Inc. (June 2012).

9. This set of NAICS industries omits perhaps 50 percent of the growth in life sciences jobs in Massachusetts because it omits life sciences in research in hospitals and universities. These jobs are not counted in the Battelle report because the NAICS industrial coding system cannot distinguish between research jobs in hospitals and other jobs in hospitals such as physicians and nurses, and life sciences research jobs in universities and other jobs such as English and social science professors.

10. It is important to note that because we could not break out faculty, staff, and students involved in the life sciences departments and research institutes from all others employed at universities and hospitals, this report does not include an analysis of the educational attainment, earnings, and occupations for those working in these institutions. Clearly, if we could have done this, our estimates of the number of those employed in the life sciences in Massachusetts would be much greater.

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12. Jane G. Gravelle and Thomas L. Hungerford, "The Challenge of Individual Income Tax Reform: An Economic Analysis of Tax Base Broadening," Congressional Research Service, 7-5700, March 22, 2012.

## Chapter Two

13. The largest of these include the exclusion from taxable income of employer contributions for medical insurance premiums and medical care; the net exclusion of contributions to 401(k) pension plans, Individual Retirement Accounts (IRAs), and Keogh plans; the deductibility of home mortgage interest on owner-occupied homes, the deductibility of charitable contributions, and the preferential tax rates on long-term capital gains.

14. Tad DeHaven, "Corporate Welfare in the Federal Budget," Policy Analysis No. 703, Cato Institute, July 25, 2012.

15. Ibid., Table 1, pp. 3–5.

16. See Louise Story, Tiff Fehr and Derek Watkins "As Companies Seek Tax Deals, Governments Pay High Price," *New York Times*, December 1, 2012, p. 1; "Lines Blur as Texas Gives Industries a Bonanza," New York Times, December 2, p. 2; "Michigan Town Woos Hollywood, but End Up with a Bit Part," *New York Times*, December 3, p. 1.

17. MA Film Office, "Mass Film Tax Credit by the Numbers," http://www.mafilm.org/mass-film-tax-credit-by-the-numbers

## Chapter Three

18. Robert Pollin and Dean Baker, "Public Investment, Industrial Policy and U.S. Economic Renewal," Center for Economic and Policy Research, Working Paper Series Number 211, December 2009, p. 2.

19. DeHaven, op. cit., p. 6.

20. DeHaven, op.cit., p. 6

21. Pollin and Baker, op. cit., p. 3

22. Barry Bluestone and Bennett Harrison, *Growing Prosperity: The Battle for Growth with Equity in the 21st Century* (New York: Houghton Mifflin Company and The Century Foundation, 2000), p. 207.

23. Bluestone and Harrison, op. cit., p. 207.

24. Paul Romer, "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Vol. 8, No. 1 (Winter 1994).

25. Bluestone and Harrison, op. cit., p. 210.

26. See Jeremy Greenwood, "The Third Industrial Revolution," Paper prepared for the American Enterprise Institute, October 25, 1996.

27. See B. Jovenovic and S. Lach, "Product Innovation and the Business Cycle," *International Economic Review*, February 1997.

28. See a series of papers by Erik Brynjolfsson and Lorin M. Hitt including "Computers and Productivity Growth: Firm-Level Experience," MIT Sloan School of Management, January 1997; "Information Technology as a Factor of Production: The Role of Differences among Firms," *Economics of Innovation and New Technology*, Vol. 3, No. 4 (1995); and "Paradox Lost: Firm-Level Evidence on the Returns to Information Systems Spending," *Management Science*, Vol. 42, No. 4 (April 1996).

29. Battelle Institute, "2012 Global R&D Funding Forecast," *R&D Magazine*, December, 2011.

30. Battelle Institute, op.cit, p 6.

31. Bluestone and Harrison, op.cit., p. 216.

32. Ben S. Bernanke, "Promoting Research and Development: The Government's Role," Remarks before the Conference on New Building Blocks for Jobs and Economic Growth," Washington, D.C., May 16, 2011.

33. See Martin Bailey, "Trends in Productivity Growth," in Jeffrey C. Fuhrer and Jane Sneddon (eds.), *Technology and Growth: Conference Proceedings*, Federal Reserve Bank of Boston, Conference Series No. 40, June 1996.

34. Matt Hourihan, "The Federal R&D Budget: Process and Perspectives," Presentation before the AAAS Leadership Seminar in Science and Technology Policy, American Association for the Advancement of Science, November 12, 2012.

35. MassBio "Biopharma Industry Snapshot, 2012," p. 22 based on data from the National Institutes of Health and the U.S. Census.

36. Congressional Budget Office, "Federal Support for Research and Development," June 2007.

37. National Science Board, *Science and Engineering Indicators 2012* (Washington, D.C.: National Science Foundation, January 2012).

38. See Economic Geography Glossary, http://faculty.washington.edu/krumme/gloss/a.html.

39. Steven J. K. Walters, "Unions and the Decline of U.S. Cities, *Cato Journal*, Vol. 30, No. 1 (Winter 2010), p. 119.

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41. IEEE History Center, "A Brief History of the U.S. Federal Government and Innovation (Part III): World War II and Beyond (1945-1987) (Washington, D.C.: Institute of Electrical and Electronic Engineers, n.d.).

42. See National Research Council, Funding a Revolution: Government Support for Computing Research, (Washington, D.C. 1999), pp. 2–3.

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43. This section is based on Mark R. Trusheim, Ernst R. Berndt, Fiona Murray, and Scott Stern, "American Entrepreneurial Chaos or Collaborative Industrial Policy: The Emergence of the Massachusetts Biotechnology Super-Cluster," Contributed Paper for the 2nd Conference on Corporate R&D (European Commission, 2010).

44. Trustheim, Berndt, Murray, and Stern, op.cit., p. 13.

45. MassBio "Biopharma Industry Snapshot, 2012," p. 23 based on MassBio membership reports and the *Boston Business Journal Book of Lists, 2012.*

46. See Greg Turner, "Boston is a Big Force in Pharma, *Boston Herald*, December 14, 2012.

47. Jones, Long LaSalle, "Life Sciences Cluster Report: Global 2011," p. 16. Boston ranked #1 on each component of the composite score with the exception of venture capital funding where it ranked #2.

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48. MassBio, "Massachusetts Life Sciences Incentives," Fact Sheet, September 2012.

49. "Refundable" tax credits are payments made to a taxpayer by the Internal Revenue Service or the Commonwealth's Department of Revenue. Such payments can offset other tax liabilities or in the case of no tax liability are a form of "negative" tax.

50. Massachusetts Life Sciences Center, *Fiscal Year (FY) 2012 Annual Report*, p. 4.

51. According to an MLSC memo to the Secretary of Administration and Finance, "The MLSC Tax Incentive Program has enforcement mechanisms, including strict monitoring and reporting requirements for recipient companies. Within 30 days of the end of each calendar year following the award, awardees are required to provide an annual report to the Center that permits the Center to determine whether the awardee's job targets have been met. The statute provides for 'clawback' provisions for companies that are found not to be fulfilling their job creation commitments to the state. Companies that fail to achieve at least 70% of their job targets at the end of any annual reporting period are subject to an investigation to determine the cause of this 'material variance.'" In cases where it is found that the company cannot meet its requirements, the Center

notifies the Massachusetts Department of Revenue so that the department can initiate claw-back procedures to recover the tax value any award provided. If a company has met at least 70% of its goal, the Center may permit the company a second year to fully meet this requirement before notifying the DOR. See memo to Jay Gonzales, Secretary, Executive Office for Administration and Finance from Susan Windham-Bannister, President and CEO of the Massachusetts Life Sciences Center, August 27, 2012.

52. Massachusetts *Life Sciences Center, Fiscal Year (FY) Annual Report*, op. cit., p. 6.

53. UMass Donahue Institute, *Growing Talent: Meeting the Evolving Needs of the Massachusetts Life Sciences Industry* (Cambridge, MA.: Massachusetts Life Sciences Center and Massachusetts Biotechnology Council, 2008), p. 15.

54. U.S. Bureau of Statistics, *Quarterly Census of Employment and Wages* as reported in MassBio "Biopharma Industry Snapshot, 2012," p. 4. These statistics are for NAICS Code 541711.

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55. See D.C. Denison, "Drugmakers, Mass. Form Consortium," *The Boston Globe*, June 20, 2012, p. B1.

56. Pfizer: Science at our Core, "R&D Locations: Cambridge, MA." http://www.pfizer.com/research/rd_works/cambridge.jsp.

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As a case in point, on January 29th, 2013 Sanofi announced the launch of LeGoo, a biopolymer gel that allows surgeons to temporarily stop blood flow during surgery without the use of clamps, elastic loops or other conventional occlusion devices that may risk trauma to blood vessels. LeGoo was developed by Pluromed, a young company that was one of the first to receive a loan through the Center's Accelerator Loan Program in 2009. The Accelerator Loan provided support for Pluromed at a critical stage in the development of LeGoo. Pluromed repaid its loan with interest to the Center following its acquisition by Sanofi.

59. See Michael B. Farrell, "Startup Funding Declines Across US," *The Boston Globe*, January 18, 2013, p. B5.

60. Michael B. Farrell, "Startup Funding Declines Across US," op. cit., p. B9.

61. See Greg Turner, "Boston is a Big Force in Pharma," *Boston Herald*, December 13, 2012.

62. MassBio "Biopharma Industry Snapshot," 2012, p. 9.

63. Greg Turner, "Boston is a Big Force in Pharma," op.cit.

64. Monya Baker, "Texas Cancer Institute gets no Funds for new Grants in Proposed Budget," *Nature.com*, January 16, 2013.

65. According to estimates prepared by the Mass DOR from recent annualized tax revenue data, state income tax revenues in the Commonwealth average 4.7% of wage and salary income and sales tax revenues average 48.7% of income tax revenues.

66. These estimates are based on data for 2010 from the American Community Survey (ACS).

67. See Barry Bluestone, et. al, *Staying Power II: A Report Card on Manufacturing in Massachusetts 2012*, Dukakis Center for Urban and Regional Policy, September 2012, Table 1.10, p. 32 based on data from the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

68. "Avoiding Blank Checks: Creating Fiscally Sound State Tax Incentives, Pew Center on the States, December 2012, Table 1, p. 5 and p. 14.

# Appendix B:
## Legislation and Other Government Documents

# AGREEMENT

# BETWEEN

# THE GOVERNMENT OF THE COMMONWEALTH OF MASSACHUSETTS

# AND

# THE GOVERNMENT OF THE STATE OF ISRAEL

# ON BILATERAL COOPERATION IN INDUSTRIAL RESEARCH AND DEVELOPMENT

**Whereas,** the Government of the Commonwealth of Massachusetts (hereinafter referred to as "**Massachusetts**") and the Government of the State of Israel (hereinafter referred to as "**Israel**"), hereinafter referred to as the "**Parties**";

**DESIRING** to develop and strengthen economic, industrial, technological and commercial cooperation between the State of Massachusetts and the State of Israel;

**CONSIDERING** the mutual interest in making progress in the fields of industrial and technological research and development (hereinafter referred to as "**R&D**") and the resulting advantages for both Parties;

**RECOGNIZING** the challenges of stimulating innovation and economic growth are of mutual concern to both Parties;

**DESIRING** to enhance their industrial competitiveness through cooperation in Industrial R&D and to develop and strengthen economic and commercial cooperation between them;

**RESOLVING** to undertake a sustained effort to promote, facilitate and support joint Industrial R&D projects, between businesses, corporations or other entities (hereinafter referred to as the "**Entity**") from the two countries;

Have reached the following Agreement:

## Article I - Scope

1. The Parties determine that the objectives of this Agreement are:

(a) To promote the activities of their respective Industrial sectors to intensify bilateral Industrial R&D cooperation;

(b) To facilitate the identification of specific projects, partnerships or collaborations between Entities from the Commonwealth of Massachusetts and from the State of Israel that could lead to Industrial R&D cooperation;

(c) To coordinate and focus suitable government resources and

programs to support industrial cooperation and commercial exploitation of Industrial R&D projects results;

(d) To establish a framework for support under which each of the Parties shall support jointly approved Industrial R&D cooperation projects between Entities from the two countries leading to commercialization in the global market.

2. The implementation of this Agreement and any activity hereunder shall be in accordance with the respective applicable laws, regulations, rules, procedures and mechanisms of each Party.

**Article II - Definition**

For the purpose of this Agreement, Industrial R&D means, inter alia, research, development and demonstration activities intended to develop new products or processes to be commercialized in the global market.

**Article III - Cooperating Authorities**

1. The Massachusetts International Trade Office (hereinafter referred to as "**MITO**") and the Ministry of Industry, Trade and Labor of the State of Israel (hereinafter referred to as "**MOITAL**") shall be in charge of the implementation of this Agreement and shall designate Cooperating Authorities for the purpose of implementing this Agreement.

2. MITO on behalf of Massachusetts and the Office of the Chief Scientist of MOITAL (hereinafter referred to as the "**OCS**"), on behalf of Israel, shall be the Cooperating Authorities for implementing, promoting and administering this Agreement. Each Party shall bear its respective costs for promoting, implementing and administering this Agreement such as traveling expenses, organization of seminars and publications. In addition, MITO and OCS may identify and empower, where appropriate, additional government entities or in the case of MITO also quasi-governmental entities, to execute the goals of this agreement.

## Article IV - R&D Projects

1. The Parties, within their competence and according to their respective applicable laws, regulations, rules, procedures and mechanisms, subject to the availability of funds, shall facilitate, support and encourage cooperation projects in the field of Industrial R&D undertaken by Entities from the Commonwealth of Massachusetts and from the State of Israel, for joint development and subsequent joint management and marketing of products or processes based on new innovative technologies to be commercialized in the global market (hereinafter referred to as the "**Projects**").

2. Each Entity which is a partner to a Project will be subject to the provisions of the applicable respective laws, regulations, rules, procedures and mechanisms of its respective state with respect to assistance and funding of R&D provided by its own government, including the level of support and the terms and conditions under which that support may be provided, and if applicable, the obligation to pay royalties.

3. The facilitation and stimulation of the cooperation Projects, may comprise, inter alia, the following forms and methods:

(a) Organization of meetings for Entities from the Commonwealth of Massachusetts and from the State of Israel to jointly assess cooperation opportunities;

(b) Performance of any other activities to promote possibilities for cooperation between Entities from the Commonwealth of Massachusetts and from the State of Israel.

## Article V - Fair and Equitable Treatment

Subject to their applicable respective laws, regulations, rules, procedures and mechanisms, each Party shall accord fair and equitable treatment to the individuals, government agencies and other Entities of the other Party engaged in the pursuit of activities under this Agreement.

## Article VI - Disclosure of Information

1. Each Party commits itself, subject to its respective laws, regulations, rules, procedures and mechanisms not to transmit, without written approval of the other Party, information concerning the results obtained from the cooperative programs for Industrial R&D covered under this Agreement to a third person, organization, or to any other country or state

2. Each Party shall notify the other immediately when it might be compelled by law or court order to disclose information or documents relating to this Agreement which would otherwise be subject to confidentiality.

3. The Party required to disclose shall, in any event, use its best efforts, to ensure that the person obtaining disclosure of the information in these circumstances protects the confidentiality at all times and observes the terms of this Agreement.

## Article VII - Intellectual Property Rights (IPR)

1. The partners to Projects supported under this Agreement shall be required to submit to the Parties evidence of contractual arrangements between them relating to the performance of the Project; commercialization of the Project's results; royalties and intellectual property rights, in particular:

(a) The ownership and use of know-how and intellectual property owned by the partners to the Project prior to the Project; and

(b) Arrangements for the ownership and use of know-how and intellectual property to be created in the course of the Project.

2. Notwithstanding the provisions of paragraph 1 above, it shall be the responsibility of the partners to Projects supported under this Agreement to safeguard their own interests.

3. Scientific and technological information of a non-proprietary nature arising from the cooperative activities under this Agreement may be made available to the public through customary channels.

## Article VIII - Final Provisions

1. Each Party shall notify the other Party, in writing, through diplomatic channels, of the completion of internal legal procedures required for bringing this Agreement into force. This Agreement shall enter into force on the date of the later notification.

2. This Agreement shall remain in force until either Party terminates it. Either Party may terminate this Agreement by written notification to the other Party, through diplomatic channels. The Agreement shall cease to be in force six months after the date of such notification.

3. This Agreement may be amended, in writing, by mutual agreement of the Parties. Any such amendment shall enter into force in accordance with the procedure set forth in paragraph (1) of this Article.

4. The amendment or termination of this Agreement shall not affect the validity of arrangements and contracts already concluded.

5. This Agreement shall not affect the present and future rights or obligations of the Parties arising from other international agreements and treaties.

In witness whereof, the undersigned being duly authorized, have signed this Agreement.

Done at Jerusalem on the 10 day of March 10 2011, corresponding to the 4 day of Adar Bet 5771, in the Hebrew calendar, in duplicate, each in the English and the Hebrew languages, both texts being equally authentic.

For the Government of the Commonwealth of Massachusetts

For the Government of the State of Israel

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Print

**Acts 2008**

**CHAPTER 130** AN ACT PROVIDING FOR THE INVESTMENT IN AND EXPANSION OF THE LIFE SCIENCES INDUSTRY IN THE COMMONWEALTH.

*Whereas,* The deferred operation of this act would tend to defeat its purpose, which is to provide forthwith for the immediate investment in and expansion of the life sciences in the commonwealth, therefore it is hereby declared to be an emergency law, necessary for the immediate preservation of the public convenience.

*Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same as follows:*

**SECTION 1.** To provide for supplementing certain items in the general appropriation act and other appropriation acts for fiscal year 2008, the sums set forth in section 2 are hereby appropriated from the General Fund unless specifically designated otherwise in this act or in those appropriation acts, for the several purposes and subject to the conditions specified in this act or in those appropriation acts, and subject to the laws regulating the disbursement of public funds for the fiscal year ending June 30, 2008; provided, however that notwithstanding any general or special law to the contrary, appropriations made in this act shall not revert and shall be available for expenditure until June 30, 2009. These sums shall be in addition to any amounts previously appropriated and made available for the purposes of those items.

**NO SECTION 2.**

**SECTION 2A.**

**EXECUTIVE OFFICE OF ADMINISTRATION AND FINANCE.**

*Small Business Capital Access Program.*

1599-7107 For a capital access reserve to provide loan guarantees to small businesses pursuant to section 57 of chapter 23A of the General Laws ..... $5,000,000

**SECTION 2B.** To provide for a program of infrastructure development, improvements and various capital investments, the sums set forth in this section for the several purposes and subject to the conditions specified in this act, are hereby made available, subject to the laws regulating the disbursement of public funds and approval thereof.

**EXECUTIVE OFFICE OF HOUSING AND ECONOMIC DEVELOPMENT.**

*Massachusetts Life Sciences Center.*

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7002-0015 For the Massachusetts Life Sciences Investment Fund established by section 6 of chapter 23I of the General Laws; provided, however, that not less than $12,900,000 shall be expended for and used to assist in water and waste water infrastructure improvements for the proposed cell culture manufacturing facility and purification plant containing office and lab facilities in the town of Framingham; provided, further, that not less than $12,600,000 shall be expended for the construction of supporting infrastructure, comprised of local arterial and connector roads for the I-93 interchange in the towns of Andover, Wilmington and Tewksbury; provided, further, that not less than $6,500,000 shall be expended for the design, construction and development for a life science incubator building at the William Stanley Business Park in the city of Pittsfield; provided, further, that not less than $10,000,000 shall be expended for a new nano and biomanufacturing facility at the University of Massachusetts at Lowell; provided, further, that $5,500,000 shall be appropriated to the Baystate Medical Center for the purpose of executing a lease agreement with the Pioneer Valley Life Sciences Institute in the city of Springfield for costs associated with the capital expansion of a life sciences incubator; provided, further, that not less than $1,100,000 shall be expended for the purchase and conversion of 3 vehicles into mobile science laboratories to support biotechnology education initiatives of the Massachusetts Academy for Life Sciences established by subsection (c) of section 2MMM of chapter 29 of the General Laws; provided, further, that said mobile science laboratories shall advance the goals of the Massachusetts Academy for Life Sciences; provided, further, that funds for those purposes shall be provided through a contract with the Massachusetts Biotechnology Education Foundation to provide grants, in consultation with the board of higher education, to public and private institutions of higher learning to purchase and convert vehicles into mobile science laboratories; provided, further, that each vehicle shall be fueled with an alternative fuel, as defined in 42 U.S.C. section 13211; provided, further, that amounts expended shall include the cost of vehicles, equipment, furniture and other costs associated with the conversion of the vehicles into mobile science laboratories; provided, further, that all 3 mobile science laboratories shall be owned and operated by each participating institution of higher learning and assigned to a specific region of the commonwealth, as designated by the Massachusetts Academy for Life Sciences, in consultation with each institution of higher learning; provided, further, that the designated regions shall not overlap; provided, further, that not less than $9,500,000 shall be expended for construction and capital improvements at the Tufts University Cummings School of Veterinary Medicine New England Regional Biosafety Laboratory to improve public health, protect public safety, improve science education and stimulate economic development by providing the opportunity to translate laboratory discoveries into viable vaccines, therapies and cures for emerging infectious diseases and bioterrorist threats; provided, further, that not less than $10,000,000 shall be expended for construction, renovations and infrastructure improvements for the Marine Biological Laboratory located in Woods Hole; provided, further, that said Marine Biological Laboratory shall collaborate with the Regional Technology Development Corporation of Cape Cod and the University of Massachusetts at Dartmouth to create and support a Center for Regenerative Biology and Medicine located at said Marine Biological Laboratory to develop commercial marine technology, provide research and development for life sciences including, but not limited to, marine-based stem cell research, and expand life science and marine technology education; provided, further, that not less than $5,000,000 shall be expended for

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the design, construction, development and related infrastructure improvements for a regional incubation center for life science initiatives to be located in the city of New Bedford and operated in conjunction with the University of Massachusetts at Dartmouth and Bristol Community College; provided, further, that not less than $5,000,000 shall be expended for the design, construction, development and related infrastructure improvements for a life sciences center which shall be located at the former Paul A. Dever State School in the city of Taunton and managed by a board of directors consisting of 13 members: 1 of whom shall be the chancellor of the University of Massachusetts at Dartmouth or his designee, 1 of whom shall be the president of Bridgewater State College or his designee, 1 of whom shall be the president of the Massachusetts Maritime Academy or his designee, 1 of whom shall be the president of Massasoit Community College or his designee, 1 of whom shall be the president of Cape Cod Community College or his designee, 1 of whom shall be the president of Bristol Community College or his designee, 1 of whom shall be the president of Wheaton College or his designee, 1 of whom shall be the commissioner of mental retardation or his designee, 1 of whom shall be the president of the Massachusetts Federationof Teachers or his designee, 1 of whom shall be the president of the Massachusetts Teachers Association or his designee, 1 of whom shall be the president of the Massachusetts AFL-CIO or his designee, 1 of whom shall be the president of the Taunton Area Chamber of Commerce or his designee, and 1 of whom shall be the director of Southeastern Regional Planning and Economic District or his designee; provided, further, that the life sciences center shall include, but not be limited to, an education and training facility and a laboratory research facility with state-of-the-art equipment offering research and development facilities for collaboration with industry partners; provided, further, that not less than $10,000,000 shall be deposited in the Massachusetts Small Business Matching Grant Fund established in section 9 of said chapter 23I of the General Laws; provided, further, that not less than $5,000,000 shall be deposited in the Massachusetts Life Sciences Education Fund established in section 10 of said chapter 23I of the General Laws; provided, further, that not less than $90,000,000 shall be expended for the design, construction, development and related infrastructure improvements for an advanced therapeutics cluster to be constructed at the University of Massachusetts Medical School in Worcester, which shall be named the Albert “Albie” Sherman Center, and shall include a RNAi institute, a stem cell biology cluster, cord blood bank and a gene therapy cluster; provided, however, that said funds shall not be used for faculty salaries; provided, further, that not less than $95,000,000 shall be expended for the design, construction, development and related infrastructure improvements of a life science laboratory research center complex including a laboratory research facility with state-of-the-art equipment offering research and development facilities for collaboration with industry partners to develop methods and technologies that may be translated into new commercial services and products at the University of Massachusetts at Amherst; provided, however, that said funds shall not be used for faculty salaries; provided, further, that not less than $10,000,000 shall be expended for the purchase of state-of-the-art equipment, renovations and related expenses to support the Center for Personalized Cancer Therapy at the University of Massachusetts at Boston, a collaboration of the University of Massachusetts at Boston and the Dana-Farber Harvard Cancer Center; provided, however, that said funds shall not be used for faculty salaries; provided, further, that funds

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appropriated for the design, construction, development and related infrastructure improvements for an advanced therapeutics cluster to be constructed at the University of Massachusetts Medical School in Worcester, for the design, construction, development and related infrastructure improvements of a life science laboratory research center complex at the University of Massachusetts at Amherst, for the design, construction, development and related infrastructure improvements for a nano and biomanufacturing facility at the University of Massachusetts at Lowell and for the renovations and related expenses for the Center for Personalized Cancer Therapy at University of Massachusetts at Boston shall be transferred to the University of Massachusetts Building Authority for these infrastructure improvements and design and construction; provided, further, that no funds shall be transferred from this item for a phase of construction until the secretary of administration and finance certifies in writing to the board of the Massachusetts Life Sciences Center established by section 3 of said chapter 23I of the General Laws and to the house and senate committees on ways and means that all sources of funding for that phase of the facility have been committed and are available as necessary for commencement of design and construction; provided, further, that said written certification shall include copies of all business plans, letters of financial commitment and other documentation as said secretary and said board deem necessary to certify that all other sources of funding have been secured; provided, further, that the University of Massachusetts Building Authority shall submit to the clerks of the house of representatives and the senate a report which shall include the following: (1) a detailed list of all private donors and amounts donated for each facility, (2) a plan for design, construction, operation and maintenance and all associated costs and revenues of the facility, including the projected timeline for the completion of all phases of said projects, and (3) a description of proposed title to any and all assets associated with each facility; provided, further, that said secretary and said board shall not expend any funds until such report is filed with the clerks of the house and senate who shall forward the same to the house and senate committees on ways and means; provided, further, that notwithstanding any general or special law to the contrary, in the construction and financing of said nano and biomanufacturing facility, said advanced therapeutics cluster, said life science laboratory research center complex and said Center for Personalized Cancer Therapy, said authority may use an alternative method for procurement of design and construction including, but not limited to, sequential construction management, turnkey, design and build procurement and the phasing of such procurement including, but not limited to, approval of design and construction stages separate from combined phases; provided, further, that said building authority shall require the assurance of labor harmony during all phases of development, including construction, reconstruction and capital and routine maintenance and shall provide adequate remedies to address the failure to maintain labor harmony which shall include, but not be limited to, assessment of liquidated damages and contract termination; provided, further, that the payment of prevailing wages, pursuant to sections 26 to 27F, inclusive, of chapter 149 of the General Laws, shall be required for all phases of said projects; and provided further, that not less than $11,400,000 shall be expended as a grant for the acquisition of land pursuant to section 37 of this act to the University of Massachusetts at Dartmouth..... $500,000,000

**SECTION 3.** Chapter 23I of the General Laws is hereby amended by striking out section 2, as

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appearing in section 24 of chapter 123 of the acts of 2006, and inserting in place thereof the following section:-

Section 2. As used in this chapter, the following words shall, unless the context clearly requires otherwise, have the following meanings:-

“Affiliate”, any business which directly or indirectly controls or is controlled by or is under direct or indirect common control of another business including, but not limited to, any business with which a business is merged or consolidated, or which purchases all or substantially all of the assets of a business.
“Board”, the board of directors of the Massachusetts Life Sciences Center.
“Center”, the Massachusetts Life Sciences Center established by section 3.
“Certification proposal”, a written proposal submitted by a life sciences company for approval as a certified life sciences company pursuant to section 5.
“Certified life sciences company”, a company that has been certified by the center for participation in the commonwealth life sciences investment program and the life sciences tax incentive program, established by section 5.
“Company”, a business corporation, partnership, firm, unincorporated association or other entity engaged or proposing to engage in economic activity within the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under chapter 62, 63, 64H or 64I.
“Department”, the department of revenue established pursuant to section 1 of chapter 14.
“Eligible new job”, a new job that shall not replace an existing job in the commonwealth and which may be a retained job; provided, however, that “eligible new job” may be further defined by rules, regulations or guidelines promulgated by the center pursuant to section 5; provided further, that an “eligible new job” shall be deemed to have been created in the commonwealth on the first day for which Massachusetts personal income tax withholding is required in connection with the compensation paid to an employee of a life sciences company or the first day for which Massachusetts estimated tax payments are payable by a partner of a partnership constituting a life sciences company.
“Enterprise”, a small business, as defined in chapters 23A or 40F, which has its principal place of business in the commonwealth and is, or proposes to be, engaged in research and development or manufacturing in the life sciences industry.
“Equity investment”, (a) a share in a life sciences company certified pursuant to section 5, whether or not transferable or denominated stock, or similar security; (b) interest of a limited partner in a limited partnership; or (c) warrant or right, other than a right to convert, to purchase, sell or subscribe to a share, security or interest of a kind specified in clauses (a) or (b); provided, however, that when making an equity investment in an enterprise pursuant to section 7, the center shall receive not less than 3 per cent of the equity in said enterprise.
“Independent research institution”, a nonprofit research organization that holds tax-exempt status granted under section 501(c)(3) of the Internal Revenue Code and shall be organized and operated exclusively for scientific or educational purposes; provided, however, that “independent research

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institution” shall not mean a hospital, college, university or private foundation.
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Life sciences company”, a business corporation, partnership, firm, unincorporated association or other entity engaged in life sciences research, development, manufacturing or commercialization in the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under chapter 62, 63, 64H or 64I.
“New state revenue”, revenue derived from a life sciences company by the creation of any eligible new jobs or by new commercial activity that would otherwise not have taken place in the commonwealth or as may be defined by any rules or regulations promulgated by the center pursuant to section 5.
“Permanent full-time employee”, an individual who: (i) is in an employment relationship which, at its inception, does not have a termination date which is a date certain or which is determined with reference to the completion of some specified scope of work; (ii) works a minimum number of weekly hours as the center may specify by rule, regulation or guideline; and (iii) receives employee benefits at least equal to those provided to other full-time employees of the employer, which shall be a life sciences company.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Program”, the commonwealth life sciences investment program established by section 5.
“Professional investor”, a bank, bank holding company, savings institution, trust company, insurance company, investment company registered under the federal Investment Company Act of 1940, pension or profit-sharing trust or other financial institution or institutional buyer, licensee under the federal Small Business Investment Act of 1958 or any person, partnership or other entity of whose resources a substantial amount shall be dedicated to investing in securities or debt instruments and whose net worth exceeds $250,000.
“Qualified security”, a note, stock, treasury stock bond, debenture, evidence of indebtedness, certificate of interest or participation in a profit-sharing agreement, preorganization certificate or subscription, transferable share, investment contract, certificate of deposit for a security, certificate of interest or participation in a patent or application therefor, or in royalty or other payments under such a patent or application; in general, any interest or instrument security, so-called, or any certificate for, receipt for, guarantee of, or option, warrant or right to subscribe to or purchase any of the foregoing; and debt of and partnership interest in, as a general or limited partner, any general or limited liability partnership organized under the laws of the commonwealth, and debt of and membership interest in any limited liability company organized under the laws of the commonwealth.
“Real estate project”, real property where, after a life sciences company is certified, construction or renovation shall be initiated which, when completed, shall result in an increase in the assessed value

of the real property of at least 100 per cent over its assessed value as of the date of certification; provided, however, that if a real estate facility is a business incubator facility and is designated as a certified life sciences company pursuant to section 5, each business which executes a binding lease for space in that facility after the date on which the construction or renovation activity begins shall be eligible for separate designation as a certified life sciences company.
“Revenue”, receipts, fees, rentals or other payments or income received or to be received on account of obligations to the center including, but not limited to, income on account of the leasing, mortgaging, sale or other disposition of a project or proceeds of a loan made by the center in connection with any project, and amounts in reserves or held in other funds or accounts established in connection with the issuance of bonds and the proceeds of any investments thereof, proceeds of foreclosure and any other fees, charges or other income received or receivable by the center.
“Seed capital”, financing that is provided for the development, refinement and commercialization of a product or process and other working capital needs.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapter 62, 63, 64H or 64I.
“Vocational technical school”, education institutions established pursuant to sections 14 and 15 of chapter 71, providing vocational-technical education as defined in section 1 of chapter 74.

**SECTION 4.** Section 3 of said chapter 23I, as so appearing, is hereby amended by striking out subsection (b) and inserting in place thereof the following subsection:—

(b) The center shall be governed and its corporate powers exercised by a board of directors consisting of 7 directors: 1 of whom shall be the secretary of administration and finance or his designee; 1 of whom shall be the secretary of housing and economic development or his designee; 1 of whom shall be the president of the University of Massachusetts or his designee; and 4 of whom shall be appointed by the governor, 1 of whom shall be a physician licensed to practice medicine in the commonwealth and affiliated with an academic medical center, 1 of whom shall be a chief executive officer of a Massachusetts-based life sciences corporation which is a member of the board of directors of the Massachusetts Biotechnology Council, 1 of whom shall be a researcher involved in the commercialization of biotechnology, pharmaceuticals or medical diagnostic products and 1 of whom shall have significant financial experience in the life sciences sector. Each appointed member shall serve a term of 5 years, except that in making his initial appointments, the governor shall appoint 1 director to serve for a term of 1 year, 1 director to serve for a term of 2 years, 1 director to serve for a term of 3 years, 1 director to serve for a term of 4 years. The secretary of the executive office of administration and finance and the secretary of the executive office of housing and economic development, or their designees, shall serve as co-chairs of the board. Any person appointed to fill a vacancy in the office of an appointed director of the board shall be appointed in a like manner and shall serve for only the unexpired term of such director. Any director shall be eligible for reappointment. Any director may be removed from his appointment by the governor for cause.

**SECTION 5.** Subsection (c) of said section 3 of said chapter 23I, as so appearing, is hereby amended

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by striking out the first paragraph and inserting in place thereof the following paragraph:-
Four directors shall constitute a quorum and the affirmative vote of a majority of directors present at a duly called meeting if a quorum is present shall be necessary for any action to be taken by the board. Any action required or permitted to be taken at a meeting of the directors may be taken without a meeting if all of the directors' consent in writing to such action and such written consent is filed with the records of the minutes of the meetings of the board. Such consent shall be treated for all purposes as a vote at a meeting. Each director shall make full disclosure, under subsection (d), of his financial interest, if any, in matters before the board by notifying the state ethics commission, in writing, and shall abstain from voting on any matter before the board in which he has a financial interest, unless otherwise permissible under chapter 268A.

**SECTION 6.** Said section 3 of said chapter 23I, as so appearing, is hereby further amended by striking out subsection (e) and inserting in place thereof the following:-

(e) The Board shall have the power to appoint and employ a president, and to fix his compensation and conditions of employment. The president shall be the chief executive, administrative and operational officer of the center and shall direct and supervise administrative affairs and the general management of the center. The president shall appoint and employ a chief financial and accounting officer and may, subject to the general supervision of the board, employ other employees, consultants, agents, including legal counsel, and advisors, and shall attend meetings of the board. The chief financial and accounting officer of the center shall be in charge of its funds, books of account and accounting records. No funds shall be transferred by the center without the approval of the board and the signatures of the chief financial and accounting officer and the treasurer, as appointed by the board pursuant to subsection (g).

**SECTION 7.** The first sentence of subsection (g) of said section 3 of said chapter 23I of the General Laws, as so appearing, is hereby amended by striking out the word "chairperson," and inserting in place thereof the following words:— treasurer and.

**SECTION 8.** Said subsection (g) of said section 3 of said chapter 23I, as so appearing, is hereby further amended by striking out the last sentence.

**SECTION 9.** Clause (14) of subsection (a) of section 4 of said chapter 23I of the General Laws, as so appearing, is hereby amended by striking out the words ", issue bonds and apply the proceeds thereof as provided in section 8,".

**SECTION 10.** Clause (15) of said subsection (a) of said section 4 of said chapter 23I, as so appearing, is hereby amended by striking out the words ", all as provided in section 8".

**SECTION 11.** Said section 4 of said chapter 23I, as so appearing, is hereby further amended by striking out clauses (16) and (17) and inserting in place thereof the following 2 clauses:-

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(16) to act as the central entity and coordinating organization of life sciences initiatives on behalf of the commonwealth and to work in collaboration with governmental entities, bodies, centers, institutes and facilities and promote all areas of life sciences to advance the commonwealth's interests and investments in the life sciences;
(17) to promulgate a code of ethics to address collaborative state and business research activities; provided, further, that said code of ethics shall include recommendations, and proposed legislation if necessary, addressing the issue of exclusive licensing agreements for intellectual property developed using state funds between state-funded colleges and universities and private companies and institutions. Said code shall be forwarded to the clerks of the house and senate who shall forward the same to the joint committee on economic development and emerging technologies.

**SECTION 12.** Said section 4 of said chapter 23I, as so appearing, is hereby further amended by adding the following 3 clauses:-

(30) to operate as a licensed small business investment corporation pursuant to the provisions of the Small Business Investment Act of 1958, 15 U.S.C. section 661 et seq., as amended; provided, however, that as an alternative, the board may establish a subsidiary corporation to operate as a licensed small business investment corporation pursuant to said Small Business Investment Act of 1958, 15 U.S.C. section 661 et seq., and to make investments in qualified securities of enterprises through such subsidiary;
(31) to track and report to the general court on federal initiatives that have an impact on life sciences companies doing business in the commonwealth; and
(32) to create award programs to acknowledge successful companies, public and private institutions and programs in industry-specific areas, as determined by the center.

**SECTION 13.** Said chapter 23I is hereby further amended by striking out sections 5 to 8, inclusive, as so appearing, and inserting in place thereof the following 13 sections:-

Section 5. (a) There shall be established a commonwealth life sciences investment program which shall be administered by the center. The purpose of the program shall be to expand life sciences-related employment opportunities in the commonwealth and to promote health-related innovations by supporting and stimulating research and development, manufacturing and commercialization in the life sciences. Life sciences companies certified pursuant to subsection (b) shall be eligible for participation in the program.
(b) The center may, upon a majority vote of the board, certify a life sciences company as a certified life sciences company upon: (i) the timely receipt, as determined by the center, of a certification proposal supported by independently verifiable information, signed under the pains and penalties of perjury by a person expressly authorized to contract on behalf of the life sciences company and which shall include, but not be limited to: (A) an estimate of the projected new state revenue the life sciences

company expects to generate during the period for which the company seeks certification, together with a plan, including precise goals and objectives, by which the life sciences company proposes to achieve the projected new state revenue, including for each tax year, an estimate of new commercial revenue that the commonwealth would not otherwise have received, an estimate of the number of permanent full-time employees to be hired or retained, an estimate of the year in which the company expects to hire or retain the employees, an estimate of the projected average salaries of said employees, an estimate of the projected taxable income pursuant to chapter 62 or 63 generated by said employees and an estimate of the methods by which the company shall obtain new employees and pursue a diverse workforce; (B) documentation of an agreement, if any, between the life sciences company and banking institutions with which the life science company shall have agreed to establish accounts and by which the banking institutions shall have agreed to commit a specified percentage of the funds deposited in the accounts for loans made thereby to companies under the small business capital access program established pursuant to section 57 of chapter 23A; and (C) if appropriate, documentation that the life sciences company has received approval for a certified project, pursuant to section 3F of chapter 23A; and (ii) findings made by the center, based on the certification proposal, documents submitted therewith and any additional investigation by the center, and incorporated in its approval, that: (A) the life sciences company shall meet all statutory requirements and any other criteria that the center may prescribe including, but not limited to criteria in the following areas: whether the life sciences company has sufficient business contacts with the commonwealth as evidenced by its business activity within the commonwealth including, but not limited to, the number of full-time employees employed in the commonwealth; the life sciences company's potential to further technological advancements in the life sciences; the life sciences company's potential to offer a breakthrough medical treatment for a particular disease, or medical condition; the life sciences company's potential for leveraging additional funding or attracting additional resources to the commonwealth; the life sciences company's potential to promote life sciences manufacturing in the commonwealth; and evidence of potential royalty income and contractual means to recapture such income for the purposes of this chapter, as the center considers appropriate; and (B) a certified life sciences company shall meet the new state revenue and employment growth projections, as specified in the certification proposal, over the period for which it receives benefits.

(c) A certified life sciences company may, upon a majority vote of the board, be eligible for the following benefits which shall be awarded by the board on a competitive basis: (1) benefits from the life sciences tax incentive program established by subsection (d); (2) grants, loans or other investments from the Massachusetts Life Sciences Investment Fund established by section 6; (3) equity investments from the Dr. Craig C. Mello Small Business Equity Investment Fund established by section 7; (4) assistance from the regional technology and innovation centers established by section 11; (5) assistance from the center to obtain designation as a certified project in an economic opportunity area pursuant to section 3F of chapter 23A; (6) assistance from the center in accessing economic incentive programs within the Massachusetts office of business development, including access to the technical, human, financial, training, educational and site-finding resources necessary to expand or locate in the commonwealth; (7) assistance from the center in obtaining federal grants; (8) assistance from the center in facilitating clinical trials; (9) preference for funding for life science job

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training programs; or (10) preference for pre-permitted industrial land as identified by the Massachusetts Development Finance Agency.
(d) There shall be established a life sciences tax incentive program. The center, in consultation with the department, may annually authorize incentives, including incentives carried forward, refunded or transferred, pursuant to the following: subsection (m) of section 6 of chapter 62, subsection (n) of said section 6 of said chapter 62, paragraph 17 of section 30 of chapter 63, section 31M of said chapter 63, paragraph 6 of subsection (f) of section 38 of said chapter 63, the fourth paragraph of section 38C of said chapter 63, subsection (j) of section 38M of said chapter 63, section 38U of said chapter 63, section 38V of said chapter 63, section 38W of said chapter 63, the third paragraph of section 42B of said chapter 63, and subsection (xx) of section 6 of chapter 64H, in a cumulative amount, including the current year cost of incentives allowed in previous years, that shall not exceed $25,000,000 annually. The center may, in consultation with the department, limit any incentive or incentives to a specific dollar amount or time duration, or in any other manner deemed appropriate by the department; provided, however, that the department shall only allocate said incentives among commonwealth certified life sciences companies pursuant to subsection (b) and shall award said tax incentives pursuant to subsection (c).
The center shall provide an estimate to the secretary of administration and finance of the tax cost of extending benefits to a proposed project before certification, as approved by the commissioner of revenue, based on reasonable projections of project activities and costs. Tax incentives shall not be available to any certified life sciences company unless expressly granted by the secretary of administration and finance in writing.
(e) (1) Certification granted pursuant to subsection (b) shall be valid for 5 years starting with the tax year in which certification is granted. Each certified life sciences company shall file an annual report with the center detailing whether it has met the specific targets established in the proposal pursuant to subclause (A) of clause (i) of subsection (b).
(2) The certification of a life sciences company may be revoked by the center after an independent investigation and determination that representations made by the certified life sciences company in its certification proposal are materially at variance with the conduct of the life sciences company after receiving certification; provided, however, that the center shall review the certified life sciences company at least annually; provided, further, that a project with an actual return on investment that is less than 70 per cent of the return on investment projected in the certification proposal shall be deemed to contain a material variance for a revocation determination. If the center determines not to revoke certification upon a finding that the actual return on investment for the project is less than 70 per cent, the center shall provide its reasons for the decision in writing to the secretary of administration and finance, the commissioner of revenue and the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on revenue and the joint committee on economic development and emerging technologies. The center shall post these reasons on the internet for public access.
(3) Under this subsection, revocation shall take effect on the first day of the tax year in which the center determines that a material variance commenced. The commissioner of revenue shall, as of the effective date of the revocation, disallow any credits, exemptions or other tax benefits allowed by the

original certification of tax benefits under this section. The department shall issue regulations to recapture the value of any credits, exemptions or other tax benefits allowed by the certification under this section; provided, however, that the recapture provisions in subsection (m) of section 6 of chapter 62 and section 38U of chapter 63 shall apply. If the original certification allowed sales and use tax exemptions pursuant to subsection (xx) of section 6 of chapter 64H, the purchaser shall accrue use tax as of the date of revocation on a portion of the sales price on which exemption was claimed that is proportionate to the remaining useful life of the property.

(4) Nothing in this subsection shall limit any legal remedies available to the commonwealth against any certified life sciences company.

(f) Capital funding may be revoked only by the center after an independent investigation and determination that representations made by the life sciences company in its certification proposal are materially at variance with the conduct of the life sciences company after certification; provided, further, that a life sciences company generating less than 70 per cent of the projected new state revenue in the certification proposal shall be deemed to contain a material variance for the purposes of a revocation determination. If the center does not revoke certification despite said material variance, the center shall provide its reasons for the decision in writing to the secretary of administration and finance, the commissioner of revenue and the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on bonding, capital expenditures and state assets and the joint committee on economic development and emerging technologies. A notice of revocation under this subsection shall specify the date on which the revocation is effective, which shall be the date of the notice or the date on which the center determined that the material variance commenced. The secretary of administration and finance shall, as of the effective date of the revocation, disallow any loans, grants or other benefits allowed by the original certification under this section. The department may issue regulations to recapture any grants or loans allowed by the certification under this section.

(g) The center shall revoke the certification of a life sciences company when independent investigations conducted in 2 consecutive years determine that representations made by the life sciences company in its project proposal are deemed materially at variance, pursuant to paragraph (2) of subsection (e) or subsection (f).

(h) The board, in consultation with the executive office of administration and finance and the executive office of housing and economic development, shall promulgate rules, regulations or guidelines necessary to carry out the provisions of this section.

Section 6. (a) There shall be established and placed within the center a fund to be known as the Massachusetts Life Sciences Investment Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds, to finance the activities of the center. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges

imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified investments pursuant to subsection (c); (2) defraying the ordinary and necessary expenses of administration and operation associated with the center; provided, however, that said administrative and operational expenses shall not exceed 15 per cent of the maximum amount authorized to be expended from the fund in a fiscal year; (3) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (4) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (5) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the board, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center, subject to the approval of the board, to make qualified investments, grants, research and other funding and loans designed to advance the following public purposes for the life sciences in the commonwealth: (1) to stimulate increased financing for the expansion of research and development by leveraging private financing for highly productive state-of-the-art research and development facilities, equipment and instrumentation and by providing financing related thereto including, but not limited to, financing for the construction or expansion of such new facilities; (2) to make targeted investments, including research funding, proof of concept funding and funding for the development of devices, drugs or therapeutics and to promote manufacturing activities for new or existing advanced technologies and life sciences research; (3) to make matching grants to colleges, universities, independent research institutions, nonprofit entities, public instrumentalities, companies and other entities in connection with support from the federal government, industry and other grant-funding sources related to the expansion of research and development and to increase and strengthen economic development, employment opportunities and commercial and industrial sectors in the field of life sciences; (4) to provide bridge financing to colleges, universities, independent research institutions, nonprofit entities, public instrumentalities, companies and other entities for the receipt of grants as described in clause (3) awarded or to be awarded by the federal government, industry or other sources; (5) to provide fellowships, co-ops, internships, loans and grants; (6) to provide workforce training grants to prepare individuals for life sciences careers; (7) to provide funding for development, coordination and marketing of higher education programs; (8) to make qualified grants to certified life sciences companies for site remediation, preparation and

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ancillary infrastructure improvement projects; and (9) to otherwise further the public purposes set forth herein.
(d) Proceeds of the fund may be used by the center to fund life sciences initiatives including: (1) international trade initiatives; (2) qualified grants to graduate level and doctoral students and post-doctoral fellows for living expenses from the Dr. Judah Folkman Higher Education Grant Fund established by section 8; (3) equity investments from the Dr. Craig C. Mello Small Business Equity Investment Fund established by section 7; (4) joint academic and industrial research and development and commercial business exchanges between the commonwealth and Israel, in collaboration with the Massachusetts international trade council; (5) the Massachusetts Technology Transfer Center, established by section 45 of chapter 75; (6) the Massachusetts Science, Technology Engineering, and Mathematics Grant Fund, established by section 2MMM of chapter 29; or (7) a program to promote the research and development of plant-made pharmaceuticals and industrial products through field trials, in collaboration with the department of agricultural resources.
(e) The center shall make no such qualified investment pursuant to clause (1) of subsection (b) unless: (1) said investment has been approved by a majority vote of the board; (2) the recipient is a certified life sciences company pursuant to section 5 or a project or initiative listed in subsection (d); (3) the center finds, to the extent possible, that a definite benefit to the commonwealth's economy may reasonably be expected from said qualified investment; provided, further, that in evaluating a request or application for funding, the center shall consider the following: (i) the appropriateness of the project; (ii) whether the project has significant potential to expand employment; (iii) the project's potential to enhance technological advancements; (iv) the project's potential to lead to a breakthrough medical treatment for a particular disease or medical condition; (v) the project's potential for leveraging additional funding or attracting resources to the commonwealth; (vi) the project's potential to promote manufacturing in the commonwealth; and (vii) evidence of potential royalty income and contractual means to recapture such income for the purposes of this chapter, as the center considers appropriate; (4) to the extent said investment is a capital investment made pursuant to clause (8) of subsection (c), the investment has been approved by the secretary of the executive office of administration and finance upon request of the center; provided, however, that said request shall be submitted to the secretary in writing and shall, include but not be limited to: (i) a description of the project or program to be funded; (ii) the economic benefits to the commonwealth which can reasonably be expected from said project or program; (iii) a copy of the proposed contract or other document executing the transaction between the center and the recipient of the funds; (iv) a description of the contractual or other legal remedies available to the center upon non-performance of the contract or other document executing the transaction by the recipient including, but not limited to, any provisions for restitution or reimbursement of the funds granted, loaned or otherwise invested in or with the recipient; and (v) any other information as the secretary may determine; and (5) said qualified investment conforms with the rules approved by the board.
Said rules shall set the terms and conditions for investments which shall constitute qualified investments including, but not limited to, loans, guarantees, loan insurance or reinsurance, equity investments, grants awarded pursuant to clause (3) of subsection (c), other financing or credit enhancing devices, as established by the center directly or on its own behalf or in conjunction with

other public instrumentalities, or private institutions or the federal government. Said rules shall provide that qualified investments made pursuant to clauses (1) and (2) of said subsection (c) shall involve a transaction with the participation of at least 1 at-risk private party.
Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities, oversee the progress of qualified investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified investments. Said rules shall provide for negotiated intellectual property agreements between the center and a qualified investment recipient which shall include the terms and conditions by which the fund's support may be reduced or withdrawn.
(f) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal creating a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.
(g) Copies of the approved rules, and any modifications, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.
(h) Qualified investment transactions made by the center pursuant to this section shall not, except as specified in this chapter, be subject to chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Life Sciences Investment Fund established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.
(i) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
Section 7. (a) There shall be established and placed within the center a fund to be known as the Dr. Craig C. Mello Small Business Equity Investment Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the

making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified equity investments pursuant to subsection (c); (2) investing funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the board, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center to make qualified equity investments in enterprises seeking to raise seed capital; provided, however, that said qualified equity investments shall not exceed $250,000 in any 1 enterprise. The center shall not make such qualified equity investments unless: (1) said investment has been approved by a majority vote of the board; (2) the recipient is a life sciences company certified pursuant to section 5; and (3) the center finds, to the extent possible, that a definite benefit to the commonwealth's economy may reasonably be expected from said qualified investment. In evaluating a request or application for funding, the center shall consider whether: (i) the proceeds of the equity investment shall only be used to cover the seed capital needs of the enterprise except as hereinafter authorized; (ii) the enterprise has a reasonable chance of success; (iii) the center's participation is necessary to the success of the enterprise because funding for the enterprise is unavailable in the traditional capital markets or contingent upon matching funds, or because funding has been offered on terms that would substantially hinder the success of the enterprise; (iv) the enterprise has reasonable potential to create a substantial amount of primary employment in the commonwealth; (v) the enterprise's principals have made or are prepared to make a substantial financial and time commitment to the enterprise; (vi) the securities to be purchased shall be qualified securities; (vii) there shall be a reasonable possibility that the center shall, at a minimum, recoup its initial investment; (viii) binding commitments have been made to the center by the enterprise for adequate reporting of financial data to the center, which shall include a requirement for an annual or other periodic audit of the books of the enterprise, and for such control on the part of the center as the board shall consider prudent over the management of the enterprise, to protect the investment of the center including the board's right to access, without limitation, financial and other records of the enterprise; and (ix) a reasonable effort has been made to find a professional investor to invest in the enterprise and such effort was unsuccessful; and (4) said qualified equity investment

conforms with the rules approved by the board.
Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities, oversee the progress of qualified equity investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified equity investments. Said rules shall provide that each recipient of a qualified investment shall be required to pay a fee as a condition of such receipt, and said fee may take the form of points, an interest rate premium or a contribution of warrants or other forms of equity or consideration to the fund. Said rules shall provide for negotiated agreements between the center and each recipient of a qualified investment regarding the terms and conditions by which the fund's support thereof could be reduced or withdrawn.
(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.
(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.
(f) Qualified equity investment transactions made by the center pursuant to this section shall not, except as specified in this chapter, be subject to chapter 175, or any successor thereto, and shall be payable solely from the Dr. Craig C. Mello Small Business Equity Investment Fund established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.
(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
Section 8. (a) There shall be established and placed within the center a fund to be known as the Dr. Judah Folkman Higher Education Grant Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the

making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.

(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.

(c) The fund shall be held and applied by the center to make qualified grants to graduate level and doctoral students and post-doctoral fellows studying or employed in the life sciences for living expenses; provided, however, that the center shall make no such qualified grants unless said grant has been approved by a majority vote of the board. Grants awarded from the fund shall, in addition to any restrictions adopted by the center, shall be awarded in $5,000 increments not to exceed $15,000 annually per recipient and further restrictions include: (1) recipients shall be enrolled in a graduate or doctorate level program or shall be working as postdoctoral fellows at a college, university, independent research institution or an academic medical center in the commonwealth; (2) recipients shall be commonwealth residents; and (3) the annual total household income of a recipient shall not exceed 300 per cent of the federal poverty level. The center shall make no such qualified grants pursuant to said clause (1) of said subsection (b) unless such qualified grant conforms with rules approved by the board.

Said rules shall establish the terms and conditions for grants which constitute qualified grants and shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make grant determinations, safeguard the fund, oversee the progress of qualified grants and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified grants.

(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a

proposal creating a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund.
(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.
(f) Qualified grants and investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Dr. Judah Folkman Higher Education Grant Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.
(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
Section 9. (a) There shall be established and placed within the center the Massachusetts Small Business Matching Grant Fund, hereinafter referred to in this section as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.
(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying

binding obligations associated with qualified investments which shall be secured by the fund as the same become payable.
(c) Notwithstanding any provision of this chapter to the contrary, a company need not be a certified life sciences company, as established in section 5, to be eligible for matching grants pursuant to this section. The fund shall be held and applied by the center to make qualified loans, grants or other investments to stimulate increased financing for life sciences and high technology research and development, manufacturing and commercialization in the commonwealth by matching grants to public agencies, independent research institutions, nonprofits or to life sciences or high technology companies to increase and strengthen the commonwealth's economic development, employment opportunities and commercial and industrial sectors. The fund shall provide matching grants to commonwealth-based life sciences or high technology companies that receive small business innovation research or small business technology transfer grants from the Small Business Administration, pursuant to 15 U.S.C. section 638, to assist companies that have developed new commercialization-ready technologies to reach production and create manufacturing jobs in the commonwealth. Said matching grants shall be used to create manufacturing jobs and may be used for, without limitation, the creation of, and capital improvements for, production facilities, workforce training, product marketing and purchasing infrastructure for product manufacturing. Said matching grants shall be distributed to eligible companies that have commercialization-ready technologies developed with assistance from the Small Business Administration in the form of $1 in matching funds for every $1 granted from the small business innovation research phase IIB grants, phase III grants and the commercialization pilot project established by 15 U.S.C. section 638. Said matching grants shall be awarded in consultation with the Small Business Association of New England. No such grant to any company shall exceed $500,000 annually and the center shall make no such qualified loan, grant or other investment unless: (1) said loan, grant or investment has been approved by a majority vote of the board; (2) the center finds that, to the extent possible, a definite benefit to the commonwealth's economy may reasonably be expected from said qualified loan, grant or investment; provided, however, that in evaluating a request or application for funding, the center shall consider whether: (i) the loan, grant or investment shall stimulate increased financing for life sciences and high technology research and development, manufacturing and commercialization; (ii) the enterprise has a reasonable chance of success; (iii) center participation is necessary; (iv) the enterprise has the reasonable potential to create a substantial amount of new employment in the commonwealth; (v) the principals of the enterprise have made or are prepared to make a substantial financial and time commitment to the enterprise; (vi) binding commitments have been made to the center by the enterprise for adequate reporting of financial data to the center, which shall include a requirement for an annual or other periodic audit of the books of the enterprise, and for such control on the part of the center as the board shall consider prudent over the management of the company to protect the investment of the center including the board's right to access, without limitation, financial and other records of the enterprise; and (vii) a reasonable effort has been made to find a professional investor to invest in the enterprise and whether such effort was unsuccessful; and (3) said loan, grant or other investment conforms with rules approved by the board.
Said rules shall define life sciences technology and high technology for purposes hereof; provided,

however, that such definition shall include companies engaging in research and development, commercialization or manufacturing in the commonwealth. Said rules shall establish the terms and conditions for investments which constitute qualified investments, and may include, but not be limited to, loans, guarantees, loan insurance or reinsurance, equity investments or other financing or credit enhancing devices, as made by the center directly or on its own behalf or in conjunction with other public instrumentalities, private institutions or the federal government. Said rules shall establish the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities for the citizens of the commonwealth, oversee the progress of qualified investments and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified investments. Said rules shall provide that each recipient of a qualified investment shall be required to pay a fee as a condition of such receipt, and said fee may take the form of points, an interest rate premium or a contribution of warrants or other forms of equity or consideration to the fund. Said rules shall provide for negotiated agreements between the center and each recipient of a qualified investment regarding the terms and conditions by which the fund's support thereof could be reduced or withdrawn.

(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund pursuant to the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors consistent with the public purpose of the fund and under the terms and conditions established to protect and preserve the assets of the fund; provided, however, that if the creation or operation of such a separate entity would require additional or clarifying amendments to the enabling act of the center, said proposal shall include proposed statutory language with regard thereto. Any additional clarifying amendments to the enabling act shall be submitted by the center to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.

(f) Qualified investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Small Business Matching Grant Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.

(g) The center shall not make expenditure from or commitment of the assets of the fund including, but

not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
(h) The center shall develop a plan ensuring that fund disbursements made pursuant to this section shall be distributed throughout all regions of the commonwealth.
Section 10. (a) There shall be established and placed within the center a fund to be known as the Massachusetts Life Sciences Education Fund, hereinafter in this section referred to as the fund, to be held by the center separate and apart from its other funds. The fund shall be credited any appropriations, bond proceeds or other monies authorized by the general court and specifically designated to be credited thereto, such additional funds as are subject to the direction and control of the center, any pension funds, federal grants or loans, royalties or private investment capital which may properly be applied in furtherance of the objectives of the fund, any proceeds from the sale of qualified investments secured or held by the fund, any fees and charges imposed relative to the making of qualified investments as defined by the center, secured or held by the fund and any other monies which may be available to the center for the purposes of the fund from any other source or sources. Any revenues, deposits, receipts, or funds received through the receipt of royalties, interest, dividends, or the sale of equity instruments shall be deposited in the fund, and shall be available to the center for the purposes described in this section, without further appropriation. All available moneys in the fund that are unexpended at the end of each fiscal year shall not revert to the General Fund and shall be available for expenditure in the subsequent fiscal year.
(b) The center shall invest and reinvest the fund and the income thereof only as follows: (1) making qualified grants pursuant to subsection (c); (2) investing any funds not required for immediate disbursement in the purchase of such securities as may be lawful investments for fiduciaries in the commonwealth; (3) paying binding obligations associated with such qualified investments which shall be secured by the fund as the same become payable; and (4) paying principal or interest on qualified investments secured by the fund or paying any redemption premium required to be paid when such qualified investments shall be redeemed prior to maturity; provided, however, that monies in the fund shall not be withdrawn at any time in such an amount as would reduce the amount of the fund to less than the minimum requirement thereof established by the center, except for the purpose of paying binding obligations associated with qualified investments which are secured by the fund as the same become payable.
(c) The fund shall be held and applied by the center to make qualified grants to vocational and technical schools for purchasing or leasing necessary equipment to train students in life sciences technology and research; provided, however, that the center shall make no such qualified grants unless: (1) said grant has been approved by a majority vote of the board; (2) the grant recipient shall be a vocational technical school; provided, however, that if funds remain after consideration of grant applications submitted by vocational technical schools, the center may make qualified grants to community colleges established by chapter 15A or any other general or special law; (3) the grant recipient has identified and properly trained instructors to use the equipment to be purchased or leased; and (4) said qualified grants conform with the rules approved by the board.
Said rules shall set the terms and conditions for grants which constitute qualified grants and shall set

forth the terms, procedures, standards and conditions which the center shall employ to identify qualified applications, process applications, make investment determinations, safeguard the fund, advance the objective of increasing employment opportunities for the citizens of the commonwealth, oversee the progress of qualified grants, and secure the participation of other public instrumentalities, private institutions or the federal government in such qualified grants.
(d) The center may solicit investments by private institutions or investors in the activities of the fund and may reach agreements with such private institutions or investors regarding the terms of any such investments including, but not limited to, the rights of such investors to participate in the income or appropriation of the fund. To further the objective of securing investments by private institutions or investors in the activities of the fund as established in the preceding sentence, the center may develop a proposal relative to the creation of a separate investment entity which shall permit the commingling of the fund's resources with the maximum participation by such private institutions or investors in a manner consistent with the public purpose of the fund and under terms and conditions established to protect and preserve the assets of the fund.
(e) Copies of the approved rules, and any modifications thereto, shall be submitted to the clerks of the house of representatives and the senate and shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies.
(f) Qualified grants and investment transactions made by the center pursuant to the provisions of this section shall not, except as specified in this chapter, be subject to the provisions of chapter 175, or any successor thereto, and shall be payable solely from the Massachusetts Life Sciences Education Fund, established by this section and shall not constitute a debt or pledge of the full faith and credit of the commonwealth, the center or any subdivision of the commonwealth.
(g) The center shall not make expenditure from or commitment of the assets of the fund including, but not limited to, the making of qualified investments secured by the fund, if following the making of said qualified investment, the amount of the fund shall be less than the minimum requirement established by the board.
Section 11. (a) The center, in consultation with the advisory board established by section 12, shall identify 1 existing life sciences entity with experience facilitating local or regional life science industry sectors to serve as a regional technology and innovation center in each of the following 5 regions: western Massachusetts, central Massachusetts, northeastern Massachusetts, southeastern Massachusetts and metropolitan Boston.
(b) The purpose of each regional technology and innovation center shall include, but shall not be limited to: (i) encouraging and facilitating collaboration between existing organizations dedicated to promoting the regional life science industry; (ii) inputting regional life science industry and educational data, including the documentation of regional lab space, into the life sciences industry database as designed and maintained by the center; (iii) organizing, facilitating and implementing regional workforce development initiatives; (iv) providing business management and resource training, including the dissemination of best business practices; (v) facilitating public and private investment; (vi) reviewing and providing recommendations to the center proposals; (vii) identifying property conducive to regional life science industry expansion; (viii) investigating and identifying specific

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regions or municipalities that have the potential to be developed into a life sciences cluster; and (ix) facilitating the regional development and implementation of section 10A of chapter 23A.
(c) The executive director, or his equivalent, of the 5 regional technology and innovation centers shall meet from time to time with the center to exchange information; identify regional needs including, but not limited to, any assistance needed in fulfilling the regional centers' purposes as provided in subsection (b); and advise the center on the effectiveness of programs administered by the center.
(d) Each regional technology and innovation center shall provide an annual report to the center containing such information as may be required by the center to evaluate the progress of each regional center. The center may withdraw a designation as a regional technology and innovation center if a regional center does not satisfactorily meet the purposes of subsection (b), and as provided in any rules, regulations or guidelines established by the center.
Section 12. There shall be an 18-member advisory board to be appointed by the governor to advise the center. The members shall include: 10 of whom shall be active members of the Massachusetts Life Sciences Collaborative, at least 2 of whom shall represent small businesses; 5 of whom shall be the chancellors at the University of Massachusetts at Amherst, Boston, Dartmouth, Lowell and Worcester, or their designees; and 3 of whom shall be patient advocates with significant interaction or experience in the life sciences. The secretary of labor and workforce development or his designee, and the 5 executive directors of the regional technology and innovation centers, established pursuant to section 11, shall serve as ex-officio, non-voting members of the advisory board.
Each member shall serve for a term of 3 years, except that in making his initial appointments, the governor shall appoint 5 members to serve for a term of 1 year, 3 members to serve for a term of 2 years, 5 members for a term of 3 years. Any person appointed to fill a vacancy in the office of a member of the advisory board shall be appointed in a like manner and shall serve for only the unexpired term of the member who vacated. Members shall be eligible for reappointment. Any member may be removed by the governor for cause. The advisory board shall meet at least bi-annually, but shall meet as often as the members shall determine, or at such other intervals as established by the executive director to review recommendations made by the board. The members of the advisory board shall serve without compensation, but each member shall be entitled to reimbursement for his actual and necessary expenses incurred in the performance of his official duties.
The duties of the advisory board shall be to advise the center and the board concerning: research and development in the life sciences; development of products and the effectiveness of public and private initiatives to further product development; manufacturing and commercialization of biotechnology, pharmaceuticals, medical diagnostic products or such other areas within the life sciences; identifying candidates and providing recommendations for the 5 regional technology and innovation centers as established in section 11; and any other area as requested by the board.
The advisory board shall not be a state agency for the purposes of chapter 268A and shall not be subject to section 11A½ of chapter 30A or chapter 66.
Section 13. The center shall develop a comprehensive, internet-based life sciences sector database for the organization of all relevant information, as determined by the center, related to the life sciences

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sector in the commonwealth. Access to said database shall be limited at the discretion of the center's executive director. Any documentary materials or data received by the center from any entity, private or public, for the express purpose of adding information to the life science database shall be exempt from section 10 of chapter 66 and the board may hold any discussion or consideration of database materials in executive session closed to the public, notwithstanding the provisions of section 11A½ of chapter 30A, but the purpose of any such executive session shall be set forth in the official minutes of the center and business not directly related to such purpose shall not be transacted nor shall any vote be taken during such executive session.
Section 14. (a) The exercise of the powers granted by this chapter shall be for the benefit of the people of the commonwealth and for the improvement of their health and living conditions; and as the operation of the center shall constitute the performance of essential governmental functions, the center shall not be required to pay any taxes or assessments, except as otherwise provided by this chapter, and the notes or bonds issued under this chapter, their transfer and the income therefrom, including any profit made on the sale thereof, at all times shall be free from taxation by and within the commonwealth.
(b) The lands and tangible personal property of the center shall be deemed to be public property used for essential public and governmental purposes and shall be exempt from taxation and from betterments and special assessments.
Section 15. The center shall annually complete a detailed report setting forth its operations and accomplishments; its receipts and expenditures during such fiscal year; its assets and liabilities at the end of its fiscal year; the anticipated return on investment to the commonwealth from the investment of funds administered by the center during such fiscal year; a complete report detailing all companies classified as a certified life sciences company; a complete list of grants awarded by the center; a list of other funding activities; reports of patents or products resulting from funded activities; the status of construction of any real estate project resulting from certification, including whether construction is on-time and on-budget; and a tracking of job creation as a result of funded projects. The center shall annually submit the report to the governor, the secretary of administration and finance, the state comptroller and the clerks of the house of representatives and senate, who shall forward the same to the house and senate committee on ways and means and the joint committee on economic development and emerging technologies on or before October 1. The report shall be posted on the internet in a manner accessible to the public.
Section 16. The books and records of the center shall be subject to a biennial audit by the auditor of the commonwealth.
Section 17. (1)(a) Notwithstanding the provisions of chapter 32, or of any general or special law to the contrary, the center shall establish 1 or more optional retirement programs that qualify under section 401, 408 or 457 of Internal Revenue Code, as may be amended from time to time, or contracts providing retirement and death benefits may be purchased by employees of the center who elect to participate in the program. The benefits offered to employees of the center in such optional retirement program shall be provided through such custodial accounts or individual or group annuity contracts, which may be fixed or variable in nature, or a combination thereof; provided, that at all times, those annuity contracts issued by licensed insurers under the optional retirement program shall provide the

minimum values and guarantees required by the laws governing such contracts in the commonwealth; and provided, further, that the benefits shall be payable only to employees of the center in the program or their beneficiaries, and such benefits shall be paid only by the selected providers in accordance with the terms of the custodial accounts, annuity contracts or certificates providing coverage to the employee of the center; and provided, further, that such optional retirement program shall not allow an employee of the center to withdraw contributions while an active participant in the center's optional retirement program.

(b) The center shall select at least 2 but no more than 4 providers for the optional retirement program and enter into contracts with them in accordance with the laws governing the procurement of services for executive agencies of the commonwealth, provided, further, that the selected providers shall be authorized to conduct business within the commonwealth, and each and every provider or issuer of annuity contracts under the optional retirement program which is a life insurance company shall hold a certificate of authority to do life insurance business in the commonwealth, maintain the minimum required capital and surplus required for life insurance companies under the laws of the commonwealth, be a member of the commonwealth's life and health insurance guaranty association and be a member of the life and health insurance guaranty associations in any and all jurisdictions where required by law with similar retirement programs funded in whole or in part through the provider's annuities in which employees of the center participating in the optional retirement program may participate upon transfer of employment; and provided, further, that said board shall coordinate the transfer of funds and information between payroll centers, the selected providers and employees of the center participating in the plan.

(2)(a) Participation in the optional retirement program provided by this section shall be limited to employees of the center who are otherwise eligible for membership in the state employees' retirement system as established under the provisions of chapter 32.

(b) Elections to participate in the optional retirement program shall be made as follows:

(i) Any eligible employee of the center who is initially appointed on or after the effective date of the optional retirement program may elect in writing to participate in the optional retirement program within 90 days of the effective date of the appointment. Any such election shall be effective as of the effective date of appointment. If an eligible employee of the center fails to make an election as provided in this paragraph, such employee shall become a member of the state employees' retirement system established under the provisions of said chapter 32.

(ii) Any eligible employee of the center who is a member of any retirement system established by the provisions of said chapter 32 on the effective date of the optional retirement program but who has less than 10 years of creditable service on the effective date of the optional retirement program may elect in writing to participate in the optional retirement program within 90 days after the effective date of the optional retirement program. Any such election shall become effective on the first day of the next pay period following such election, and shall constitute a waiver of all retirement benefits to which the individual may be entitled as an employee under any retirement system established under the provisions of said chapter 32.

(iii) Any employee of the center who is a member of any retirement system established by the provisions of said chapter 32 but who has less than 10 years of creditable service on the date such

employee becomes eligible to participate in the optional retirement program may elect in writing to participate in such optional retirement program within 90 days of the date said employee becomes eligible. Any such election shall become effective on the first day of the next pay period following such election, and shall constitute a waiver of all retirement benefits to which the individual may be entitled as an employee under any retirement system established by the provisions of said chapter 32.
(iv) Any eligible employee of the center electing to participate in the optional retirement program shall be ineligible for membership in the state employees' retirement system while he remains continuously employed by the center; provided, that the election by an eligible employee to participate in the optional retirement program shall be irrevocable while the employee continues to meet the eligibility requirements; provided, however, that if an employee becomes ineligible to continue in the optional retirement program, the employee shall thereafter participate in the state employees' retirement system established in accordance with the provisions of said chapter 32.
(3)(a) Any eligible employee of the center electing to participate in the optional retirement program shall not be required to make contributions to the state employee's retirement system but shall contribute to the optional retirement program an amount equal to the contribution which would have been required had such employee been a member of the state employees' retirement system.
(b) For each eligible employee of the center electing to participate in the optional retirement program, the center shall contribute an amount equal to 5 per cent of each employee's regular compensation, as defined in section 1 of chapter 32, to the optional retirement program and a plan established to provide life and disability benefits to all participants in the program; provided, however, that not more than 1 per cent of said contribution shall be made to the plan established to provide said life and disability benefits; provided, further, that the balance of said contribution shall be remitted to the appropriate provider for application to the participating employee's contract or custodial account, less any monthly fees established by the board in order to cover the reasonably necessary direct costs incurred by the board in establishing and administering the plan.
(c) If any eligible employee of the center is a member of any retirement system established by the provisions of said chapter 32 at the time such employee elects to participate in the optional retirement program, the employee may direct that the amount of the accumulated total deductions, and any interest to which the employee would be entitled under said chapter 32 if the employee withdrew from the system, credited to such employee's account in such retirement system be transferred directly to such employee's account in the optional retirement program. Any such transfer shall be made in the form of a direct trustee-to-trustee transfer in compliance with the requirements of subchapter D of chapter 1 of the Internal Revenue Code.
(d) The funds accumulated under the optional retirement program shall be exempt from taxation. The rights of a participant to a custodial account, an annuity, the annuity contracts or certificates providing coverage to participants, and all right in and to the funds accumulated under the custodial accounts, annuity contracts or certificates shall be exempt from taxation, including income taxes levied under the provisions of said chapter 62. No assignment of any right in or to any funds or annuities under the optional retirement program shall be valid except such assignment as may be made for the purpose of making restitution in the case of dereliction from duty by any participant as established in section 15 of

said chapter 32 if such assignment does not violate the restrictions of the Internal Revenue Code; provided that nothing in this section shall prevent a participant's custodial account or annuity from being attached, taken on execution, assigned, or subject to other process to satisfy a support order under chapters 208, 209, or 273 if such order constitutes a qualified domestic relations order under the terms of the Internal Revenue Code.

(e) Any eligible employee of the center enrolled in the optional retirement program who retires and wishes to retain his group insurance coverage as provided in chapter 32A, or retires and wishes to enroll in group insurance coverage pursuant to said chapter 32A, may do so in the same manner, and subject to the same limitations and requirements as an active employee member of the state employees' retirement system. Any eligible employee of the center enrolled in the optional retirement program who retains or enrolls in the group insurance coverage upon retirement shall be deemed to have authorized his optional retirement program plan provider to deduct from the retired employees account, on a monthly basis, and forward to the group insurance commission, an amount equal to the retired employee's share of the premium as set by said chapter 32A and each annual appropriation act. Each optional retirement program plan provider shall be required to deduct and forward said premium amounts, as determined by the group insurance commission, to the group insurance commission in advance of the month for which the premium is due and in a manner as may be prescribed by the group insurance commission. For group insurance commission purposes employees who were members of the state retirement system when they became eligible to participate in the optional retirement program, and who then enrolled in the optional retirement program, may add their time in the state retirement system to their time in the optional retirement program in determining years of creditable service.

(f) No contribution shall be made under any provision of this section in excess of, or on the basis of compensation in excess of, any limitation that may be imposed pursuant to federal law including, but not limited to, the limitations in 26 U.S.C. sections 401(a)(17), 402(g), 403(b) and 415, to the extent such limitations apply. The center may adopt rules and regulations as it deems necessary to carry out the purposes of this section including, but not limited to, rules or regulations establishing such limitations only when it determines that such limitations are necessary to comply with applicable provisions of the Internal Revenue Code.

**SECTION 14.** Section 5 of said chapter 23I, as appearing in section 14, is hereby amended by striking out subsection (d).

**SECTION 15.** Section 1 of chapter 32 of the General Laws, as appearing in the 2006 Official Edition, is hereby amended by inserting after the word "connector", in line 211, the following words:- , the Massachusetts Life Sciences Center, except those employees of the center opting to participate in an optional retirement plan established by the center pursuant to section 17 of chapter 23I.

**SECTION 16.** Section 2 of chapter 32A of the General Laws is hereby amended by inserting after the word "authority", in line 12, as so appearing, the following words:- , the Massachusetts Life Sciences Center.

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**SECTION 17.** Section 6 of chapter 62 of the General Laws, as most recently amended by section 4 of chapter 63 of the acts of 2007, is hereby further amended by adding the following 2 subsections:-
(m) (1) As used in this subsection and in subsection (n), the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Primarily”, more than 50 per cent.
“Research and development costs”, in-house research expenses within the meaning of section 41(b)(2) of the Internal Revenue Code.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapters 62, 63, 64H or 64I.
“User fees”, the monetary amount actually paid by a taxpayer to the U.S.F.D.A. that constitutes the fee due upon the submission of a human drug application or supplement pursuant to 21 U.S.C. section 379h(a)(1) for a human drug, the research and development costs of which, were primarily incurred in the commonwealth.
“U.S.F.D.A.”, the United States Food and Drug Administration.
(2) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, take a credit against the taxes imposed by this chapter in an amount equal to 10 per cent of the cost of qualifying property acquired, constructed, reconstructed or erected during the taxable year and used exclusively in the commonwealth.
Qualifying property shall be tangible personal property and other tangible property including buildings and structural components of buildings acquired by purchase, as defined by section 179(d) of the Internal Revenue Code, as amended and in effect for the taxable year, but not including property that is taxable under chapter 60A; provided, however, that such property shall be depreciable under section 167 of the Internal Revenue Code and have a useful life of 4 years or more. With respect to property which is disposed of or ceases to be in qualified use prior to the end of the taxable year in which the credit is to be taken, the amount of the credit shall be that portion of the credit provided for in this paragraph which represents the ratio which the months of qualified use bear to the months of useful life. If property on which credit has been taken is disposed of or ceases to be in qualified use prior to the end of its useful life, the difference between the credit taken and the credit allowed for actual use must be added back as additional taxes due in the year of disposition; provided, however, if such property is disposed of or ceases to be in qualified use after it has been in qualified use for more than twelve consecutive years, it shall not be necessary to add back the credit, as provided in this paragraph. The amount of credit allowed for actual use shall be determined by multiplying the original

credit by the ratio which the months of qualified use bear to the months of useful life. For the purposes of this paragraph, useful life of property shall be the same as that used by the corporation for depreciation purposes when computing federal income tax liability.
A taxpayer taking a credit allowed under this subsection may not take the credit allowed by subsection (g) except to such extent, not to exceed 2 per cent of the cost of any qualifying property, as may be provided in a certification pursuant to said section 5 of chapter 23I.
Nothing in this section shall limit the authority of the commissioner to make adjustments to a taxpayer's liability upon audit or limit any other legal remedies available to the commissioner or the commonwealth against said taxpayer.
(3) Any taxpayer entitled to a credit under this section for any taxable year may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, carry over and apply to its tax for any 1 or more of the next succeeding 10 taxable years, the portion, as reduced from year to year, of those credits which exceed the tax for the taxable year.
(4) The commissioner in consultation with the Massachusetts Life Sciences Center established by section 3 of chapter 23I, shall promulgate regulations necessary for the administration of this subsection; provided, further, that said regulations may provide the adjustment of intercompany prices and elimination of intercompany transactions to ensure that all amounts upon which the credit is based reasonably reflect fair market value; and provided, further, that said regulations shall include provisions to prevent the generation of multiple credits with respect to the same property.
(5) If a credit allowed under this subsection, or such credit as may be allowed under subsection (g) as limited in this subsection, exceeds the tax otherwise due under chapter 62, 90 per cent of the balance of such credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year in which qualified property giving rise to that credit is placed in service. If such credit balance is refunded to the taxpayer, then the credit carryover provisions of paragraph (3), and paragraph (2) of subsection (g), shall not apply.
(n) (1) Except as otherwise limited by subsection (4), a taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, be allowed a refundable credit against the tax liability imposed under this chapter in an amount equal to 100 per cent of the cost of user fees paid by such taxpayer.
(2) A taxpayer shall claim the credit in the taxable year in which its application for the licensure of an establishment to manufacture the human drug in the commonwealth is approved by the U.S.F.D.A.
(3) If a credit allowed to a taxpayer exceeds the tax otherwise due under chapter 62, 90 per cent of the balance of that credit may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of said chapter 23I, be refundable to the taxpayer for the taxable year in which the credit is claimed.
(4) The deduction from gross income that may be taken with respect to any expenditures qualifying for the credit under this section shall be disallowed to the extent of the credit.
(5) Only user fees paid by a taxpayer to the U.S.F.D.A. on or after the effective date of this section shall be eligible for the credit.

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**SECTION 18.** Said section 6 of said chapter 62 is hereby further amended by striking out subsections (m) and (n), inserted by section 17.

**SECTION 19.** Section 30 of chapter 63 of the General Laws, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
17. Notwithstanding the last sentence in subparagraph (b) of paragraph 5, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, losses sustained in any taxable year by a taxpayer engaged in business as a life sciences company as defined by section 2 of chapter 23I may, to the extent approved pursuant to said life sciences tax incentive program, be carried forward for not more than 15 years; provided, however, that said losses shall not be carried back.

**SECTION 20.** Said section 30 of said chapter 63 is hereby further amended by striking out paragraph 17, inserted by section 19.

**SECTION 21.** Said chapter 63 is hereby further amended by inserting after section 31L the following section:-
Section 31M. (a) As used in this section, the following words shall, unless the context otherwise requires, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Primarily”, more than 50 per cent.
“Research and development costs”, in-house research expenses within the meaning of section 41(b)(2) of the Internal Revenue Code.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapters 62, 63, 64H or 64I.
“User fees”, the monetary amount actually paid by a taxpayer to the U.S.F.D.A. that constitutes the fee due upon the submission of a human drug application or supplement pursuant to 21 U.S.C. section 379h(a)(1) for a human drug, the research and development costs of which, were primarily incurred in the commonwealth.
“U.S.F.D.A.”, the United States Food and Drug Administration.
(b) Except as otherwise limited by subsection (e), a taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of chapter 23I, be allowed a refundable credit against the tax liability imposed under this chapter in an amount equal to 100 per

cent of the cost of user fees paid by such company.
(c) A taxpayer shall claim the credit in the taxable year in which its application for the licensure of an establishment to manufacture the human drug in the commonwealth is approved by the U.S.F.D.A.
(d) The credit allowed may reduce the excise due under subsection (b) of section 32, or subsection (b) of section 39. The credit allowed to a taxpayer shall not be subject to the provisions of section 32C. Where such credit allowed to a taxpayer exceeds the excise otherwise due under said subsection (b) of section 32 or subsection (b) of said section 39, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of said chapter 23I, be refundable to the taxpayer for the taxable year in which the credit is claimed.
If a taxpayer files as a member of a combined group and applies its excess credit against the excise of another group member, then the credit as applied to corporations other than such taxpayer is not subject to section 32C and may reduce to zero the excise due under subsection (b) of section 32, or subsection (b) of section 39 and under any act in addition thereto. Where such credit allowed to a taxpayer that is applied against the excise liability of such other corporations exceeds the excise otherwise due to such corporations under this chapter, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program, be refundable to the taxpayer for the taxable year in which the credit is claimed.
(e) For the purposes of section 30, the deduction from gross income that may be taken with respect to any expenditures qualifying for the credit under this section is disallowed to the extent of the credit.
(f) Only user fees paid by a taxpayer to the U.S.F.D.A. on or after the effective date of this section shall be eligible for the credit.

**SECTION 22.** Section 31M of said chapter 63 is hereby repealed.

**SECTION 23.** Section 38 of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by striking out, in line 162, the word “and”.

**SECTION 24.** Said section 38 of said chapter 63, as so appearing, is hereby further amended by inserting after the word “contracts”, in line 169, the following:- ; and (6) to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, a certified life sciences company, as defined by section 5 of chapter 23I, may be deemed to be taxable in the state of the purchaser if the property of the project is delivered or shipped to a purchaser in another state.

**SECTION 25.** Said section 38 of said chapter 63 is hereby further amended by striking out clause (6), inserted by section 24.

**SECTION 26.** Section 38C of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
To the extent authorized pursuant to the life sciences tax incentive program established by section 5

of chapter 23I, a certified life sciences company may be deemed a research and development corporation for purposes of exemptions under chapters 64H and 64I.

**SECTION 27.** Said section 38C of said chapter 63 is hereby further amended by striking out the fourth paragraph, inserted by section 26.

**SECTION 28.** Section 38M of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following subsection:-
(j)(1) As used in this section, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Taxpayer”, a certified life sciences company or person subject to the taxes imposed by chapter 62, 63, 64H or 64I.
(2) If a credit claimed under this section by a taxpayer exceeds the amount that may otherwise be allowed under this section for a taxable year, 90 per cent of the balance of that credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year. If such credit balance is refunded to the taxpayer, then the credit carryover provisions of paragraph (f) shall not apply.

**SECTION 29.** Said section 38M of said chapter 63 is hereby further amended by striking out paragraph (j), added by section 28.

**SECTION 30.** Said chapter 63 is hereby further amended by inserting after section 38T the following 3 sections:-

Section 38U. (a) As used in this section, section 38V and section 38W, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product

pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Person”, a natural person, corporation, association, partnership or other legal entity.
“Taxpayer”, a life sciences company or person subject to the taxes imposed by this chapter or chapter 62, 64H or 64I.
(b) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, take a credit against the taxes imposed by this chapter in an amount equal to 10 per cent of the cost of qualifying property acquired, constructed, reconstructed or erected during the taxable year and used exclusively in the commonwealth.
Qualifying property shall be tangible personal property and other tangible property including buildings and structural components of buildings acquired by purchase, as defined under section 179(d) of the Code, as amended, and in effect for the taxable year, but not including property that is taxable under chapter 60A; provided, however, that such property shall be depreciable under section 167 of the Code and shall have a useful life of 4 years or more.
With respect to property which is disposed of or ceases to be in qualified use prior to the end of the taxable year in which the credit is to be taken, the amount of the credit shall be that portion of the credit provided for in this paragraph which represents the ratio which the months of qualified use bear to the months of useful life. If property on which credit has been taken is disposed of or ceases to be in qualified use prior to the end of its useful life, the difference between the credit taken and the credit allowed for actual use must be added back as additional taxes due in the year of disposition; provided, however, if such property is disposed of or ceases to be in qualified use after it has been in qualified use for more than twelve consecutive years, it shall not be necessary to add back the credit, as provided in this paragraph. The amount of credit allowed for actual use shall be determined by multiplying the original credit by the ratio which the months of qualified use bear to the months of useful life. For the purposes of this paragraph, useful life of property shall be the same as that used by the corporation for depreciation purposes when computing federal income tax liability.
The credit allowed under this section may be taken by an eligible corporation; provided, however, that neither credit allowed by section 31A nor section 31H is taken by such corporation; and provided, further, that the credit allowed by section 38N shall not be taken except to such extent, not to exceed 2 per cent of the cost of any qualifying property.
Nothing in this section shall limit the authority of the commissioner to make adjustments to a taxpayer’s liability upon audit or limit any other legal remedies available to the commissioner or the commonwealth against said taxpayer.
(c) The credit allowed by this section shall not be subject to section 32C.
(d) If a taxpayer that is subject to a minimum excise under this chapter, the amount of the credit allowed by this section shall not reduce the excise to an amount less than such minimum excise.
(e) A taxpayer entitled to a credit under this section for any taxable year may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, carry over and apply to its excise for any 1 or more of the next succeeding 10 taxable years, the portion, as reduced from year to year, of those credits which were not allowed by subsection (c) or which exceed the excise for the taxable year.

(f) For corporations filing a combined return of income under section 32B, a credit generated by an individual member corporation under this section shall first be applied against the separately determined excise attributable to that member, subject to the limitations of subsection (d). A member corporation with an excess credit may apply its excess credit against the excise of another group member, to the extent that such other member corporation may use additional credits under the limitation of paragraph (d). Unused, unexpired credits generated by member corporations shall be carried over from year to year by the individual corporation that generated the credit.
(g) The commissioner shall promulgate regulations necessary to implement this section. Said regulations may provide for the adjustment of intercompany prices and elimination of intercompany transactions to ensure that all amounts upon which the credit is based reasonably reflect fair market value and shall include provisions to prevent the generation of multiple credits with respect to the same property.
(h) If a credit allowed to a taxpayer under this section, or such credit as may be allowed under section 38N of this chapter as limited in this subsection, exceeds the excise otherwise due under this chapter, 90 per cent of the balance of such credit may, at the option of the taxpayer and to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be refundable to the taxpayer for the taxable year in which qualified property giving rise to that credit is placed in service. If such credit balance is refunded to the taxpayer, the credit carryover provisions of subsection (e) and said section 38N shall not apply.
Section 38V. A taxpayer which is a certified life sciences company pursuant to section 5 of chapter 23I may, to the extent authorized pursuant to the life sciences tax incentive program established by said section 5 of chapter 23I, be allowed a deduction under paragraph 4 of section 30 for that portion of qualified clinical testing expenses paid or incurred for the taxable year equal to the amount of the credit allowable for the taxable year under section 45C of the Internal Revenue Code and otherwise disallowed as a deduction under section 280C(b) of said Code.
Section 38W. (a) A taxpayer may, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, be allowed a credit against its excise due under this chapter equal to the sum of 10 per cent of the excess, if any, of the qualified research expenses for the taxable year, over the base amount, and 15 per cent of the basic research payments determined pursuant to section 41(e)(1)(A) of the Internal Revenue Code. The terms “qualified research expenses”, “base amount”, “qualified organization base period amount”, “basic research” and any other terms affecting the calculation of the credit shall, unless the context otherwise requires or unless otherwise stated in this section, have the same meanings as under said section 41 of said Code.
In determining the amount of the credit allowable under this section, the commissioner of revenue may aggregate the activities of all corporations that are members of a controlled group of corporations, as defined by 41(f)(1)(A) of said Code, and may aggregate the activities of all entities, whether or not incorporated, that are under common control, as defined in section 41(f)(1)(B) of said Code.
(b) For a qualified life science company, research and development costs, within the meaning of section 41 of said Code, shall include, to the extent they relate to legally mandated clinical trial activities, those qualified research expenditures that are performed both inside and outside of the commonwealth.

(c) For purposes of section 30, the deduction from gross income that may be taken with respect to any expenditures qualifying for a credit under said section 41 of said Code shall be based upon its cost less the credit allowable under this section; provided, however, that section 280C(c) of said Code shall not apply.
(d) The credit allowed hereunder for any taxable year shall not reduce the excise to less than the amount due under subsection (b) of section 32, subsection (b) of section 39, section 67 or under any other general or special law.
(e) The credit allowed under this section shall be limited to 100 per cent of a corporation's first $25,000 of excise, as determined before the allowance of any credits, plus 75 per cent of the corporation's excise, as so determined in excess of $25,000. The commissioner of revenue shall promulgate regulations similar to those authorized under section 38(c)(2)(B) of the Internal Revenue Code for purposes of apportioning the $25,000 amount among members of a controlled group. Nothing in this section shall alter section 32C, as it affects other credits under this chapter.
(f) If a corporation files a combined return of income under section 32B, a credit generated by an individual member corporation under this section shall first be applied against the excise attributable to that company under sections 32 or 39, subject to the limitations of subsections (d) and (e). A member corporation with an excess research and development credit may apply its excess credit against the excise of another group member if such other member corporation may use additional credits under the limitations of said subsections (d) and (e). Unused, unexpired credits generated by a member corporation shall be carried over from year to year by the individual corporation that generated the credit and shall not be refundable. Nothing in this section shall alter subsection (h) of section 31A.
(g) A corporation entitled to a credit under this section for any taxable year may carry over and apply to its excise for any of the next succeeding 15 taxable years that portion, as reduced from year to year, of its credit which exceeds its excise for the taxable year. A corporation may carry over and apply to its excise for any subsequent taxable year that portion, as reduced from year to year, of those credits which were not allowed by subsection (f).
(h) The commissioner of revenue shall promulgate regulations necessary to carry out this section.

**SECTION 31.** Sections 38U, 38V and 38W of said chapter 63 are hereby repealed.

**SECTION 32.** Section 42B of said chapter 63, as appearing in the 2006 Official Edition, is hereby amended by adding the following paragraph:-
To the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, a certified life sciences company may be deemed a research and development corporation for purposes of exemptions under chapters 64H and 64I.

**SECTION 33.** Said section 42B of said chapter 63 is hereby further amended by striking out the last paragraph, added by section 32.

**SECTION 34.** Section 6 of chapter 64H of the General Laws, as amended by section 12 of chapter 63

of the acts of 2007, is hereby further amended by adding the following paragraph:-

(xx) (1) Sales of tangible personal property purchased for a certified life sciences company, to the extent authorized pursuant to the life sciences tax incentive program established by section 5 of chapter 23I, for use in connection with the construction, alteration, remodeling, repair or remediation of research, development or manufacturing facilities and utility support systems. Only purchases made on or after the effective date of this section shall be eligible for this exemption.
(2) As used in this section, the following words shall, unless the context clearly requires otherwise, have the following meanings:-
“Life sciences”, advanced and applied sciences that expand the understanding of human physiology and have the potential to lead to medical advances or therapeutic applications including, but not limited to, agricultural biotechnology, biogenerics, bioinformatics, biomedical engineering, biopharmaceuticals, biotechnology, chemical synthesis, chemistry technology, diagnostics, genomics, image analysis, marine biology, marine technology, medical devices, nanotechnology, natural product pharmaceuticals, proteomics, regenerative medicine, RNA interference, stem cell research and veterinary science.
“Life sciences company”, a business corporation, partnership, firm, unincorporated association or other entity engaged in life sciences research, development, manufacturing or commercialization in the commonwealth, and any affiliate thereof, which is, or the members of which are, subject to taxation under this chapter.
“Utility support systems”, all areas of utility support systems including, but not limited to, site, civil, mechanical, electrical and plumbing systems.

**SECTION 35.** Said section 6 of said chapter 64H is hereby further amended by striking out paragraph (xx), added by section 34.

**SECTION 36.** Notwithstanding any general or special law to the contrary, the University of Massachusetts at Dartmouth shall acquire from the Massachusetts Development Finance Agency the land and improvements thereon located at 151 Martine street in the city of Fall River together with the accessory parking lot owned by the Massachusetts Development Finance Agency located on the north side of Martine street, hereinafter collectively referred to as the Advanced Technology Manufacturing Center, for an amount not to exceed $11,400,000 and pursuant to such other terms as the parties may mutually agree; provided, however, that said conveyance shall be approved by the board of trustees of the University of Massachusetts and the board of directors of Massachusetts Development Finance Agency. The conveyance shall be subject to a restrictive covenant prohibiting the University of Massachusetts at Dartmouth from occupying more than 60 per cent of the total square footage of the Advanced Technology Manufacturing Center at any time. The University of Massachusetts at Dartmouth shall retain any rent, license fees, appropriations, grants, fees, or such other monies earned in connection with owning and operating the Advanced Technology Manufacturing Center and shall apply such revenues solely to offset the costs associated with owning, operating, improving, leasing, licensing, managing and maintaining the land and improvements that constitute the Advanced

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Technology Manufacturing Center.

**SECTION 37.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, in collaboration with the Massachusetts International Trade Council shall, subject to appropriation, facilitate and support joint academic and industrial research and development and commercial business exchanges between the commonwealth and Israel in the area of life sciences; provided, further, that subject to appropriation, there shall be established a trade and incubator facility in Israel and a trade and incubator facility in Massachusetts facilitated by the Massachusetts International Trade Council in consultation with the Massachusetts office of international trade and investment, established by section 24 of chapter 23A of the General Laws, for collaborative, joint and pilot projects with the Government of the State of Israel, the Boston Haifa International Life Sciences Institute and other organizations working with Israel.

**SECTION 38.** Notwithstanding any general or special law to the contrary, the term of any member appointed prior to the effective date of this act to the board of directors of the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall expire upon the effective date of this act; provided, however, that any appointed board member whose term has expired pursuant to this section shall be eligible for reappointment to the board. Such appointments shall be made in accordance with section 3 of chapter 23I of the General Laws.

**SECTION 39.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws, in consultation with the department of agricultural resources, shall, subject to appropriation, establish a program to promote the research and development of plant-made pharmaceuticals and industrial products through field trials approved under a permit or approved notification by the Biotechnology Regulatory Service of the Animal and Plant Health Inspection Service of the United States Department of Agriculture.

**SECTION 40.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws, in conjunction with the office of the state treasurer, shall conduct an investigation and study of the feasibility of vetting and bundling life sciences enterprises for the purpose of securitization of enterprises to create investment opportunities to provide seed capital for enterprises. For the purposes of this study, “enterprise” shall be defined as a small business, as defined in chapter 40F of the General Laws, with its principal place of business in the commonwealth and which is, or proposes to be, engaged in manufacturing or research and development in the area of life sciences. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before March 31, 2009.

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**SECTION 41.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall conduct an investigation and study the feasibility of increasing the number of clinical trials conducted or expediting the process of conducting clinical trials in the commonwealth, by life sciences companies in the commonwealth. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate who shall forward the same to the house of representatives and the senate committees on ways and means, the joint committee on economic development and emerging technologies, the joint committee on public health and the joint committee on health care financing on or before March 31, 2009.

**SECTION 42.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, shall conduct an investigation and study of ways to enhance coordination between the angel investor community, so-called, and the life science industry. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before March 31, 2009.

**SECTION 43.** Notwithstanding any general or special law to the contrary, the Massachusetts Life Sciences Center, established by section 3 of chapter 23I of the General Laws, in conjunction with the appropriate state agencies, shall conduct an investigation and study to assess the feasibility of developing and implementing a program to engage and train community college students in the area of life sciences. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the joint committee on economic development and emerging technologies, the joint committee on education and the joint committee on labor and workforce development on or before June 30, 2009.

**SECTION 44.** Notwithstanding any general or special law to the contrary, the total administrative and operational expenses of the Massachusetts Life Sciences Center established by section 3 of chapter 23I of the General Laws shall not exceed $3,750,000 for fiscal year 2009; provided, further that said center shall conduct an investigation and study the center’s annual operating expenses including, but not limited to, lease payments, payroll and contracted costs, to be used by the legislature to calculate annual operating expenses for future fiscal years. Said center shall report to the general court the

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results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means and the joint committee on economic development and emerging technologies on or before December 31, 2008.

**SECTION 45.** Notwithstanding any general or special law to the contrary, the department of revenue shall conduct an investigation and study including a detailed description and a numerical accounting of all tax incentives awarded to life sciences companies certified by section 5 of chapter 23I of the General Laws, including the value of tax incentives authorized pursuant to the life sciences tax incentive program, as established by said section 5 of said chapter 23I, for each year for which the project was certified, and the value of tax incentives actually used as a result of the project. Said center shall report to the general court the results of its investigation and study and its recommendations, if any, together with drafts of legislation necessary to carry its recommendations into effect by filing the same with the clerks of the house of representatives and the senate, who shall forward the same to the house and senate committees on ways and means, the joint committee on economic development and emerging technologies and the joint committee on revenue annually on or before June 30. Such report shall be posted on the internet in a manner accessible to the public.

**SECTION 46.** To meet the expenditures necessary in carrying out the provisions of section 2B, the state treasurer shall, upon receipt of a request by the governor, issue and sell bonds of the commonwealth in an amount to be specified by the governor from time to time, but not exceeding, in the aggregate, $500,000,000. All bonds issued by the commonwealth, as aforesaid, shall be designated on their face, Life Sciences Center Capital Improvement Loan Act of 2008, and shall be issued for a maximum term of years, not exceeding 20 years, as the governor may recommend to the general court pursuant to Section 3 of Article LXII of the Amendments to the Constitution; provided, however, that all such bonds shall be payable not later than June 30, 2033. All interest and payments on account of principal on such obligations shall be payable from the General Fund. Bonds and interest thereon issued under the authority of this section shall, notwithstanding any other provisions of this act, be general obligations of the commonwealth.

**SECTION 47.** Notwithstanding any general or special law to the contrary, only certified life sciences projects authorized under section 5 of chapter 23I of the General Laws shall be eligible for the available capital funding provided in item 7002-0015 in section 2B.

**SECTION 48.** Notwithstanding any general or special law to the contrary, a private entity engaged in a construction, development, renovation, remodeling, reconstruction, rehabilitation or redevelopment project receiving funds pursuant to this act shall properly classify individuals employed on the project and shall comply with all laws concerning workers' compensation insurance coverage, unemployment insurance, social security taxes and income taxes with respect to all such employees. All construction contractors engaged by an entity on any such project shall furnish documentation to the appointing

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authority showing that all employees employed on the project have hospitalization and medical benefits that meet the minimum requirements of the connector board established in chapter 176Q of the General Laws.

**SECTION 49.** The value of any tax incentive award under the life sciences tax incentive program established in subsection (d) of section 5 of chapter 23I of the General Laws which extends beyond December 31, 2018, including carry-forwards of losses or credits, shall be taken into account during the year awarded and the full amount of such tax benefits potentially realized in periods after December 31, 2018 shall be counted against the annual ceilings for years ending prior to January 1, 2019. Tax incentives authorized pursuant to the life sciences tax incentive program shall count toward this $25,000,000 annual ceiling only if they are not otherwise available to a taxpayer.

**SECTION 50.** Notwithstanding any general or special law to the contrary, the sales tax exemption in paragraph (xx) in section 6 of chapter 64H of the General Laws shall apply to sales of tangible personal property purchased for a certified life sciences company established in section 5 of chapter 23I of the General Laws on or after the effective date of this act.

**SECTION 51.** Notwithstanding any general or special law to the contrary, eligibility for a tax credit on user fees under paragraph (2) of subsection (n) of section 6 of chapter 62 of the General Laws and under subsection (f) of section 31M of chapter 63 of the General Laws shall apply to user fees paid on or after the effective date of this act.

**SECTION 52.** Subsection (d) of section 5 of chapter 23I of the General Laws, as appearing in section 14, shall take effect on January 1, 2009.

**SECTION 53.** Sections 17, 19, 21, 24, 26, 28, 30, 32, and 34 shall take effect on January 1, 2009.

**SECTION 54.** Sections 18, 20, 22, 23, 25, 27, 29, 31, 33, and 35 shall take effect on December 31, 2018.

*Approved June 16, 2008*

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# Appendix C:
## Independent Reports and Documents

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# OFFICE OF PERFORMANCE MANAGEMENT & OVERSIGHT FISCAL 2012 ANNUAL REPORT

The Office of Performance Management & Oversight (OPMO) measures the performance of all public and quasi-public entities engaged in economic development. All agencies are required to submit an Annual Report. The annual reports of each agency will be published on the official website of the Commonwealth, and be electronically submitted to the clerks of the senate and house of representatives, the chairs of the house and senate committees on ways and means and the house and senate chairs of the joint committee on economic development and emerging technologies.

## 1) AGENCY INFORMATION

| | | | |
|---|---|---|---|
| **Agency Name** | Massachusetts Life Sciences Center | | |
| **Agency Head** | Susan Windham-Bannister, Ph.D. | **Title** | President & CEO |
| **Website** | www.masslifesciences.com | | |
| **Address** | 1000 Winter Street, Suite 2900, Waltham, MA 02451 | | |

## 2) MISSION STATEMENT

Please include the Mission Statement for your organization below.

The Massachusetts Life Sciences Center (MLSC) is a quasi-public agency of the Commonwealth of Massachusetts tasked with implementing the Massachusetts Life Sciences Act, a ten-year, $1 billion initiative that was signed into law in June of 2008. The Center's mission is to create jobs in the life sciences and support vital scientific research that will improve the human condition. This work includes making financial investments in public and private institutions that are advancing life sciences research, development and commercialization as well as building ties among sectors of the Massachusetts life sciences community.

## 3) OPERATIONS AND ACCOMPLISHMENT DETAILS

Please provide details on the agency's operations and accomplishments for Fiscal Year 2012 as **Attachment A.** Questions 5 through 10 will provide guidance on the type of information required under Chapter 240 of the Acts of 2010. (**Please see attached FY12 MLSC Annual Report )**

## 4) Accounting

Please provide financial information for your agency. Below please give a summary of *Receipts and Expenditures* during the fiscal year, and include the *Assets and Liabilities* at the end of the fiscal year. Please include the most recent audited financial report for the agency as **Attachment B**.

**(Please see attached MLSC Audit Report)**

| | Amount |
|---|---|
| **Receipts** | **$** |
| **Expenditures** | **$** |
| **Assets** | **$** |
| **Liabilities** | **$** |

## 5) Investments or Grants to Businesses or Individuals

Does your agency make **investments** and/or provide **grants** to businesses or individuals? **Yes X** **No** ☐
If **Yes**, please provide detailed information on investments and/or grants made during FY12 in the Operations and Accomplishments Section of this report. Information should include the number, nature and amounts of investments made and grants awarded by your agency along with job, investment and/or other economic development impact. Please list the name(s) of the investment and/or grant programs offered by your agency in the space provided below:

Please see attached MLSC FY12 Annual Report

## 6) Debt or Equity Investment Details

Is your agency involved in **debt** or **equity investments** for businesses? **Yes X No** ☐
If **Yes**, please provide detailed information on debt and/or equity investments made during FY12 in the Operations and Accomplishments Section of this report along with job, investment and/or other economic development impact. Please list the name(s) of the debit and/or equity investments programs offered by your agency in the space provided below:

Please see attached MLSC FY12 Annual Report – Accelerator Loan Program

## 7) Loan Details

Is your agency involved in **real estate loans**, **working capital loans**, or any **other type of loan** or **guarantee**? **Yes X** **No** ☐
If **Yes**, please provide detailed information on loan(s) and/or guarantee(s) made during FY12 in the Operations and Accomplishments Section of this report along with job, investment and/or other economic development impact. Please list the types of loan(s) and/or guarantee(s) offered by your

agency in the space provided below:

Please see attached MLSC FY12 Annual Report. Please also note that the Center is not involved in real estate loans.

## 8) Other forms of Financing or Financial Assistance?

If your agency provides any other form of financing or financial assistance please include FY12 details in the Operations and Accomplishments Section of this report along with job, investment and/or other economic development impact. Please list the types of other forms of financing offered by your agency in the space provided below:

Please see attached FY12 Annual Report

## 9) Patents or Products

Does your agency track **patents** or **products** resulting from agency-funded activities? **Yes** ☐ **No X**
If **Yes**, please include details in the Operations and Accomplishments Section of this report along with job, investment and/or other economic development impact. Please list the agency-funded activities of your agency that promote patent and product advancement in the space provided below:

[Please enter the details on patents or products here.]

## 10) Technical Assistance

If your agency provides technical assistance, please provide detailed information on technical assistance provided during FY12 in the Operations and Accomplishments Section of this report along with job, investment and/or other economic development impact. Please list the name(s) of the technical assistance programs offered by your agency in the space provided below:

N/A

**Please note:**

The Fiscal Year 2013 Annual Report will require details of above mentioned categories as well as performance to plan as outlined in your Agency's Fiscal 2013 Business Plan. The Office of Performance Management and Oversight will annually re-evaluate the goals and measures established by the agencies. The Office will recommend changes to goals and measures as are appropriate to align with the statewide economic development policy and plan.

**Filing Instructions:**

THE FISCAL YEAR 2012 REPORT IS DUE NO LATER THAN MONDAY, OCTOBER 1ST. AN ELECTRONIC COPY OF THE REPORT AND ATTACHMENTS A & B SHOULD BE E-MAILED TO ROB.ANDERSON@STATE.MA.US. THE OFFICE OF PERFORMANCE MANAGEMENT AND OVERSIGHT WILL REVIEW REPORTS PRIOR TO FILING WITH LEGISLATURE AND POSTING TO THE WEBSITE.

MASSACHUSETTS LIFE SCIENCES CENTER

# Fiscal Year (FY) 2012 Annual Report

## *OUTPACING THE COMPETITION*

*U.S. sprinter Allyson Felix leads the field on her way to winning the women's 200-meter gold medal in the London 2012 Olympics*

MASSACHUSETTS LIFE SCIENCES CENTER

**To:** Governor Deval Patrick
Secretary of Administration and Finance Jay Gonzalez
Senate President Therese Murray
Speaker of the House Robert DeLeo
State Comptroller Martin Benison
Clerk of the Senate William Welch
Clerk of the House of Representatives Steven James

*By forward: House and Senate Committees on Ways and Means and the Joint Committee on Economic Development and Emerging Technologies*

**From:** Susan Windham-Bannister, Ph.D.

**Date:** September 28, 2012

**Re:** FY 2012 Annual Report of the Massachusetts Life Sciences Center

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The Massachusetts Life Sciences Center (the "Center") respectfully submits this Annual Report detailing our operations and accomplishments during FY 2012.

We are the hub of the Commonwealth's thriving life sciences community and proudly serve as stewards of the $1 billion Massachusetts Life Sciences Initiative, which was passed by the state legislature and signed into law in June 2008. In FY 2012, through investments made by the Center, Massachusetts pulled away from its major competitors and emerged as the undisputed global leader in the life sciences.

This report and the accompanying FY 2012 Audit Report are submitted in fulfillment of the requirements mandated by the General Court pursuant to the Center's enabling statute of the Massachusetts General Laws, Chapter 23I (formerly Section 7, now Section 15), as amended by Chapter 130 of the Acts of 2008. Financial statements are contained in the accompanying FY 2012 Audit Report by PricewaterhouseCoopers.

As always, we appreciate your continued interest and support.

Sincerely,

SWindhamBannister

Susan Windham-Bannister, Ph.D.
President & CEO

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## Outpacing the Competition

Four years ago, Massachusetts was a recognized leader in the life sciences, but the state faced stiff competition, both domestic and international. Inaction have diminished our leadership position – with negative repercussions for the state's scientific reputation as well as our economy.

At the 2007 BIO International Convention, Governor Deval Patrick proposed the Massachusetts Life Science Initiative, a 10-year, $1 billion investment to secure and strengthen the state's leadership in the life sciences, and to bolster the life sciences as an economic engine for the Commonwealth. This initiative was passed by our state legislature and signed into law in June 2008.

The Center is charged with implementing the Life Sciences Initiative. The Center's strategic priorities include funding translational life sciences research, making financial investments in promising new technologies, ensuring that the next generation of life sciences workers has skills that are well-aligned with industry needs, and building unique partnerships between sectors of the local and international life sciences communities. Since 2008, we have not only been investing in innovation, we have been innovating – creating new programs, tools and partnerships that create jobs, drive business growth and accelerate the commercialization of good science that holds the potential to improve the human condition.

*President & CEO*
*Dr. Susan Windham-Bannister*

Since the enactment of the Initiative in 2008, the Center has made numerous investments that have secured and strengthened Massachusetts' leadership in the life sciences. The Commonwealth has pulled ahead of the competition – Massachusetts is now **the** recognized life sciences leader in the U.S. and across the globe. This past December, independent studies once again rated Massachusetts number one for life sciences in the U.S. by a wide margin (Jones, Lang, Lasalle, 2011) and the number-one region for biotech construction (Richards, Barry, Joyce, 2011).

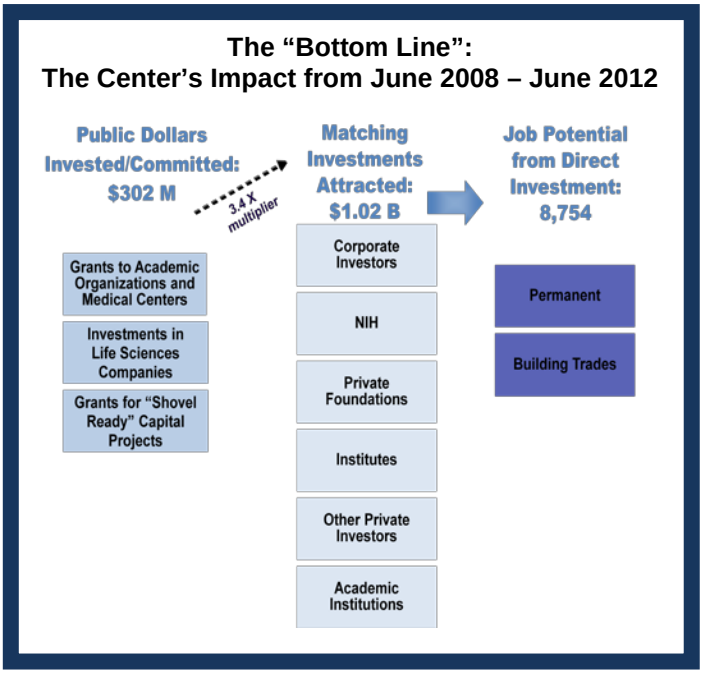
### The Bottom Line

The Center's investment strategy is based on public-private collaboration to leverage public tax dollars. This strategy has proven effective; since 2008, the Center has directly invested or committed more than $300 million and leveraged more than $1 billion in third-party investment. In other words, for every $1 of taxpayer money that the Center has invested, Massachusetts has attracted $3.40 in additional, outside investment – creating a public-private investment fund of more than $1.3 billion for the state's life sciences ecosystem that would not have existed without the Life Sciences Initiative.

For every $1 of taxpayer money that the Center has invested, Massachusetts has attracted $3.40 in additional, outside investment.

The Center uses a portfolio of tools and investments to achieve its goals and objectives. To ensure that all investments are evaluated on the basis of merit and "relative best use" of the Commonwealth's funds, the Center makes its awards based on competitive solicitations and a rigorous, transparent review process that draws on experts from the life sciences sectors across the state. The broad expertise that informs the Center's decisions has enabled us to make smart, strategic investments that attract matching investment capital and highly leverage the public dollars that have been entrusted to the Center.

The Center's direct investments to date are projected to create thousands of jobs across Massachusetts. According to MassBio's "2012 Biopharma Industry Snapshot," biopharma employment has grown 42 percent in Massachusetts since 2002, and the new jobs being created are not only for scientists. Most of these new jobs are for people with skills in manufacturing, IT, sales and marketing, and other fields. A large percentage of the available jobs are open to workers with a Bachelor's degree or less.




Furthermore, the Center's investments are made with the goals of improving health-care quality for and reducing the health-care costs of patients. A substantial portion of our portfolio represents investments both in translational research with strong potential for commercialization and in companies that are bringing new products to the marketplace.

During these challenging economic times, the Center is proud to play such a prominent role in Massachusetts' economic recovery.

## Investment Portfolio

The Center's investments in FY 2012 included six new capital projects, grants or loans to nine early-stage companies and tax incentive awards to 26 companies.

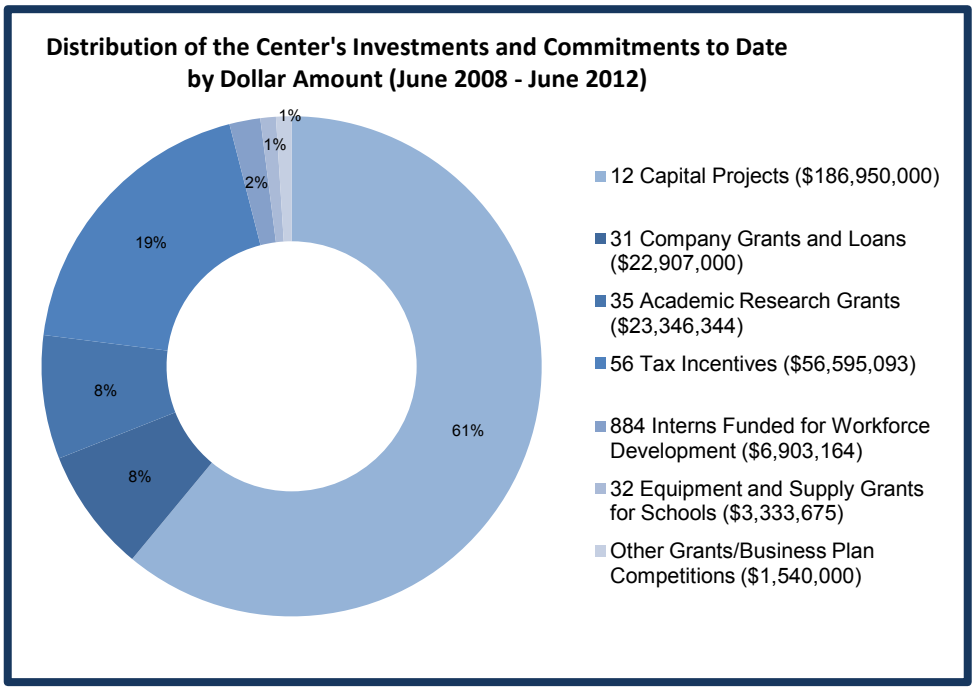
In FY 2012, more than 1,600 students applied for the Life Sciences Internship Challenge, and the Center placed 405 interns at 203 companies across Massachusetts. The Internship Challenge is now in its fourth year of investing in the next generation of talented life sciences workers in Massachusetts.

FY 2012 was also a strong year for company recruitment to Massachusetts. Motivated by the Center's tax incentives and investments in the state's life sciences ecosystem, several global life sciences leaders significantly expanded their presence in the state. The Center welcomed companies, large and small, to the Massachusetts life sciences community, helping to organize their ribbon-cutting events and collaborating on their press announcements.

The Center plays an important role as a convener across the life sciences industry at the global, national and state levels. One manifestation of these efforts is the creation of the Massachusetts Neuroscience Consortium ("the Consortium"). This pioneering model for supporting pre-clinical research, announced at the 2012 BIO International Convention, is designed to leverage the rich research environment in Massachusetts and build on the Commonwealth's status as a global leader in neuroscience. Charter sponsors of the Consortium are Abbott, Biogen Idec, EMD Serono, Janssen Research & Development LLC, Merck, Pfizer and Sunovion Pharmaceuticals Inc. The Consortium announced its first solicitation for research projects in September of 2012.

The Center currently manages a portfolio of approximately 200 grants, loans and tax incentives.

The Center currently manages a portfolio of approximately 200 grants, loans and tax incentives.




Concluding a great fiscal year, in June the Center co-hosted with MassBio Massachusetts' presence at the 2012 BIO International Convention in Boston. This convention was a landmark opportunity to showcase the accomplishments in Massachusetts since the inception of the Life Sciences Initiative and all that Massachusetts has to offer as the global leader in the life sciences.

## Investing in Infrastructure

Massachusetts has demonstrated its commitment to the life sciences community through investments in infrastructure to accelerate promising science as well as to create a business-friendly environment. Half of the resources, $500 million, committed via the Life Sciences Initiative are dedicated to capital projects designed to ensure that more institutions and regions of the state have the necessary infrastructure to be "life-sciences ready." The Center's investments in infrastructure are funded through our capital fund, which received $43.5 million in bonding capacity in FY 2012 as part of the state's overall capital plan. Grants from the Center not only make possible the creation of the cutting-edge infrastructure needed for scientific advancement but also support basic infrastructure upgrades that often are needed for biomanufacturing and company expansion. Additionally, the Center is committed to funding the development of novel resources that companies and researchers will be able to find only in Massachusetts.

The Center's Board of Directors approved six new infrastructure projects in FY 2012, totaling $56 million:

- **Joslin Diabetes Center** was awarded $5 million to support the construction of its comprehensive **Translational Center for the Cure of Diabetes**. According to Joslin officials, the Center's grant is the largest single grant ever awarded to support diabetes-related research in Massachusetts. This new facility will enable the Joslin Diabetes Center to accelerate its clinical and research endeavors through the creation of cutting-edge labs and platforms. The work at this new facility will lead to the development of translational studies for curing Type 1 and Type 2 diabetes and their complications, as well as to the advancement of

*Lilly Branka, a Type 1 diabetes patient, prepares to knock down a wall of the old Joslin Clinical Research Center at the groundbreaking of the Translational Center for the Cure of Diabetes, as Governor Patrick and Dr. Windham-Bannister look on.*

Joslin's work in diabetes prevention and obesity. Joslin will renovate nearly 20,000 square feet of space, and the project is projected to create approximately 50 construction jobs beginning in FY 2013 and approximately 50 new permanent jobs in the life sciences. At the 2012 BIO International Convention, the biopharma giant, Sanofi, and the Joslin Diabetes Center announced a new collaboration to promote the development of medicines for the treatment of diabetes and related disorders. The creation of Joslin's new Translational Center will enable this partnership.

Over the past four fiscal years, the Center has committed $187 million to 12 capital projects, which have so far created more than 2,000 jobs in the building trades and 425 permanent jobs in the life sciences.

- **Dana-Farber Cancer Institute** was awarded $10 million to support the expansion of its Molecular Cancer Imaging Facility, a pioneering $20-million research initiative to develop new molecular imaging probes. The facility will ultimately allow physicians to better diagnose and characterize cancer, choose targeted therapies, monitor treatment efficacy and improve the outcomes of patients with cancer. This project is expected to create 100 construction jobs and 15 permanent positions in the facility.

- The **Boston Museum of Science** was awarded $5 million for the construction of its "Hall of Human Life." Envisioned as one of the museum's largest and most far-reaching exhibits, the "Hall of Human Life," opening in July of 2013, aims to revolutionize the way people understand their own biology and manage their health. Designed to evolve with the increasing number of breakthroughs in biology and biotechnology, this 10,000 square-foot exhibit will spark visitors' curiosity about innovations in the life sciences, address their concerns about health care and help them develop the thinking skills needed to make informed choices. The Center's grant has leveraged $11 million in project funding from other sources, and the project is expected to create 75 jobs in the construction trades and 20 permanent new jobs at the museum.

- **UMass Dartmouth** was awarded $14.6 million to build its new Massachusetts Biomanufacturing Center in Fall River. Designed to accelerate the development of the life sciences industry in the region, the 32,000 square-foot building will provide emerging companies with a place to prove the feasibility of their products to investors and will feature R&D laboratories and educational space. The new facility will anchor the recently established Fall River Biopark. This $28-million project is expected to create 120 construction jobs, 10 permanent positions and additional jobs within the biomanufacturing industry.

The Center's infrastructure investments have contributed to the creation of more than one *million* square feet of new life sciences research and manufacturing space across the Commonwealth.

- **UMass Lowell** was awarded $10 million to equip laboratories within its new Emerging Technologies and Innovation Center. The 84,000 square-foot facility builds on UMass Lowell's unique expertise in plastics engineering, nanotechnology, bioprocessing, electro-optics and advanced manufacturing. The grant will fund research facilities at the new center, providing the university and companies access to clean-room capabilities that are unparalleled in this region of the Commonwealth and a state-of-the-art lab focused on developing new medical applications and other capabilities tied to nano, bio-optics and other technologies. This $70-million project is expected to create 100 construction jobs.

- **UMass Dartmouth** was awarded $11.4 million to purchase the land and finance improvements, previously funded by Massachusetts Development Finance Agency, needed to establish the Advanced Technology Manufacturing Center (ATMC). This facility is designed to leverage university resources for regional economic development on the South Coast. The ATMC engages in research and works with industry partners to provide opportunities for technology exchange, while providing educational opportunities for students, and research and commercialization opportunities for faculty. The facility also includes a Technology Venture Center that incubates early-stage companies. The Center's funding has allowed UMass

Dartmouth to accelerate its investment in campus labs by approximately five-to-eight years through the investment of $13.2 million in internal funds.

Three of the six aforementioned projects – the Dana-Farber Cancer Institute, Joslin Diabetes Center and the Museum of Science – were funded through the Center's first-ever Capital Project Matching Grant solicitation. The Center received 22 applications for infrastructure projects from across the state through this program. In FY 2013, the Capital Project Matching Grant program will make $40 million available for life-sciences-related capital projects around the state.

Over the past four fiscal years, the Center has committed $187 million to 12 capital projects, which have thus far created more than 2,000 jobs in the building trades and 425 permanent jobs in the life sciences, with many more jobs projected as the projects are completed and the facilities become operational:

**Investments in Infrastructure**

| Project | Award Amount | Year of Award | Status at End of FY 2012 |
|---|---|---|---|
| Framingham Wastewater and Pumping Station | $14.3 million | FY 2009 | Substantial completion and under-budget |
| Marine Biological Laboratory in Woods Hole | $10 million | FY 2009 | Project completed in FY 2010 |
| Tufts/Cummings School of Veterinary Medicine, NE Regional Biosafety Lab in Grafton | $9.5 million | FY 2009 | Project completed in FY 2010 |
| Albert Sherman Center at UMass Medical School | $90 million | FY 2010 | Project to be completed in Winter 2013 |
| Worcester Polytechnic Institute/Gateway Park | $5.15 million | FY 2010 | Project construction well underway |
| UMass Boston/Dana Farber Center for Personalized Cancer Therapy | $2 million | FY 2011 | Project construction to begin in FY 2013 |
| UMass Dartmouth Biomanufacturing Center | $14.6 million | FY 2012 | Project underway |
| Dana Farber Molecular Cancer Imaging Center | $10 million | FY 2012 | Project underway |
| Joslin Translational Center for the Cure of Diabetes | $5 million | FY 2012 | Project underway |
| Museum of Science "Hall of Human Life" | $5 million | FY 2012 | Project underway |
| UMass Lowell Emerging Technologies and Innovation Center | $10 million | FY 2012 | Project underway |
| UMass Dartmouth Advanced Technology Manufacturing Center (ATMC) | $11.4 million | FY 2012 | Project authorized for FY 2015 |

The Center's infrastructure investments have contributed to the creation of more than one *million* square feet of new life sciences research and manufacturing space across the Commonwealth.

# Incubating the Companies of the Future

## Accelerating the Growth of Early-Stage Companies

From the Accelerator program's inception through the end of FY 2012, the Center has funded or committed to a total of $11.2 million in Accelerator Loans.

In FY 2012, the Center continued its commitment to building the pipeline of new life sciences companies in Massachusetts by committing to a total of $3.1 million in Accelerator Loans to six early-stage companies. The Center's Accelerator Loan program provides working capital to early-stage life sciences companies at a critical stage in their development. This program seeks to de-risk these companies for future – usually private -- investors by funding the necessary steps to achieve critical milestones. Some of these companies may hold the promise of becoming the next Vertex or Boston Scientific, while others may be acquired by large companies that are increasingly depending on the creativity of entrepreneurs to find the next promising technology. These young companies help to create an exciting environment in Massachusetts for life sciences entrepreneurs. They also make Massachusetts a fertile environment for mature life sciences companies, whose business models are increasingly reliant on "external innovation."

During FY 2012, the Center expanded the Accelerator program from one round per year to two, with the goals of reaching more prospective applicants and reducing the "wait time" for companies that miss the deadline on a particular round of the program. Over the past year, the Center received a total of 67 applications, of which 63 were eligible for review by experts selected from among the Center's 200-plus *pro bono* volunteer peer reviewers. The Center's peer reviewers recommended 33 of these applicants for review by the Center's Scientific Advisory Board (SAB – see Appendix B). Eight companies were recommended by the Investment Subcommittee of the Center's Board of Directors ("the Board" – see Appendix A), approved by the Board and designated by the Center as certified life sciences companies, as required by the Life Sciences Act. However, one company exited the program prior to receiving an award because it was acquired by a larger company. Another one of the eight recommended companies became ineligible because of a change in its strategic direction. The Center committed to a total of six loans during FY 2012, as indicated below:

To date, Accelerator companies have raised more than $100 million in funding subsequent to receiving a loan from the Center.

**Accelerator Loans in FY 2012**

| Company | Location | Area of Development | Loan Amount |
|---|---|---|---|
| Allurion | Wellesley | Developing a novel medical device designed to induce significant weight loss by displacing volume in the stomach | $750,000 |
| Alcyone Lifesciences, Inc. | Ayer | Developing novel micro-catheter approach for treating neurological conditions | $750,000 |
| Christcot Medical | Sudbury | Developing an innovative and unique device for rectal medication delivery to enhance the lives of patients with chronic diseases | $257,000 |
| HepatoChem | Beverly | Developing difficult-to-synthesize small molecules based on chemical reactions allowed by porphyrins and other catalysts | $330,000 |
| Sample6 Technologies | Boston | Building the world's first "near-real-time" microbial monitoring system with first application in food safety | $750,000 |
| Strohl Medical | Weymouth | Creating a new medical device for triaging potential stroke patients to accelerate their time to treatment | $245,000 |

From the Accelerator program's inception through the end of FY 2012, the Center has funded or committed to a total of $11.2 million in Accelerator Loans.

In FY 2012, two companies repaid Accelerator Loans with interest early, after achieving significant success in private fundraising or the sale of the company. As of the close of FY 2012, a total of four companies have pre-paid their loans: two in FY 2012 and two in prior fiscal years.

*Pluromed and 4s3 Bioscience, Inc., prepay their Accelerator Loans during FY 2012.*

Pluromed, recipient of an Accelerator Loan in 2009, repaid its loan in FY 2012 after being acquired by Sanofi. Pluromed's product, a new and simple device for clampless vascular and cardiovascular surgery, will now be marketed globally by Sanofi's Biosurgery Division. In addition, 4s3 Bioscience, recipient of an Accelerator Loan in 2010, prepaid its Accelerator loan after raising $20 million in private financing. To date, Accelerator companies have raised more than $100 million in funding subsequent to receiving a loan from the Center.

## Support for Small Businesses

*From left to right: Lydia Villa-Komaroff, Ph.D., Director and CSO, Cytonome/ST; Davide Marini, Co-Founder and CEO, Firefly BioWorks; Susan Windham-Bannister, Ph.D., President and CEO, Massachusetts Life Sciences Center; Edward Benz, M.D., President and CEO, Dana-Farber Cancer Institute*

The Small Business Matching Grant (SBMG) program builds on federal investments Massachusetts companies have received through grants from the National Institutes of Health (NIH), the National Science Foundation (NSF) and the Department of Defense (DOD). One of the goals of this program is to create jobs in Massachusetts based on the commercialization of products with high potential for market adoption and penetration.

In FY 2012, 19 small businesses applied for the SBMG program. The Center awarded a $500,000 SBMG grant to Firefly Bioworks, Inc., based in Cambridge, after extensive review by the Center's peer reviewers, the SAB and the Board. Per statute, companies receiving a SBMG award are not required to be certified.

Firefly BioWorks, Inc.'s first product was recently launched and is designed to detect microRNAs, an

emerging class of biomarkers that has shown great promise in the diagnosis of cancer, neurological disorders and many other diseases. This product consists of a high-performance, universal technology platform for multiplexed biomarker detection, with applications in life sciences research and diagnostics. The platform enables detection of clinically relevant biomolecules with an unprecedented combination of performance, throughput and cost.

**Small Business Matching Grants in FY 2012**

| Company | Location | Area of Development | Amount Awarded |
|---|---|---|---|
| Firefly Bioworks, Inc. | Cambridge | High-performance, universal technology platform for multiplexed biomarker detection for life sciences research and diagnostics | $500,000 |

From the time of the SBMG program's inception through the close of FY 2012, the Center has awarded $4 million to eight companies. To date, SBMG awardees have raised more than $20 million from other grants, investments or sale of the company.

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Also, the Center supported entrepreneurship and company creation by co-sponsoring two important business plan competitions in FY 2012: MassChallenge received a $100,000 contribution, and the WPI Venture Forum received a $10,000 contribution for its annual business plan competition.

## From Bench to Bedside: Academic Research Matching Grant Programs

The promise offered by innovation begins with "discovery," usually in an academic setting. Thus, the Center's key priorities are to preserve the strong competitive position of Massachusetts' academic institutions and medical centers, support translational research in the life sciences, and accelerate the discovery and transfer of technology out of academic settings. To accomplish these objectives, the Center has created several research matching grant programs. During FY 2012, 19 of the 34 grants awarded through these programs concluded, and most of the remaining grants will conclude by December 31, 2012.

### New Investigator Research Matching Grants

The New Investigator Research Matching Grant program is designed to spur innovative research and advance the careers of new investigators working in the life sciences at research institutions in the Commonwealth. To date, the Center has awarded 21 grants, totaling $5.1 million to early-career investigators.

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As of September 2012, 62 percent of the Center's New Investigators (13 of 21) have leveraged their grants from the Center with awards of follow-on funding from other sources (i.e. federal agencies, private foundations, academic institutions, etc.). The Center's investment in these 13 investigators totaled $3.25 million. Since being awarded the Center's New Investigator Grant, these 13 investigators have won at least 28 additional research awards and grants from other sources, totaling over $13 million — leverage of 4-times the Center's initial investment.

The New Investigator Grants have also enabled the awardees to advance science. Ninety percent of the Center's New Investigators (19 of 21) have published articles based on the projects funded by the Center.

These 19 grantees have published a combined total of 80-plus articles in more than 50 scientific, peer-reviewed journals, including the following:

*Advanced Materials*
*Cell*
*EMBO Journal*
*Gastroenterology*
*Genes & Development*
*Journal of Cell Biology*
*Journal of Bacteriology*
*Journal of Infectious Diseases*
*Lab on a Chip*
*Nature*
*Nature Biotechnology*
*Nature Materials*
*New England Journal of Medicine*
*Optics Express*
*PLoS One*
*Proceedings of the National Academy of Sciences (PNAS)*
*Science*

These publications include top-tier journals – the most prestigious, high-impact publications in the life sciences, such as *Nature*, *Science* and *Cell*.

The case study below provides an illustrative example of the scientific impact enabled by the New Investigator Grants:

**Case Study: Dr. Matthias Marti**

A $200,000 New Investigator Grant was awarded to Harvard School of Public Health's Dr. Matthias Marti in 2009 to establish a high throughput screen focused on preventing the development of gametocytes, which mediate transmission of malaria. No current drugs target the sexual part of the parasite's lifecycle and the therapeutic value of these drugs is decreasing.

- **2010**
  - Generated a fluorescent-reporter parasite line.
  - Established , optimized, and validated screen assay in 96-well format, using known bioactive malaria compounds.
- **2011**
  - Performed small-scale screen targeting a pathway that had been implicated in sexual-conversion of malarial parasites. This standardized screen addressed conflicting evidence in the literature regarding the role of pathway components in malaria.
- **Current**
  - Pursuing additional small-scale screens with collaborators targeting other pathways
  - Developing a new screening assay with higher throughput and increased sensitivity.

**Dr. Marti's work is creating a screening assay that has the potential to identify the next generation of malaria drug candidates.**

## Cooperative Research Grants

The Center's Cooperative Research Grants encourage industry-sponsored research at Massachusetts academic institutions and accelerate translational research. Between 2008 and 2011, the Center has awarded eight grants, totaling $4.78 million.

As of September 2012, two of the eight, or one quarter, of the Cooperative Research Grants' academic researchers have leveraged their grants from the Center with follow-on funding. The Center's investment in these two investigators totals $1.35 million. These two investigators have won three additional research grants from other sources, totaling more than $8.6 million — leverage of approximately 6.4 times

the Center's investment. Moreover, one investigator has received follow-on funding from the project's industry partner to continue his translational research project.

Four of the eight, or half, of the Cooperative Research investigators have published articles based on the work conducted through their cooperative research projects funded by the Center. These grantees have published a combined total of at least 10 articles that have been presented in six scientific journals. Moreover, through their sponsored research projects, of the eight investigators, one has been granted a full U.S. patent, and another has filed a U.S. provisional patent application and international PCT provisional patent application.

The case study below provides an illustrative example of the scientific impact of the Cooperative Research Grants:

**Case Study: Baxter Healthcare and the Immune Disease Institute**

A $750,000 Cooperative Research Matching Grant was awarded to the Immune Disease Institute's Dr. Judy Lieberman in 2008 (matched by Baxter Healthcare) to develop an siRNA-based microbicide for viruses, such as herpes, HPV, and HIV.

- **2009:**
  - Improved siRNA's effectiveness and targeting for multiple species, including human
  - Optimized conditions for formulation of siRNA-based microbicide
  - Developed an human *ex vivo* system for testing infection and siRNA-based microbicide
- **2010:**
  - Optimized conditions for formulation of siRNA-based microbicide
  - Optimized methods for human *ex vivo* system
  - **Awarded 5-year grant from NIAID of NIH based in part on these studies**
- **2011:**
  - Assessed optimized siRNA-based microbicide's effectiveness against herpes virus in mice, and characterized the mechanism by which protection was achieved
  - Published on siRNA-conferred protection from HIV infection in mouse and *ex vivo* human studies
- **2012:**
  - US Patent granted for "siRNA microbicides for preventing and treating diseases"
  - Characterized HIV-targeted siRNA efficiency and protection from infection in humanized mice and human explants

## Developing the Next Generation of Life Sciences Leaders

### The Internship Challenge Program

The Internship Challenge is a workforce development program focused on enhancing the talent pipeline for life sciences companies in Massachusetts while simultaneously providing interns with practical, "hands-on" experience that prepares them to step into the workforce ready to meet the job requirements of life sciences employers. The program provides paid internships to sophomores, juniors and seniors; community college students; graduate students; and recent college graduates. Since the program first launched in 2009, 884 interns representing 124 different colleges and universities

Since the program first launched in 2009, 884 interns representing 124 different colleges and universities, have been placed at 290 companies across the state.

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In this program, host companies commit to providing a dedicated mentor and a meaningful internship opportunity related to the academic focus of eligible students. The Center uses a web-based interface to connect student candidates and the host companies; there, students post resumes, and host companies can match skills with their needs. Host companies then contact and interview candidates, select interns for their programs and notify the Center of their desire to provide an internship to a qualified student.

*On August 30, 2012, SouthCoast participants in the Massachusetts Life Sciences Center's Internship Challenge gathered at UMass Dartmouth's Advanced Technology and Manufacturing Center to present on their summer internship experiences.*

The Internship Challenge is designed to expand the pool of prospective employees who have practical experience, enhance opportunities for mentoring, enable more students to explore career opportunities despite the challenging economic environment, and provide students interested in working in the life sciences with a peer network through educational and informational exchange events. The Center's interns usually work in smaller and younger companies, so they also receive exposure to the dynamic environment of entrepreneurship.

The Internship Challenge is also a human-capital subsidy program for small and early-stage companies. The Center only reimburses student stipends for companies with 100 or fewer employees. Life sciences companies with more than 100 employees and research institutions can recruit students from the Center's database, but do not receive reimbursement for the interns that they hire. Host companies represent a broad spectrum of the life sciences industry, including pharmaceuticals, medical devices, biotechnology and contract research organizations.

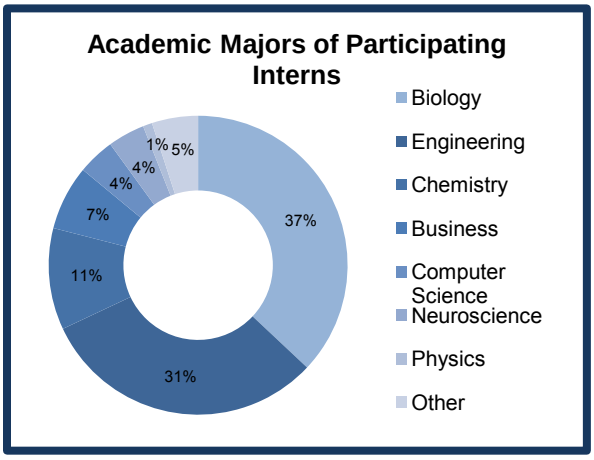
Based on the success of the program, on May 25, 2011 the Center's Board of Directors authorized its expansion from a summer-only program to a year-round program, allowing greater flexibility for students and companies.

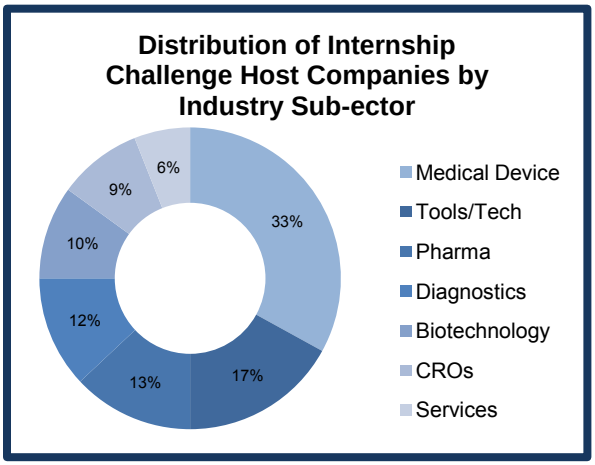
More than 1,645 students submitted applications for review by 274 life sciences companies across Massachusetts in FY 2012. The program placed a total of 405 interns with 203 host companies, a substantial increase over prior years. Interns were demographically diverse and represented 79 different colleges and universities.

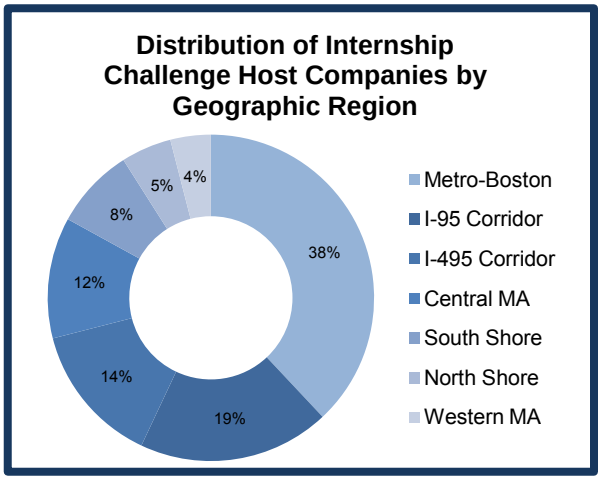
As a result, FY 2012 brought additional growth, funding and recognition for the Center's Internship Challenge program. More than 1,645 students submitted applications for review by 274 life sciences companies across Massachusetts. The program placed a total of 405 interns with 203 host companies, a substantial increase over prior years. (See Appendix C for a complete list of the FY 2012 Internship Challenge host companies.) Interns were demographically diverse and represented 79 different colleges and universities. Nearly all of the interns selected for the Internship Challenge were hired for a 12-week work period, with a maximum reimbursement from the Center of $15 per hour, up to $7,200 total per intern.

C-20

The Center's Internship Challenge program is broadly inclusive, as the following data on participating interns and sponsoring companies illustrates:



## Feedback about the Internship Challenge Program

The Center conducts a survey of both interns and sponsors at the conclusion of the internship period because we believe that the Internship Challenge participants themselves provide the best evidence of the program's value and impact.

Surveys of participating interns show that nearly 30 percent of the interns that were entering the workforce (recent graduates) found immediate full-time employment as a result of their internships. In most cases, these interns were hired by the company that hosted their respective internships.

Additional feedback from participants, both interns and host companies, is included below:

"This summer internship has been much more than I expected. Working at a biotech start-up has opened my eyes to the great potential there is in the life sciences industry right here in Massachusetts."

– Juan Betanzo, Babson College

"Interning with NuOrtho Surgical has enhanced my understanding in both the marketing and financial fields. The opportunity to work with such upbeat and intuitive professionals has been an exceptional introduction to the business world. I feel as though I have already become a more confident and skilled individual thanks to the practical training this internship has provided."

– Tamer Plourd, UMass Dartmouth

"We were fortunate to have two interns this past summer, [and one] has proven to be a great addition to our team and was recently promoted to a project engineer. All four of our engineers started as interns, two of them as part of the Internship Challenge. Their hard work and dedication contributed to a 30 percent growth in 2011."

– David Comeau, President, Albright Technologies

"We are very pleased with the biology and analytical students that have worked with us. The program gives us the opportunity to hire talented students that we would otherwise not have access to. It's a win-win situation: We are extremely impressed with the contributions the students make, and it's great work experience for them."

– Shana Dobson, Operations Manager, Tetraphase Pharmaceuticals

"Comprising of five full-time employees, the company at which I interned allowed me to thrive through regular contributions to several different projects and has introduced me to the intricacies of running a biopharmaceutical company. This experience has inspired me to pursue a career in the business sector of the biopharmaceutical industry."

– Renee McKell, Massachusetts Institute of Technology

### The Skilled Careers in Life Sciences (SCILS) Initiative

In March of 2012, the Center competed for and received for the first time federal grant funding, with the funds going to supplement the Internship Challenge program. The Center will be receiving $800,000 over the next four years as part of a $5 million grant to the City of Boston from the U.S. Department of Labor intended to grow and maintain the area's life sciences workforce. The SCILS Initiative is being implemented in collaboration with the City of Boston's Department of Jobs and Community Services, as well as with the Metro North, Metro Southwest and South Coastal workforce regions. This program will serve more than 80 cities and towns in greater Boston.

The Center will be receiving $800,000 over the next four years.

*Boston Mayor Thomas Menino speaks at the SCILS Initiative announcement at Boston University.*

### Supporting STEM (Science, Technology, Engineering, and Math) Education and an Inclusive Workforce

The Center awarded grants totaling $180,000 to four programs focused on STEM education and diversity in the life sciences workforce during FY 2012. The grants build upon the Patrick/Murray Administration's strategy for enhancing STEM educational opportunities across Massachusetts, and on the Center's commitment to ensuring an inclusive life sciences workforce. Dr. Windham-Bannister serves on the Governor's STEM Council.

The four organizations that received grants focus on different strategies for enhancing STEM education and diversity:

- **Women in Engineering, Science and Technology (WEST)** was awarded $30,000. WEST is primarily focused on workforce development for women at all career stages in science and technology: students, early career, mid-career and executive. WEST's programs are designed to develop skills, build and expand professional relationships, and empower women to achieve full leadership potential. The purpose of the Center's grant was to expand WEST's offerings to regions of Massachusetts outside of Cambridge and Boston. The WEST organization is using the Center's funds to add 12 programs, targeting two main corridors – Route #128/Suburbs and Route #495/Worcester – and cities and towns along these corridors. These two corridors are home to more than 230 life sciences companies and 18 colleges.

The Center awarded grants totaling $180,000 to four programs focused on STEM education and diversity in the life sciences workforce during FY 2012.

- The **Urban Massachusetts Louis Stokes Alliance for Minority Participation (UMLSAMP) program at UMass Boston** was awarded $50,000 to expand its offerings. The UMLSAMP program is a consortium of eight Massachusetts academic institutions of higher learning: UMass Boston, UMass Dartmouth, UMass Lowell, Wentworth Institute of Technology, and Bristol, Bunker Hill, Middlesex and Roxbury Community Colleges. The mission of the NSF UMLSAMP grant under which this consortium has operated for the last five years has been to establish best practices and innovative approaches to increase the number of STEM bachelor-degree graduates, especially those from underrepresented minority communities. The Center's funds will be used for the design, development and implementation of two undergraduate Biotechnology Research

Skills Development workshops that will be delivered in April of 2012 for the Boston and New Bedford/Fall River metropolitan areas.

- Consistent with the Center's emphasis on promoting diversity in the life sciences workforce, the Center awarded a $50,000 grant to the **Girl Scouts of Eastern Massachusetts (GSEM)** in November 2011 to support girls and their involvement in STEM education and careers. GSEM serves 178 communities composed of 41,000 girls ranging in age from five to 18 and more than 17,000 adult volunteers. One of every seven girls in eastern Massachusetts is a Girl Scout. In particular, this grant will fund a 10-week module in STEM within the FaB Factor program, which is an early intervention and prevention program for at-risk, low-income, inner-city girls ranging in age from five to 17 years old, designed to address the fact that women are underrepresented in the majority of STEM fields.

- **Search4STEM** was awarded $50,000 that will be put toward creating a "one-stop" portal for STEM education – to connect teachers, educational leaders, businesses and other stakeholders with STEM programs, projects, products, initiatives, collaborations and services. Millions of dollars are appropriated every year for STEM initiatives throughout the nation, but existing STEM data warehouses, inventories and other resource lists are disconnected, disparate and difficult to use, and challenging to find. Search4STEM is an interactive, searchable "one-stop" portal for resource and knowledge exchange. The Center's funds will be used to develop the interactive web-based portal; fund the programming activities and technical consultant; and pay for materials and supplies.

The Center will continue to seek additional opportunities to expand access to STEM education and to ensure an inclusive life sciences workforce in the fiscal year ahead.

## Investing in Industry and Job Creation

### The Life Sciences Tax Incentive Program

In calendar year 2012, the Center awarded $20.3 million in tax incentives to 26 life sciences companies under the Center's 2011 Life Sciences Tax Incentive program. The companies receiving tax incentive awards have committed to creating more than 900 new jobs in the Commonwealth during calendar year 2012.

The Life Sciences Act authorizes up to $25 million in tax incentives each year for companies engaged in life sciences research and development, commercialization and manufacturing. The primary goal of the program is to incentivize life sciences companies to create new long-term jobs in Massachusetts. Companies receiving incentives must commit to the creation of a specific number of net new jobs during the following calendar year and also to the retention of those jobs for a five-year period.

The 2011 round of the program featured 10 different incentives, which address the significant capital expenditures associated with the life sciences R&D cycle and the high costs of translating research into commercially viable products. A total of 45 companies applied for tax incentives in 2011. Details of the 26 tax incentive awardees are below:

| Tax Incentives Awarded Under the Center's 2011 Life Sciences Tax Incentive Program | | | |
|---|---|---|---|
| Company | Location | Tax Incentive Amount Awarded | Jobs Committed |
| Aegerion Pharmaceuticals, Inc. | Cambridge | $661,122 | 27 |
| AVEO Pharmaceuticals, Inc. | Cambridge | $2,301,683 | 94 |
| Biogen Idec MA, Inc. | Weston | $1,836,449 | 75 |
| Blueprint Medicines Corporation | Cambridge | $160,750 | 15 |
| Boston Heart Diagnostics Corporation | Framingham | $220,000 | 31 |
| Cell Signaling Technology | Danvers | $489,720 | 20 |
| Courtagen Life Sciences, Inc. | Woburn | $125,000 | 13 |
| DePuy Othopaedics, Inc. | Raynham | $1,224,300 | 50 |
| Ironwood Pharmaceuticals, Inc. | Cambridge | $1,836,449 | 75 |
| Knome, Inc. | Cambridge | $49,000 | 12 |
| LightLab Imaging, Inc. | Westford | $636,636 | 26 |
| Metamark Genetics, Inc. | Cambridge | $269,346 | 11 |
| Moderna Therapeutics, Inc. | Cambridge | $138,270 | 13 |
| Momenta Pharmaceuticals, Inc. | Cambridge | $1,224,300 | 50 |
| New England Biolabs, Inc. | Ipswich | $244,860 | 10 |
| NinePoint Medical, Inc. | Cambridge | $313,483 | 15 |
| Nova Biomedical Corporation | Waltham | $244,860 | 10 |
| Organogensis, Inc. | Canton | $857,010 | 35 |
| PAREXEL International Corporation | Billerica | $150,000 | 32 |
| PerkinElmer, Inc. | Waltham | $1,224,300 | 50 |
| Pharmalucence, Inc. | Bedford | $293,832 | 12 |
| Quanterix Corporation | Cambridge | $465,234 | 19 |
| Ra Pharmaceuticals, Inc. | Cambridge | $161,270 | 10 |
| Shire HGT, Inc. | Lexington | $3,000,000 | 100 |
| T2 Biosystems, Inc. | Lexington | $244,860 | 10 |
| Vertex Pharmaceuticals | Cambridge | $2,448,599 | 100 |

In FY 2012, Shire HGT, Inc., of Lexington received an additional $3.5 million of tax incentives under an existing tax commitment by the Commonwealth.

The Center takes its stewardship of these resources seriously and has built in strong accountability measures to ensure that the program has "teeth." The Center is carefully monitoring the performance of companies that have received tax incentives to ensure compliance with the tax incentive agreements they are required to execute with the Center. Headcount requirements must not only be met in the year following receipt of the award, but also maintained for the following five years. Under agreements by awardees, recipients of tax incentives are required to report job creation results to the Center by the end of the calendar year. Under the Life Sciences Act, the Department of Revenue has the authority to recover or "claw back" incentives from companies that the Center determines will not meet the minimum job creation threshold in their tax incentive agreement.

Through three rounds of the program, the Center has provided 86 awards to 71 companies at an aggregate amount of $73.6 million. Ten awardees declined their awards due to changes in their business or general economic conditions. Eighteen awardees determined that they were unlikely to reach their job creation commitment under the statutory guidelines and opted to voluntarily terminate their agreements, either by foregoing taking the tax benefits at all or by returning the benefits to the Commonwealth if they had already received them. The Center decertified two awardees for not achieving the statutory thresholds. As of June 20, 2012, the Center had provided 56 active awards across all program years to 44 different companies. Eight active companies have received two or more active awards, illustrating their continued commitment to grow their headcount in the Commonwealth.

To date, the tax program has resulted in a combined net new hire commitment of more than 2,000 jobs among active awardees.

In FY 2012, awardees from the 2009 and 2010 tax programs were required to report their headcount as of December 31, 2011. As of December 31, 2011, reporting awardees from the 2009 and 2010 programs had hired or maintained 1,899 new employees, representing a 145 percent attainment of their commitment.

As of June 30, 2012 there were 30 active awards from the 2009 and 2010 program years, with a combined commitment of maintaining or fulfilling their 1,150 new hire commitment under the program. The 26 active awardees from the 2011 Tax Incentive program will provide their initial headcount reports – reflecting headcount as of December 31, 2012 – in January of 2013, as required under the program. The 2011 awardees have committed to creating an additional 915 jobs within the Commonwealth in calendar year 2012. To date, the tax program has resulted in a combined net new hire commitment of more than 2,000 jobs among active awardees.

### Attracting Companies to Massachusetts

Massachusetts continues to be a magnet for growing companies, both domestic and international. The Commonwealth is a great place for life sciences companies to do business because it is home to cutting-edge research, a superior workforce, a vibrant investment community and a supportive environment for growth. The Center actively recruits new companies to the state through extensive marketing efforts and our portfolio of tools and programs, and supports the integration of these companies into our life sciences community.

FY 2012 was an active year for the Center -- we helped organize numerous grand openings and press announcements for new or expanding life sciences companies in Massachusetts:

- Thermo Fisher celebrated the opening of its new manufacturing facility in Tewksbury, a project that will bring approximately 100 new jobs to Massachusetts.
- Lieutenant Governor Murray helped to celebrate the grand opening of Forma Therapeutics' new headquarters in Watertown.
- Spanish life sciences company Progenika opened its expanded facilities in Medford.

*On June 11, 2012, Governor Deval Patrick and other officials celebrated the grand opening of Thermo Fisher Scientific's Center for Excellence for portable analytical instruments in Tewksbury.*

- U.K.-based Xenetic announced plans to relocate its drug discovery operations to Massachusetts, a direct return on investment for the Governor's trade mission to the U.K., in which the Center participated.
- H3 Biomedicine, a start-up drug discovery company funded by Japan-based Easai, located its facilities in Cambridge.

Other recent arrivals include Batavia Bioservices from the Netherlands, Izon from New Zealand, Ohio-based Navidea and California-based BioSurplus; these companies opened new facilities in Woburn, Cambridge, Andover and Boston, respectively.

In addition, U.K.-based IDBS celebrated a significant expansion in Burlington, including the designation of its Burlington office as the company's U.S. healthcare headquarters. Ipsen-Biomeasure, based in France, announced a $45-million expansion of its facilities in Milford. Ipsen, Izon and IDBS all came as a direct result of a meeting that each company had with Governor Patrick at the BIO Convention in 2011. These companies continue to cite the Life Sciences Initiative, along with the state's talented workforce, world-class academic institutions and industry-leading companies, as their primary reasons for locating or expanding in Massachusetts.

Company officials cite Massachusetts' Life Sciences Initiative, talented workforce, and leading research institutions as important reasons for choosing the state. A sampling of companies that have expanded or located in Massachusetts over the past four years is shown below:

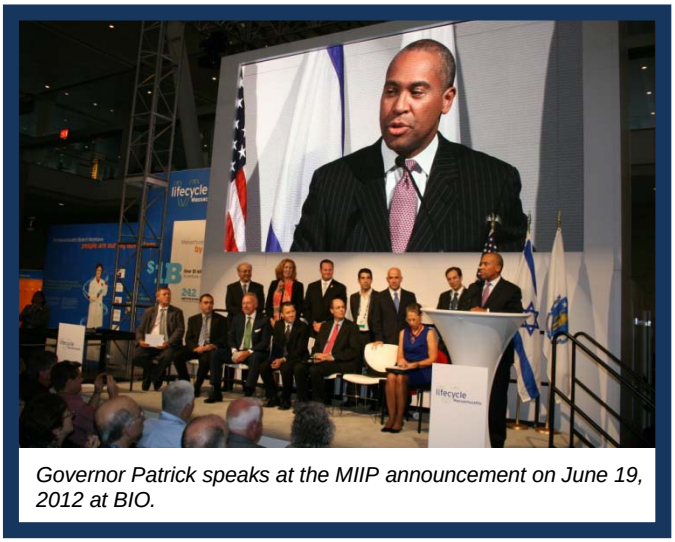
The Center continues to engage companies across the nation and around the world, in order to encourage them to invest and locate in Massachusetts. We anticipate many more announcements in FY 2013.

# Building Partnerships

## International Partnerships

The Center continues to solidify Massachusetts' global life sciences leadership. In 2012, we further expanded relationships with companies and governments around the world by cultivating important new relationships in Brazil as a result of the Governor's trade mission to this emerging life sciences leader.

Another significant international collaboration for the Center emerged through the Northern Ireland Massachusetts Connection (NIMAC): a new multi-national research study that will develop non-invasive procedures to detect pre-malignant lesions. An international contingent of academic and economic development officials representing Finland, Northern Ireland and Catalonia have also made commitments to be part of the study. The study, which is being supported by the Center with a $300,000 grant, will look at samples from all of the participating regions and will also utilize the most effective, cutting-edge applications to analyze the data collected. The result will be to determine at-risk patients without unnecessary surgery.



*Governor Patrick speaks at the MIIP announcement on June 19, 2012 at BIO.*

At the 2011 BIO International Convention, Governor Patrick joined Avi Hasson, the Israeli Chief Scientist, the U.S.-Israel Science and Technology Foundation (USISTF), and three Massachusetts economic development agencies, including the Center, to announce a formal collaboration between the State of Israel and the Commonwealth of Massachusetts to encourage and support innovation and entrepreneurship between Massachusetts' and Israel's life sciences, clean energy and technology sectors.

During FY 2012, this partnership, known as the Massachusetts-Israel Innovation Partnership (MIIP), launched a joint solicitation seeking Industrial R&D collaborations between Massachusetts and Israeli companies. After an eight-month process, Governor Patrick and Chief Scientist Hasson announced the award winners at the 2012 BIO International Convention in Boston.

The Center, along with the Massachusetts Technology Collaborative (MTC) and the Massachusetts Clean Energy Center (MassCEC), awarded a total of more than $600,000 to fund four partnerships between Massachusetts and Israeli companies. The two projects awarded by the Center, for a total of $300,000 in expected grant funding, are as follows:

**MIIP Projects in Round 1**

| Companies | Massachusetts Location | Project Description | Amount Awarded |
|---|---|---|---|
| Automated Medical Instruments (AMI) and STI Lasers (Israel) | Needham | Emerging medical device company developing new radio frequency energy-based approach to perform circumferential ablation of the pulmonary veins | $116,000 |
| SBH Sciences and Improdia (Israel) | Natick | Developing and planning to manufacture chronic inflammation-dependent immunosuppression prognostic kit using a novel biomarker, which predicts changes in patient's immune system response as an indicator of disease status | $184,000 |

The Center also participated in Massachusetts Senate President Therese Murray's announcement at the 2012 BIO International Convention that the first-ever United States-European Union (U.S.-E.U.) Conference on Connected Health would be held not in Washington, D.C., but in Boston in October of 2012. The European Commission selected Massachusetts to hold this conference to further develop and implement the U.S.-E.U. Memorandum of Understanding on e-Health between the E.U. and the U.S. Department of Health and Human Services. Senate President Murray is hosting the E.U.; other states; and biotechnology, medical device and e-health companies from across the globe. This two-day event will include a business marketplace that will provide opportunities for companies, health care providers, research institutions and others from both sides of the Atlantic to encourage business relationships, research and collaboration.

### Pursuing a Strategy for Biomanufacturing

The Center's priorities include making investments that strengthen Massachusetts' ability to compete for biomanufacturing jobs. In August of 2011, the Center provided a second $50,000 grant to support the Massachusetts Biomanufacturing Roundtable ("the Roundtable"), a partnership between the Center and Massachusetts Institute of Technology's Industrial Performance Center to work with industry and academic biomanufacturing leaders and experts from across the state. The Roundtable is co-chaired by Eleven Biotherapeutics, Inc., CEO Abbie Celniker; Acceleron Pharma Senior Vice President of Manufacturing Bob Steininger; and former Pfizer Vice President Mickey Koplove.

Current priority areas include biomanufacturing technology innovation, workforce development and business development. To further these priorities, the Center worked with members of the Roundtable to host a panel at BIO 2012 on Massachusetts' leadership in biomanufacturing. In addition, the Center worked with the Roundtable to develop a brochure to showcase biomanufacturing innovation in Massachusetts, the global leadership role played by Massachusetts companies in biopharmaceutical manufacturing and technology, and the strength and depth of biomanufacturing experience in academic institutions as they collaborate with industry partners.

### The Massachusetts Neuroscience Consortium

Beginning in 2009, the Center began work to create a Massachusetts Neuroscience Consortium ("the Consortium") to accelerate pre-clinical research available to the pharmaceutical industry, introduce academic researchers to the challenges of targeted research and facilitate industry-academic partnerships. We were thrilled when Governor Patrick joined the Center to announce the formalization of this new Consortium at the 2012 BIO International Convention. The Consortium is comprised of seven global pharmaceutical leaders that recognize the value of leveraging the rich Massachusetts environment in the field of neuroscience. Consortium members are seeking an

The charter Consortium members are Abbott, Biogen Idec, EMD Serono, Janssen Research and Development, Merck, Pfizer, and Sunovion Pharmaceuticals Inc.

*On June 20, 2012, Massachusetts Governor Deval Patrick, the Massachusetts Life Sciences Center and seven global biopharmaceutical companies announced the formation of the Massachusetts Neuroscience Consortium (the "Consortium").*

opportunity to advance our collective understanding and treatment of neurological diseases through engagement with researchers representing all major fields of neurobiology and neurology.

The charter Consortium members, Abbott, Biogen Idec, EMD Serono, Janssen Research and Development, Merck, Pfizer, and Sunovion Pharmaceuticals Inc., have pooled their resources to fund the identification and validation of novel targets for the symptomatic treatment and modification of chronic and debilitating neurological diseases. Each Consortium member has agreed to contribute $250,000, for total first-year funding of $1,750,000.

During FY 2012, the Center grew its email list from 3,900 to more than 4,700 contacts.

The Center had more than 2,200 media mentions during FY 2012.

During FY 2012, Center staff participated as presenters, speakers or panelists at more than 50 public events.

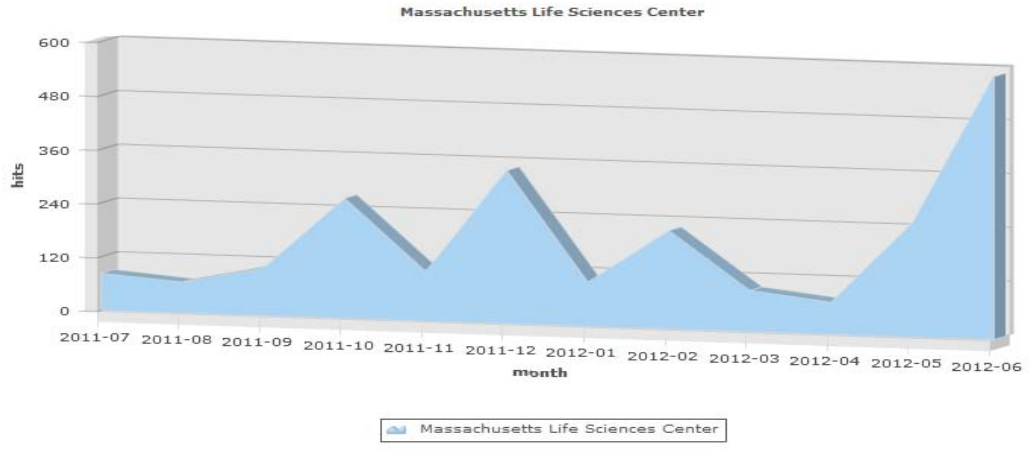
## Staying Connected

The Center's communications program keeps our stakeholders and the general public informed about the Center's investments of public dollars, promotes public accountability for the Center's progress in accomplishing our mission, and provides ongoing updates and information exchange with the life sciences community in order to encourage its involvement and input. Communication and outreach have been integral to the Center's success in attracting a robust and diverse pool of applicants for Center programs.

During FY 2012, the Center grew its email list from 3,900 to more than 4,700 contacts. We used our website as both a clearinghouse for information about the Center and a portal for applying to the Center's programs.

The Center had more than 2,200 media mentions during FY 2012. Publications across the nation and around the world covered our activities. The chart below shows the monthly distribution of the Center's media coverage during FY 2012. Periods of greater coverage tended to coincide with the announcement of new programs or investments, with a substantial increase resulting from the 2012 BIO International Convention in June.

**Monthly Distribution of MSLC Media Mentions**
**(July 1, 2011 – June 30, 2012)**




During FY 2012, Center staff participated as presenters, speakers or panelists at more than 50 public events.

### Massachusetts Takes BIO 2012 by Storm

One noteworthy event is the 2012 BIO International Convention, which was an important moment for Massachusetts that provided an opportunity to showcase all that the Commonwealth has to offer. More than 16,500 people participated from 48 states and 65 countries. The Massachusetts Pavilion experienced heavy traffic throughout the event. More than 100 business development meetings took place with companies from all over the world, and new relationships were forged with regions across the globe, including the signing of formal agreements with the Medicon Valley region (Denmark and Sweden) and the Catalonia region (Spain).

## Pulling Ahead and Taking the Lead

In FY 2012, Massachusetts emerged as the clear global leader in life sciences. The Center made enormous strides in fulfilling our mission and delivering on the promise of the Life Sciences Initiative to create jobs, advance good science and coalesce the state's life sciences community.

The year ahead will present major opportunities to showcase Massachusetts' leadership in the life sciences, with the AdvaMed and International Society for Stem Cell Research annual conferences both coming to Boston during FY 2013.

The state budget calls for a FY 2013 investment fund appropriation of $15 million, a $5-million increase over the course of FY 2012, contingent on the comptroller's declaration of a consolidated net surplus for FY 2012. We are appreciative and excited about this vote of confidence by Governor Patrick, Lt. Governor Murray and the State Legislature, under the leadership of Senate President Murray and Speaker of the House DeLeo. We look forward to delivering another productive and impactful year.

## Appendix A - The Board of Directors of the Massachusetts Life Sciences Center as of June 30, 2012

- **Gregory Bialecki, Co-Chair**
  Secretary, Executive Office of Housing and Economic Development

- **Jay Gonzalez, Co-Chair**
  Secretary, Executive Office for Administration and Finance

- **Edward J. Benz, Jr., M.D.**
  President and CEO, Dana-Farber Cancer Institute

- **Josh Boger, Ph.D.**
  Founder & CEO (retired), Vertex Pharmaceuticals

- **Robert L. Caret, Ph.D.**
  President, University of Massachusetts

- **Abbie Celniker, Ph.D.**
  CEO, Eleven Biotherapeutics, Inc.

- **Lydia Villa-Komaroff, Ph.D.**
  Director and Chief Scientific Officer, Cytonome/ST

## Appendix B - Massachusetts Life Sciences Center Scientific Advisory Board Members as of June 30, 2012

- **Harvey Lodish, Ph.D., Chair**
  Whitehead Institute for Biomedical Research and Professor of Biology and of Bioengineering, Massachusetts Institute of Technology

- **James Barry, Ph.D.**
  Executive Vice President and COO, Arsenal Medical

- **Gary Borisy, Ph.D.**
  Director and CEO, Marine Biological Laboratory

- **Dalia Cohen, Ph.D.**
  Chief Scientific Officer, Asterand, Inc.

- **James Collins, Ph.D.**
  Professor of Biomedical Engineering, Boston University

- **John Collins, Ph.D.**
  Chief Operating Officer, Center for Integration of Medicine & Innovative Technology

- **T. (Teo) Forcht Dagi, M.D.**
  Partner, HLM Venture Partners

- **Robert D'Amato, M.D., Ph.D.**
  Judah Folkman Chair in Surgery and Director, Center for Macular Degeneration Research, Children's Hospital, Boston

- **Jonathan Fleming, M.P.A.**
  Managing General Partner, Oxford Bioscience Partners

- **Rainer Fuchs, Ph.D.**
  Chief Information Officer, Harvard Medical School

- **Richard A. Goldsby, Ph.D.**
  John Woodruff Simpson Lecturer and Professor of Biology, Amherst College

- **Dale Larson**
  Director of Biomedical Systems, Draper Laboratory

- **Lita Nelsen**
  Director, Technology Licensing Office, Massachusetts Institute of Technology

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- **Carmichael Roberts, Ph.D.**
  Partner, North Bridge Venture Partners

- **Lauren Silverman, Ph.D.**
  Managing Director, Novartis Option Fund

- **Alan Smith, Ph.D.**
  Former Chief Scientific Officer, Genzyme Corporation

- **Allison Taunton-Rigby, Ph.D.**
  Co-founder, CEO and Director, RiboNovix, Inc.

- **David Walt, Ph.D.**
  Robinson Professor of Chemistry and Howard Hughes Medical Institute Professor, Tufts University School of Medicine

- **Philip Zamore, Ph.D.**
  Professor, Biochemistry and Molecular Pharmacology, UMass Medical School

# Appendix C - FY 2012 Internship Challenge Host Companies

480 Biomedical, Inc.
A Chemtek Inc.
AB Biosciences, Inc.
Abazyme LLC
AbPro Labs
Acceleron Pharma, Inc.
Addgene, Inc.
Advanced Research and Development
AdvanDx, Inc.
Advantagene, Inc.
Aegerion Pharmaceuticals
Agilux Laboratories
Agrivida, Inc.
Akaza Research, LLC
Alacrita LLC
Albright Technologies
Allied Minds Devices, LLC
Alzheimers Disease Center
Antagen Pharmaceuticals, Inc
Antigen Targeting & Consulting Services Inc
Appembler, Inc.
Arsenal Medical
Arteriocyte Medical Systems
Aushon BioSystems
Avaxia Biologics, Inc.
Averica Discovery Services Inc
Bach Pharma, Inc
BIND Biosciences
Bio2 Technologies
Biomedical Research Models, Inc.
BIOS2 Medical, Inc.
BioSensics LLC
BioSurfaces, Inc.
BioTechnic Products, Ltd
Biotrofix, Inc.
Blossom Innovations
Blue Ocean Biomanufacturing, Inc.
Blue Sky Biotech, Inc.
Blue Stream Laboratories, Inc.
Boston Biomedical Associates
Boston MedTech Advisors
Boston Microfluidics Inc.
Boston Micromachines Corporation
Boston Open Labs
Cambridge Biolabs LLC
Cambridge Biomedical, Inc.
Cambridge Polymer Group, Inc.
CBT Advisors
Cellay, Inc.
Celldex Therapeutics, Inc.
CellMosaic LLC
Celltreat Scientific Products
Cephos Corp.
CeQur Corporation
ChemGenes Corp.
Christcot Medical Company
Clover Medical LLC
Constellation Pharmaceuticals
Convergence Medical Devices, Inc.
Court Square Group, Inc.
Courtagen Life Sciences, Inc.
CreaGen Biosciences, Inc
Cytonome/ST, LLC
Daktari Diagnostics, Inc.
Dentovations Inc
Differential Proteomics, Inc.
Digilab, Inc.
DMI Dx, LLC
DNA Medicine Institute
DocBox Inc
Ekam Imaging, Inc.
Emergent Inc.
EndoDynamix, Inc.
EndoSim, LLC
Energesis Pharmaceuticals, Inc.
Ensemble Therapeutics Corporation
Enumeral Biomedical
EpigenDx, Inc.
Essential Life Solutions Ltd.
Eutropics Pharmaceuticals
Excellims Corporation
First Light Biosciences
Five Star Manufacturing, Inc.
Five Star Surgical, Inc.
FloDesign Sonics
Flow Forward Medical, LLC
G&F Industries, Inc.
G&F Medical Inc.
Genocea Biosciences, Inc.
Giner, Inc.
Ginkgo BioWorks, Inc.
Global Business Support, Inc.
GlycoSolutions Corporation
Glycosyn Inc.
Grove Instruments, Inc.
Harvard Apparatus
Hemedex Inc.
Hepatochem, Inc.
Hepregen Corporation
HighRes Biosolutions Inc
HPA Ventures
Hstar Technologies Co.
HydroCision, Inc
Imgen BioSciences, Inc.
Immunetics, Inc
Immunotrex Biologics Inc.

InCrowd, Inc.
incTANK Ventures Management LLC
InfoBionic
Infraredx, Inc.
Institute for Pediatric Innovation, Inc.
Interactive Motion Technologies
Interscope, Inc.
inviCRO
InVivo Therapeutics Corporation
IonSense
iQuartic, Inc.
Janus Biotherapeutics
JEF Core, Inc.
JNK Healthcare Inc
KeraFAST
LaVoie Strategic Communications, Inc.
Ligon Discovery
MagneMotion Inc.
Massachsetts Medical Devices Journal, LLC
Matrigen LLC.
Matrivax R&D Corporation
Maxiom Consulting Group Inc.
Med Techna, Inc.
MedChem Partners LLC
MedPanel
Metis Manufacturing LLC
Microbiotix, Inc.
Microtest Laboratories, Inc.
Most Corporation
MOSTMED, Inc.
Mouse Specifics, Inc.
MSM Protein Technologies
MX Orthopedics
Myomo, Inc.
Nemucore Medical Innovations, Inc.
Neo-Advent Technologies, LLC
New England Peptide LLC
Nexcelom Bioscience LLC
NKT Therapeutics Inc.
Northeast Biomedical, Inc.
NovoBiotic Pharmaceuticals, LLC
Nuclea Biotechnologies, Inc.
Ocean Genome Legacy
OnSite Therapeutics, Inc.
OpenClinica, LLC
Ora, Inc.
PharmaHealth Clinical Research Services
Pharmalucence, Inc.
Phosphorex, Inc.
Phylonix Pharmaceuticals, Inc.
pION INC
Pluromed, Inc
Pressure BioSciences, Inc.
Privo Technologies
Progenika Inc
Quanterix Corporation
Reflectance Medical Inc.
Relay Technology Management, Inc.
Respiratory Motion, Inc.
ReSurfX LLC
Safe Food Scientific, LLC.
Safety Partners, Inc.
Sage Science, Inc.
Sample6 Technologies, Inc.
SBH Sciences, Inc.
Scientia Advisors, LLC
Segterra Inc.
Selecta Biosciences, Inc.
SemiNex Corporation
Senscio Systems, Inc.
Sentien Biotechnologies, Inc.
Seventh Sense Biosystems
Sharp Edge Labs, Inc.
SonyaSoft
Sproxil, Inc.
STAR Analytical Services
STC Biologics, Inc.
Targeted Cell Therapies, LLC
TDC Medical, Inc.
Tetraphase Pharmaceuticals, Inc.
TheraTorr Medical, Inc.
THINQ Pharma
TRA360
Two Square Science, LLC
Union Biometrica, Inc.
VasoTech, Inc.
VelQuest Corporation
Vista Scientific LLC
VitaThreads Inc.
VivoPath, LLC
WaterSep Technology Corp
WaveGuide Corporation
White Systems, Inc.
WorldCare Clinical, LLC
X-CHEM, Inc.
Xtal BioStructures Inc.
ZeptoMetrix Corporation

# Appendix D - List of Active Certified Life Sciences Companies as of June 30, 2012

| Company | Location |
|---|---|
| 4s3 Bioscience, Inc. | Medford |
| Aegerion Pharmaceuticals, Inc. | Cambridge |
| AesRx, LLC | Newton |
| Aura Medsystems, Inc. | Duxbury |
| Avaxia Biologics, Inc. | Burlington |
| AVEO Pharmaceuticals, Inc. | Cambridge |
| Bind Biosciences, Inc. | Cambridge |
| Biogen Idec MA, Inc. | Cambridge |
| Bluebird Bio, Inc. | Cambridge |
| Blueprint Medicines Corporation | Cambridge |
| Boston Heart Diagnostics Corporation | Framingham |
| Cell Signaling Technology | Danvers |
| Christcot Medical, Inc | Sudbury |
| Constellation Pharmaceuticals, Inc. | Cambridge |
| Courtagen Life Sciences, Inc | Woburn |
| Cubist Pharmaceuticals, Inc. | Lexington |
| DePuy Othopaedics, Inc. | Raynham |
| Dyax Corporation | Cambridge |
| Eutropics Pharmaceuticals, Inc. | Dorchester |
| Foundation Medicine, Inc | Cambridge |
| Good Start Genetics, Inc. | Boston |
| Grove Instruments, Inc | Worcester |
| Infinity Pharmaceuticals, Inc. | Cambridge |
| InfraReDx, Inc. | Burlington |
| Instrumentation Laboratory Company | Bedford |
| InVivo Therapeutics, Inc. | Cambridge |
| Ironwood Pharmaceuticals, Inc | Cambridge |
| Knome, Inc | Cambridge |
| LeMaitre Vascular, Inc. | Burlington |
| Lightlab Imaging, Inc. | Westford |
| Merrimack Pharmaceuticals, Inc. | Cambridge |
| Metamark Genetics, Inc | Cambridge |
| Mevion, Inc. | Littleton |
| Moderna Therapeutics, Inc | Cambridge |
| MoMelan Technologies, Inc | Cambridge |
| Momenta Pharmaceuticals, Inc | Cambridge |
| Myomo, Inc | Cambridge |
| New England Biolabs, Inc | Ipswich |
| NinePoint Medical, Inc | Cambridge |
| Nova Biomedical Corporation | Waltham |
| NxStage Medical, Inc. | Lawrence |
| OmniGuide, Inc. | Cambridge |
| Organogenesis, Inc. | Canton |
| PAREXEL International Corporation | Lowell |

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| | |
|---|---|
| PerkinElmer, Inc | Waltham |
| Pharmalucence, Inc | Bedford |
| Pluromed, Inc. | Woburn |
| Quanterix Corporation | Cambridge |
| Ra Pharmaceuticals, Inc | Cambridge |
| Sanofi-Aventis, Inc. | Cambridge |
| Shire Human Genetic Therapies, Inc. | Lexington |
| STD Med, Inc. | Stoughton |
| Sunovion, Inc. | Marlboro |
| T2Biosystems, Inc | Lexington |
| Valeritas, Inc. | Shrewsbury |
| Vertex Pharmaceuticals, Inc | Cambridge |
| Wadsworth Medical Technologies, Inc | Westborough |
| Wolfe Laboratories, Inc. | Watertown |

# Massachusetts Life Sciences Center

**Financial Statements with Management's Discussion and Analysis**
**June 30, 2012 and 2011**

# Massachusetts Life Sciences Center
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## June 30, 2012 and 2011


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## Report of Independent Auditors

To the Board of Directors of the
Massachusetts Life Sciences Center:

In our opinion, the accompanying balance sheets and the related statements of revenues, expenses and changes in net assets and of cash flows of the Massachusetts Life Sciences Center (the "Center") (a component unit of the Commonwealth of Massachusetts), present fairly, in all material respects, the financial position of the Center at June 30, 2012 and June 30, 2011, and the related changes in financial position and cash flows for the years then ended, in conformity with accounting principles accepted in the United States of America. These financial statements are the responsibility of the Center's management. Our responsibility is to express an opinion on these financial statements based on our audits. We conducted our audits of these statements in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, and evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

The accompanying management's discussion and analysis on pages 2 through 5 is required by accounting principles generally accepted in the United States of America to supplement the basic financial statements. Such information, although not a part of the basic financial statements, is required by the Governmental Accounting Standards Board who considers it to be an essential part of financial reporting for placing the basic financial statements in the appropriate operational, economic, or historical context. We have applied certain limited procedures to the required supplementary information in accordance with auditing standards generally accepted in the United States of America, which consisted of inquiries of management about the methods of preparing the information and comparing the information for consistency with management's responses to our inquiries, the basic financial statements, and other knowledge we obtained during our audits of the basic financial statements. We do not express an opinion or provide any assurance on the information because the limited procedures do not provide us with sufficient evidence to express an opinion or provide any assurance.

PricewaterhouseCoopers LLP

September 26, 2012

*PricewaterhouseCoopers LLP, 125 High Street, Boston, MA 02110*
*T: (617) 530 5000, F: (617) 530 5001,* www.pwc.com/us

# Massachusetts Life Sciences Center
## Management's Discussion and Analysis (unaudited)
## June 30, 2012 and 2011

As the Board of Directors of the Massachusetts Life Sciences Center (the "Center") we offer the following narrative overview and analysis of the financial activities of the Center for the fiscal years ended June 30, 2012, 2011 and 2010. This unaudited management discussion and analysis should be read in conjunction with the audited financial statements and the notes thereto, which follow this section.

The Center was created on June 24, 2006 in the Economic Stimulus Bill, Chapter 123, Section 24 of the Acts of 2006 and codified in the Massachusetts General Laws, Chapter 23I. The Center is a body politic and corporate. Exercise of the powers conferred by Chapter 23I is considered to be the performance of an essential governmental function. The purpose of the Center is to promote the life sciences within the Commonwealth of Massachusetts (the "Commonwealth"). It is tasked with investing in life sciences research and economic development initiatives. This work includes making financial investments in public and private institutions growing life sciences research, development and commercialization, as well as building ties between sectors of the Massachusetts life sciences community.

On June 16, 2008, the Life Sciences Act enacted by the Massachusetts Legislature was signed into law by Governor Deval Patrick. The Commonwealth committed to investing $1 billion over a ten year period to create jobs, drive innovation and promote biomedical breakthroughs that improve people's lives. The Center is the steward of the $1 billion and uses three statutory funding vehicles to achieve the Commonwealth's mission: the Life Sciences Investment Fund (the "Investment Fund"), the Capital Program and the Life Sciences Tax Incentive Program.

The Life Sciences Investment Fund is to be used in making appropriations, allocations, grants or loans to leverage development and investments in life sciences in Massachusetts. The Capital Program is for municipalities and institutions for buildings, upgrades to roads, equipment, sewer lines and other infrastructure that supports growth in the life sciences sector. The Life Sciences Tax Incentive Program allows the Center to award tax incentives to companies at every stage of development.

The Center is governed by a seven member Board of Directors (the "Board of Directors") consisting of: the Secretary of Administration and Finance or her/his designee; the Secretary of Housing and Economic Development or his/her designee; the president of the University of Massachusetts or his/her designee; and four members appointed by the Governor, one of whom is a physician licensed to practice medicine in Massachusetts and affiliated with an academic medical center, one of whom is a CEO of a Massachusetts-based life sciences corporation that is a member of the board of directors of the Massachusetts Biotechnology Council, one of whom is a researcher involved in the commercialization of biotechnology, pharmaceuticals or medical diagnostic products and one of whom has significant financial experience in the life sciences sector.

**Using the Financial Statements**

The Center's annual report includes three basic financial statements: the balance sheet; the statement of revenues, expenses and changes in net assets; and the statement of cash flows. The basic financial statements are prepared in accordance with accounting principles generally accepted in the United States of America ("GAAP") as promulgated by the Governmental Accounting Standards Board ("GASB").

# Massachusetts Life Sciences Center
## Management's Discussion and Analysis (unaudited)
## June 30, 2012 and 2011

**Financial Highlights**
The balance sheet is presented to illustrate both the current and non-current balances of each asset and liability. All revenues and expenses are classified as either operating or non-operating activities in the statement of revenues, expenses and changes in net assets. Operating activities are those that support the mission and purpose of the Center. Non-operating activities represent transactions that are capital, investing, legislative or regulated in nature. The GASB requires that resources be classified into three categories of net assets. Net assets represent the residual interest in the Center's assets after liabilities are deducted and consist of: invested in capital assets, net of related debt; restricted; and unrestricted.

Total assets of the Center fluctuate year to year mainly based on timing of receipts of reimbursements due to the Center for Investment Fund and Capital Program expenses incurred by grantees in addition to contributions received from the Commonwealth of Massachusetts. Total liabilities fluctuate year to year mainly due to the timing of related payments for the Investment Fund and Capital Program passed through the Center payable to the grantees. Net assets of the Center are all unrestricted, aside from those invested in capital assets. Ending net assets as of June 30, 2012, 2011 and 2010 is $27,201,578, $26,271,099 and $25,452,148, respectively. Changes in net assets year over year is driven by the changes in revenues and expenses by the Center. The significant components of change in revenues and expenses year over year are discussed in the remainder of the management discussion and analysis of this document.

Fiscal year 2012 is the fourth year of the initiative and reflects a year of significant operating activities of the Center as grants were made both from the Investment Fund and Capital Programs and a third round of awards under the Life Sciences Tax Incentive Program were made.

**Investment Fund**
Section 24 of Chapter 123 of the Acts of 2006 established the Massachusetts Life Sciences Investment Fund to be administered by the Center to finance its activities. The Life Sciences Act of 2008 contemplates an annual appropriation from the legislature totaling $250 million over 10 years. The Investment Fund is also to be used to support the administrative expenses and investment in property and equipment of the Center.

The legislature appropriated $10 million in fiscal year 2012, $10 million in fiscal year 2011 and $10 million in fiscal year 2010.

In fiscal year 2012, the Board of Directors authorized $5.1 million in commitments as compared to $4.5 million in fiscal year 2011 and $4.4 million in fiscal year 2010. The commitments were for research grants, workforce development programs, and programs that support innovation in life sciences. The increase in fiscal year 2012 from fiscal year 2011 is due to an expansion of existing programs and a new international innovation program. The slight increase in commitments in fiscal year 2011 from fiscal year 2010 was due to an expansion of existing programs. In fiscal year 2012, the Center incurred $6.8 million of grant expense compared to $6.6 million in fiscal year 2011 and $9.1 million in fiscal year 2010. The slight increase in expense in fiscal year 2012 from fiscal year 2011 is due to the timing of programs. The decrease in fiscal year 2011 from fiscal year 2010 is due to fewer grants in 2011 and grants obligations that were fulfilled in fiscal year 2010. Remaining payment commitments as of June 30, 2012 on the outstanding grants are approximately $9.2 million.

In fiscal year 2012, the Board of Directors authorized $6 million for early stage company loans under the Life Sciences Accelerator Loan program for fiscal year 2013. The loan program provides working capital to early stage companies at a critical stage of development. From prior year authorizations, the Center awarded $3.1 million in fiscal year 2012 and $3.75 million in fiscal year 2011. Of the $3.1 million in investment funds awarded in fiscal year 2012, none have been disbursed as of June 30, 2012.

**Capital Programs**
The Capital Program was created by the Life Sciences Act and is for municipalities and institutions for buildings, upgrades to roads, sewer lines and other infrastructure that supports growth in the life sciences sectors. The Life Sciences Act provides for $500 million to the Capital Program over 10 years. The Capital Program is funded by the Commonwealth of Massachusetts. In fiscal year 2012, the Center entered into six new commitments for $56 million. In fiscal year 2012, the Center incurred $42.5 million of grant expense compared to approximately $29.1 million in fiscal year 2011 and $28.5 million in fiscal year 2010. The increase in fiscal year 2012 from fiscal year 2011 is due to prior commitments incurring greater expense in fiscal year 2012. The increase in fiscal year 2011 from fiscal year 2010 is due to prior commitments incurring greater expense in fiscal year 2011. The Life Sciences Act also provides for a Life Sciences Education fund for providing grants for purchasing or leasing equipment to train students in life sciences and research. In fiscal year 2011, the Center made 32 grants for a new program to vocational/technical high schools, community colleges and other workforce development programs totaling nearly $3.4 million and incurring expense of $2.9 million. In fiscal year 2012, no new awards were made and the Center incurred $483,000 of grant expense under the program from prior year awards.

The Life Sciences Act also provides for a small business matching grant fund under the Capital Program. Under the program companies that have received Phase II or later small business innovation research ("SBIR") grants can receive up to $500,000 in grants from the Center to assist the awardee with commercializing their product. In fiscal year 2010, three companies received awards and the Center incurred $1,500,000 of expense in fiscal year 2010. In fiscal year 2011, four companies received awards and the Center incurred $2,000,000 of expense in fiscal year 2011. In fiscal year 2012, the Center made one award totaling $500,000 under the program.

**Life Sciences Tax Incentive Program**
The Life Sciences Tax Incentive Program was created by the Life Sciences Act and allows the Center to award tax incentives to companies at every stage of development. The Center has the ability to award ten different tax incentives with a cumulative cap of $25 million per year for 10 years. The tax incentives have no financial impact on the Center. The Center awarded $20.3 million to 26 companies in fiscal year 2012, $20.9 million to 24 companies in fiscal year 2011, and $24.4 million to 26 companies in fiscal year 2010.

**Investment Income**
Investment income in fiscal year 2012 was $73,000 compared to $86,000 in fiscal year 2011 and $113,000 in fiscal year 2010. Investment income relates to interest earned throughout the fiscal year on the Center's cash and cash equivalent balance. The decrease in fiscal year 2012 from fiscal year 2011 is due to a lower average balance. The decrease in fiscal year 2011 from fiscal year 2010 is due to a lower average balance.

**Administrative Expenses and Investments in Property and Equipment**

In accordance with the Act, administrative expenses and purchases of property and equipment are provided by the Investment Fund. In fiscal year 2012, the Center incurred approximately $2.2 million of administrative expenses and purchases of property and equipment. In fiscal year 2011 and 2010 the Center incurred approximately $2.2 million and $2.3 million, respectively, of administrative expenses. The same level of expenditures in fiscal year 2012 from fiscal year 2011 is due to higher staffing costs as a result of a full year of costs for open positions filled during fiscal year 2011 and lower fiscal year 2012 communications programs, professional fees and administrative expenses. The decrease in expenditures in fiscal year 2011 from fiscal year 2010 is due to lower staffing costs as a result of open positions and lower communications programs. For the fiscal years ended June 30, 2012, June 30, 2011 and June 30, 2010, the headcount of the Center was ten, nine, and nine, respectively.

**Liquidity of the Investment Fund**

From inception through June 30, 2012, the Investment Fund has received appropriations from the Commonwealth of $70 million. In addition, the Center has received investment income of approximately $2.1 million and in loan repayments, sponsorship and corporate consortium revenues of approximately $3.8 million during the corresponding period for total inflows of approximately $75.9 million. The Center reserves all the funds required for a grant or loan commitment at the time of the Board of Directors' authorization. From inception through June 30, 2012, the Center has disbursed or reserved approximately $72.2 million resulting in approximately $3.7 million of available funds as of June 30, 2012.

# Massachusetts Life Sciences Center
## Balance Sheets
## June 30, 2012 and 2011

| | 2012 | 2011 |
|---|---|---|
| **Assets** | | |
| Current assets | | |
| Cash and cash equivalents | $ 27,513,436 | $ 27,279,085 |
| Accounts receivable | - | 64,900 |
| Grant reimbursement from the Commonwealth | 17,464,289 | 19,715,000 |
| Interest receivable, net | 351,674 | 198,126 |
| Prepaid expenses and other current assets | 49,646 | 38,517 |
| Total current assets | 45,379,045 | 47,295,628 |
| Loans receivable, net | 2,503,500 | 2,012,500 |
| Property and equipment, net | 31,683 | 100,018 |
| Total noncurrent assets | 2,535,183 | 2,112,518 |
| Total assets | $ 47,914,228 | $ 49,408,146 |
| **Liabilities** | | |
| Current liabilities | | |
| Accounts payable and accrued expenses | $ 201,371 | $ 231,438 |
| Grants payable and accrued grant expense | 20,466,488 | 22,717,961 |
| Other current liabilities | - | 125,000 |
| Total current liabilities | 20,667,859 | 23,074,399 |
| Deferred rent | 44,791 | 62,648 |
| Total liabilities | 20,712,650 | 23,137,047 |
| **Net Assets** | | |
| Invested in capital assets | 31,683 | 100,018 |
| Unrestricted net assets | 27,169,895 | 26,171,081 |
| Total net assets | 27,201,578 | 26,271,099 |
| Total liabilities and net assets | $ 47,914,228 | $ 49,408,146 |

The accompanying notes are an integral part of these financial statements.

# Massachusetts Life Sciences Center
## Statements of Revenues, Expenses, and Changes in Net Assets
## Years Ended June 30, 2012 and 2011

| | 2012 | 2011 |
|---|---|---|
| **Operating income** | | |
| Capital program revenues from the Commonwealth | $ 43,500,000 | $ 34,000,000 |
| Sponsorship/corporate consortium revenues | 131,300 | 607,567 |
| Interest income | 392,911 | 178,864 |
| Total operating income | 44,024,211 | 34,786,431 |
| **Operating expenses** | | |
| Grant expense | 50,265,235 | 40,564,217 |
| Salary and related employee expenses | 1,438,984 | 1,277,158 |
| Professional and consulting fees | 180,152 | 202,576 |
| Communications programs, sponsorships and contributions | 224,874 | 326,516 |
| General and administrative expenses | 368,248 | 383,184 |
| Loan loss reserve expense, net | 616,000 | 1,212,500 |
| Depreciation | 73,386 | 87,659 |
| Total operating expenses | 53,166,879 | 44,053,810 |
| Operating loss | (9,142,668) | (9,267,379) |
| Nonoperating revenues | | |
| Investment income | 73,147 | 86,330 |
| Total nonoperating revenues | 73,147 | 86,330 |
| Loss before capital contributions | (9,069,521) | (9,181,049) |
| Contributions from the Commonwealth | 10,000,000 | 10,000,000 |
| Increase in net assets | 930,479 | 818,951 |
| **Net assets** | | |
| Beginning of year | 26,271,099 | 25,452,148 |
| End of year | $ 27,201,578 | $ 26,271,099 |

The accompanying notes are an integral part of these financial statements.

# Massachusetts Life Sciences Center
## Statements of Cash Flows
## Years Ended June 30, 2012 and 2011

| | 2012 | 2011 |
|---|---|---|
| **Cash flows from operating activities** | | |
| Receipts for reimbursements from the Commonwealth | $ 45,750,711 | $ 23,952,583 |
| Payments for grants | (52,516,708) | (30,312,008) |
| Payments for salary and related employee expenses | (1,424,832) | (1,268,000) |
| Payments for professional consulting fees | (161,574) | (173,363) |
| Payments for general and administrative expenses | (389,814) | (437,340) |
| Payments for communication programs, sponsorships and contributions | (295,091) | (253,894) |
| Receipts for interest income | 239,363 | 130,587 |
| Receipts for sponsorships | 71,200 | 662,767 |
| Net cash used in operating activities | (8,726,745) | (7,698,668) |
| **Cash flows from capital financing activities** | | |
| Receipt of contributions from the Commonwealth | 10,000,000 | 10,000,000 |
| Net cash provided by capital financing activities | 10,000,000 | 10,000,000 |
| **Cash flows from investing activities** | | |
| Purchase of property and equipment | (5,051) | (2,676) |
| Issuance of loans | (2,207,000) | (2,775,000) |
| Repayment of loans | 1,100,000 | 1,000,000 |
| Receipt of investment income | 73,147 | 86,330 |
| Net cash used in investing activities | (1,038,904) | (1,691,346) |
| Net increase in cash and cash equivalents | 234,351 | 609,986 |
| **Cash and cash equivalents** | | |
| Beginning of year | 27,279,085 | 26,669,099 |
| End of year | $ 27,513,436 | $ 27,279,085 |
| **Reconciliation of cash flows from operating activities** | | |
| Operating loss | $ (9,142,668) | $ (9,267,379) |
| Adjustments to reconcile operating loss to net cash used in operating activities | | |
| Depreciation expense | 73,386 | 87,659 |
| Loan loss reserve | 616,000 | 1,212,500 |
| Loan interest reserve | 215,599 | 186,484 |
| Changes in assets and liabilities | | |
| Accounts receivable | 64,900 | 346,867 |
| Grant reimbursement from the Commonwealth | 2,250,711 | (10,047,417) |
| Interest receivable | (369,147) | (234,761) |
| Prepaid expenses and other current assets | (11,129) | (17,956) |
| Accounts payable and accrued expenses | (30,067) | 86,796 |
| Grants payable and accrued grant expense | (2,251,473) | 10,252,209 |
| Deferred rent | (17,857) | (12,003) |
| Other current liabilities | (125,000) | (291,667) |
| Total adjustments | 415,923 | 1,568,711 |
| Net cash used in operating activities | $ (8,726,745) | $ (7,698,668) |

The accompanying notes are an integral part of these financial statements.

# Massachusetts Life Sciences Center
## Notes to Financial Statements
## June 30, 2012 and 2011

### 1. Organization

On June 24, 2006, the Commonwealth of Massachusetts (the "Commonwealth") enacted Section 24 of Chapter 123 of the Acts of 2006, creating the Massachusetts Life Sciences Center (the "Center") and establishing the Massachusetts Life Sciences Investment Fund (the "Investment Fund") to financially support its activities.

On June 16, 2008, the Life Sciences Act enacted by the Massachusetts Legislature was signed into law by Governor Deval Patrick. The Commonwealth committed to investing $1 billion over a ten year period to create jobs, drive innovation and promote biomedical breakthroughs that improve people's lives. The Center is the steward of the $1 billion and uses three statutory funding vehicles to achieve the Commonwealth's mission: the Life Sciences Investment Fund (the "Investment Fund'), the Capital Program and the Life Sciences Tax Incentive Program.

The Life Sciences Investment Fund is to be used in making appropriations, allocations, grants or loans to leverage development and investments in life sciences in Massachusetts. The Capital Program is for municipalities and institutions for buildings, upgrades to roads, equipment, sewer lines and other infrastructure that supports growth in the life sciences sector. The Life Sciences Tax Incentive Program allows the Center to award tax incentives to companies at every stage of development.

All investments to be made by the Center require approval by its Board of Directors.

The Center is a component unit of the Commonwealth of Massachusetts.

### 2. Significant Accounting Principles

**Accounting and Reporting Standards**
These financial statements have been prepared in accordance with accounting principles generally accepted in the United States of America, as prescribed by the Governmental Accounting Standards Board.

The Center applies all Governmental Accounting Standards Board ("GASB") pronouncements and Financial Accounting Standards Board ("FASB") pronouncements issued before November 30, 1989 that do not conflict with GASB pronouncements, under the provisions of GASB Statement No. 20, *Accounting and Financial Reporting for Proprietary Funds and Other Governmental Entities That Use Proprietary Fund Accounting*.

The GASB defines the basic financial statements of a business type activity as the: balance sheet, statement of revenues, expenses and changes in net assets, the statement of cash flows, and management's discussion and analysis as required supplemental information. The balance sheet is presented to illustrate both the current and noncurrent balances of each asset and liability. All revenues and expenses are classified as either operating or nonoperating activities in the statement of revenues, expenses and changes in net assets. Operating activities are those that support the mission and purpose of the Center. Nonoperating activities represent transactions that are capital, investing, legislative or regulated in nature. The GASB requires that resources be classified into three categories of net assets. Net assets represent the residual interest in the Center's assets after liabilities are deducted and consist of: invested in capital assets, net of related debt; restricted; and unrestricted. Those assets are defined as follows:

***Invested in Capital Assets***
Invested in capital assets, net of related debt, includes capital assets, net of accumulated depreciation and outstanding principal balances of debt attributable to the acquisition, construction or improvement of those assets.

***Restricted***
Restricted assets are those net assets subject to externally imposed stipulations that can be fulfilled by actions of the Center pursuant to those stipulations or that expire by the passage of time.

***Unrestricted***
Unrestricted assets are those net assets that are not subject to externally imposed stipulations. Unrestricted net assets may be designated for specific purposes by action of management or the Board of Directors or may be otherwise limited by contractual agreements with outside parties. The Center's unrestricted net assets include appropriations received from the Commonwealth that are restricted for the general purposes of the Center. Per its enabling legislation, the Center may not expend more than fifteen percent of the amounts to be expended from the Life Sciences Investment Fund for the fiscal year for administrative expenditures and property and equipment.

**Use of Estimates**
The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

**Cash and Cash Equivalents**
Cash and cash equivalents consist of amounts on hand and highly liquid interest investments with maturities of three months or less at acquisition.

**Revenue Recognition**
Investment income is recognized as earned. Sponsorship revenues are related to the Center providing tradeshow booths and other space for companies for a trade show. Sponsorship revenues are recognized when earned upon occurrence of the event. Consortium revenues are fees paid by corporations to sponsor and participate in the Center's small business matching grant and accelerator loan programs. Fees are for a specific time period. Revenues are recognized over the specified time period.

Interest income on loans is recognized as earned. Interest income is net of any interest income loss reserve.

Capital program revenues are amounts due to the Center by the Commonwealth for related capital program expenditures by the Center for grantees of the Center. Capital program revenues are recognized in the period earned.

**Contributions From the Commonwealth of Massachusetts**
Contributions from the Commonwealth are recognized when received from the Commonwealth.

**Loans Receivable and Interest Receivable, Net**
Loans receivable, net, consists of loans issued by the Center to facilitate research, development, manufacturing and commercialization in life sciences by early stage companies. The loans have repayment terms of the earlier of 5 years or a qualified financing greater than $5,000,000. The stated interest rate on each loan is 10% compounded annually.

As of June 30, 2012, $11,207,000 of loans receivable has been authorized and $8,382,000 has been disbursed. During fiscal year 2012, two borrowers repaid back their loans in full with a combined repayment of principal of $1,100,000. On a periodic basis, the Center assesses the collectability of each loan and establishes a loss reserve. As of June 30, 2012, $5,782,000 of loans receivable are outstanding and $3,278,500 has been reserved for losses, resulting in net loans receivable of $2,503,500. The Center has no write-offs or recoveries in fiscal years 2012 and 2011.

As of June 30, 2012, the gross interest receivable balance was $903,607. On a periodic basis, the Center assesses the collectability of the interest receivable and establishes a loss reserve. As of June 30, 2012, $551,933 has been reserved resulting in net interest receivable of $351,674. Interest is due at the end of the loan term or upon repayment of the loan due to a qualified financing of these companies of greater than $5,000,000.

**Grant Expense and Grants Payable**
Grant expenses are related to grant awardees in the period incurred. The Center had grant expense of $50,265,235 and $40,564,217 for fiscal year 2012 and 2011, respectively. As of June 30, 2012 and 2011, $20,466,488 and $22,717,961, respectively, was recorded as grants payable, representing grant expense incurred but not yet paid.

**Income Taxes**
Pursuant to Massachusetts General Laws chapter 23I §6(a), the operations of the Center constitute the performance of an essential government function and are therefore exempt from taxation by and within the Commonwealth.

**Defined Contribution Plan**
All employees of the Center participate in either the Commonwealth of Massachusetts State Retirement systems or the statutorily prescribed optional defined contribution plan provided by the Center. The Center makes no contributions for employees participating in the Commonwealth of Massachusetts State Retirement systems' pension plan. In fiscal year 2010, as provided by the 2008 Statute, the Center established the optional defined contribution plan. The Center annually contributes an amount equal to 12% (5% statutorily mandated) of an employee's annual gross salary less the cost of life and disability insurance. Total optional defined contribution expense by the Center for the years ended June 30, 2012 and 2011 was $94,715 and $80,536, respectively. Vesting is immediate upon contribution. The Center pays administrative expenses of the Plan for the plan participants and ING is the custodian of the plan's assets. The balances of the plan are not included in the financial statements of the Center.

**Massachusetts Neuroscience Consortium**
In June 2012, the Center announced the formation of a separate initiative, the Massachusetts Neuroscience Consortium (the "Consortium), a collaboration between seven global pharmaceutical companies. The Consortium will fund pre-clinical neuroscience at Massachusetts academic and research institutions. Each Consortium member has agreed to contribute $250,000 to the Consortium for the first year membership contribution. The Center is not a member of the Consortium and makes no financial contribution to the Consortium. The financial burden and administrative control does not reside with the Center. The designated members of the Consortium are responsible for all decisions regarding disbursement of funds. The Center acts solely as a custodian of the Consortium funds which are segregated in a separate bank account, the Center does not receive any fees for custodial services provided. No amounts due to the Consortium were received by the Consortium as of June 30, 2012. Subsequent to year end, the Consortium has received $1,500,000 from membership contributions to date held within the segregated bank account of the Center. The balances of the Consortium are not included in the financial statements of the Center as of June 30, 2012. If the Consortium was to terminate, all remaining funds would be due back to the contributing members on a pro-rata basis.

## 3. Related Party Transactions

Certain of the Center's Board of Director's members have relationships with institutions that have received grants. Absent any statutory exemptions to the conflict of interest law, in circumstances where approval of such votes would create a conflict of interest, the Center's Board members are required to rescue themselves.

## 4. Cash and Cash Equivalents

The following summarizes the cash and cash equivalents of the Center and identifies certain types of investment risk as defined by GASB Statement No. 40, *Deposit and Investment Risk Disclosures*, at June 30, 2012 and 2011.

| **June 30, 2012** | **Carrying Amount** | **Fair Value** |
|---|---|---|
| Cash deposits | $ 2,913,399 | $ 2,913,399 |
| Massachusetts Municipal Depository Trust (MMDT) Cash Portfolio | 24,600,037 | 24,600,037 |
| Total at June 30, 2012 | $ 27,513,436 | $ 27,513,436 |

| **June 30, 2011** | **Carrying Amount** | **Fair Value** |
|---|---|---|
| Cash deposits | $ 3,748,111 | $ 3,748,111 |
| Massachusetts Municipal Depository Trust (MMDT) Cash Portfolio | 23,530,974 | 23,530,974 |
| Total at June 30, 2011 | $ 27,279,085 | $ 27,279,085 |

# Massachusetts Life Sciences Center
## Notes to Financial Statements
## June 30, 2012 and 2011

**Custodial Credit Risk—Deposits**
The custodial credit risk for deposits is the risk that in the event of a bank failure, the deposits may not be recovered. The Center's cash and cash equivalents are held by financial institutions, and exceed generally insured limits. All deposits are uninsured and uncollateralized.

**Interest Rate Risk**
Interest rate risk is the risk that changes in interest rates will adversely affect the fair value of an investment. The Center manages its exposure to interest rate risk by so that investments mature to meet cash requirements for ongoing operations and investing operating funds primarily in cash equivalents.

As of June 30, 2012 and 2011, the Massachusetts Municipal Depository Trust investment maturities are summarized as follows:

| 2012 | | Investment Maturities (in Years) | | | |
|---|---|---|---|---|---|
| **Investment Type** | **Fair Value** | **Less Then 1** | **1-5** | **6-10** | **More Then 10** |
| Certificates of deposit | $ 8,589,201 | $ 8,589,201 | $ - | $ - | $ - |
| Commercial paper | 6,191,431 | 6,191,431 | | | |
| U.S. Government and government agency obligations | 1,327,076 | 1,327,076 | | | |
| U.S. Treasury obligations | 2,869,529 | 2,869,529 | | | |
| Medium-term notes | 783,606 | 783,606 | | | |
| Repurchase agreements | 4,827,653 | 4,827,653 | | | |
| Total investment | 24,588,496 | 24,588,496 | - | - | - |
| Net other assets/liabilities | 11,541 | 11,541 | | | |
| Net assets | $ 24,600,037 | $ 24,600,037 | $ - | $ - | $ - |

| 2011 | | Investment Maturities (in Years) | | | |
|---|---|---|---|---|---|
| **Investment Type** | **Fair Value** | **Less Then 1** | **1-5** | **6-10** | **More Then 10** |
| Certificates of deposit | $ 11,529,131 | $ 11,529,131 | $ - | $ - | $ - |
| Commercial paper | 3,676,039 | 3,676,039 | | | |
| U.S. Government and government agency obligati | 68,100 | 68,100 | | | |
| Federal agencies | | | | | |
| U.S. Treasury obligations | 1,439,120 | 1,439,120 | | | |
| Assets-backed securities | 125,464 | 125,464 | | | |
| Medium-term notes | 1,195,979 | 1,195,979 | | | |
| Municipal securities | 162,217 | 162,217 | | | |
| Repurchase agreements | 5,323,346 | 5,323,346 | | | |
| Total investment | 23,519,396 | 23,519,396 | - | - | - |
| Net other assets/liabilities | 11,578 | 11,578 | | | |
| Net assets | $ 23,530,974 | $ 23,530,974 | $ - | $ - | $ - |

## 5. Property and Equipment, Net

Property, equipment, and leasehold improvements are all stated at cost. Depreciation is recorded over the estimated useful lives of the assets by the straight line method. Expenditures for maintenance and repairs are charged to expense as incurred. Depreciation expense totaled $73,386 and $87,659 for the years ended June 30, 2012 and 2011, respectively. Estimated useful lives used for computing depreciation on property, equipment and leasehold improvements are as follows:

| | |
|---|---|
| Computer equipment and software | 3 years |
| Office equipment | 3 years |
| Office furniture | 3 years |
| Leasehold improvements | shorter of the remaining term of lease or asset life |

Property and equipment, net, at June 30, 2012 and 2011 consisted of the following:

| | 2012 | 2011 |
|---|---|---|
| Computer equipment | $ 96,803 | $ 92,537 |
| Office furniture | 133,561 | 132,776 |
| Leasehold improvements | 73,459 | 73,459 |
| | 303,823 | 298,772 |
| Accumulated depreciation | (272,140) | (198,754) |
| Property and equipment, net | $ 31,683 | $ 100,018 |

## 6. Accounts Payable and Accrued Expenses

As of June 30, 2012 and 2011, accounts payable and accrued expenses totaled $201,371 and $231,438, respectively. Those expenses primarily accounted for accrued salary, professional and consulting fees and reimbursements owed for services provided by the Massachusetts Technology Collaborative.

## 7. Grants and Commitments

**Investment Fund**
The following grants were made out of the Massachusetts Life Sciences Investment Fund (the "Investment Fund"):

In October 2007, the Board of Directors voted to approve two grants for the University of Massachusetts Medical School: 1) $570,000 for funding for a stem cell registry; and 2) $7,665,000 for a stem cell bank. In June 2009, the Board of Directors voted to approve an additional $695,000 for the stem cell registry. In September 2010, the Board of Directors voted to approve an additional $440,000 for the stem cell registry. In January and May 2012, the Board of Directors voted to approve an additional $950,000 for the stem cell bank. For the year ended June 30, 2012, the Center expensed $994,149, of which $519,011 was not paid as of June 30, 2012 and is included in

grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $1,117,081. Remaining payments under the authorized grants are $1,166,544 as of June 30, 2012.

In July 2008, the Board of Directors voted to approve $6,918,378 in funding for two research matching grant programs to attract top scientific talent, spur new research opportunities and increase industry-sponsored research. Specifically, the Board of Directors awarded five new faculty grants totaling $3,750,000 to various Massachusetts universities. The Board of Directors also awarded eleven new investigator grants totaling $3,168,378 to a variety of research centers. For the year ended June 30, 2012, the Center expensed $1,558,045 of which $449,216 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $2,207,626. Remaining payments under the authorized grants are $1,485,533 as of June 30, 2012.

In December 2008, the Board of Directors voted to approve $3,786,867 for six cooperative research grants over a three-year period to foster collaborations between scientists, academic institutions and industry. In fiscal year 2012, one of the awards was mutually terminated due to a change in focus by the industry sponsor. The amount remaining on the terminated grant was $658,779. For the year ended June 30, 2012, the Center expensed $1,061,638 of which $650,811 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $832,739. Remaining payments under the authorized grants are $831,623 as of June 30, 2012.

In April 2011, the Board of Directors voted to approve $1,000,000 for two cooperative research grants. For the year ended June 30, 2012, the Center expensed $127,897 of which all was not paid as of June 30, 2012. For the year ended June 30, 2011, the Center did not incur any expense or make any payments under the grants. Remaining payments under the grants are $1,000,000 as of June 30, 2012.

In December 2011 and June 2012, the Board of Directors authorized $3,200,000 for the 2012 Internship Challenge Program which is a year round program. For the year ended June 30, 2012, the Center expensed $949,876 of which all was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. Remaining payments under the authorized program are $3,200,000. In the winter and spring of 2011, the Board of Directors authorized up to $2,200,000 for the expenditures for the 2011 Internship Challenge Program. For the 2011 program $1,327,048 was expensed of which $107,448 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $535,665. Remaining payments under the authorized program are $444,735. For the 2010 Internship program, $615,400 was expensed and paid in fiscal year 2011 with no remaining payments as of June 30, 2012.

In June 2009, the Board of Directors voted to approve $1,380,256 for seven new investigator grants to various research centers. For the year ended June 30, 2012, the Center expensed $210,597 of which $122,681 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expenses on the balance sheet. For the year ended June 30, 2011, the Center expensed $603,783. Remaining payments under the authorized program are $177,524 as of June 30, 2012.

In July 2009, the Board of Directors voted to approve $600,000 for three new investigator matching grants. For the year ended June 30, 2012, the Center expensed $144,606 of which $36,657 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $278,591. Remaining payments under the authorized program are $45,485 as of June 30, 2012.

**Other Grants**
The Center has also made $1,325,000 of grants to various business plan competitions, international collaborations and workforce development and educational programs to foster company development foster collaboration between Massachusetts and international organizations and expand life sciences education and workforce within the Commonwealth. For the year ended June 30, 2012, the Center expensed $354,586 of which $40,104 was not paid as of June 30, 2012 and is included in grant payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $139,371. Remaining payments under the authorized grants are $751,148 as of June 30, 2012.

In fiscal 2012, the Center made an additional $50,000 grant to the Massachusetts Life Sciences Collaborative to launch and develop a formal Massachusetts Biomanufacturing Roundtable to support and promote the retention and growth of biomanufacturing in Massachusetts. The total amount of awards provided to the Massachusetts Biomanufacturing Roundtable is $100,000. For the year ended June 30, 2012, the Center expensed $36,792 of which $36,792 was not paid as of June 30, 2012 and is included in grant payable and accrued grant expense on the balance sheet. Remaining payments under the authorized grant are $55,042 as of June 30, 2012.

Pursuant to the Massachusetts fiscal year 2011 state budget, the Center made a $210,000 grant to the Massachusetts Biomedical Initiative which shall be expended for the operation and maintenance of the Massachusetts Biomedical Initiatives for the purpose of promoting the commercialization of new, academic-based research and development and raising the scientific awareness of the communities of the Commonwealth. The award amount was expensed and paid in the year ended June 30, 2011. There are no remaining payments as of June 30, 2012 under the authorized grant.

Total remaining payments for all Investment Fund grants as of June 30, 2012 are $9,157,634.

**Capital Program Grants**
The following grants were made under the Capital Program:

In October 2008, the Board of Directors voted to approve $5,200,000 for the replacement of a wastewater pump station that will help support the expansion of Genzyme Corporation's manufacturing facility in Framingham, Massachusetts. This grant is the first installment of approximately $12,900,000 that has been allocated to the Framingham project in connection with the Life Sciences Statute. In October 2009, the Board of Directors voted to approve the second installment of $7,700,000 for the $12,900,000 grant. In May 2011, the Board of Directors voted to approve an additional $1,400,000 for the town of Framingham. For the year ended June 30, 2012, the Center expensed $4,328,321 of which $1,255,322 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $2,883,475. Remaining payments under the authorized grant are $2,694,788 as of June 30, 2012.

In September 2009, the Board of Directors voted to approve $90,000,000 for the design, construction, development and related infrastructure improvements for an advanced therapeutics cluster to be constructed at the University of Massachusetts Medical School in Worcester. The payments are to be paid over four fiscal years beginning in fiscal year 2010 and concluding in fiscal year 2013. For the year ended June 30, 2012, the Center expensed $34,196,102 of which $12,434,062 was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $25,888,094. Remaining payments under the authorized grant are $29,069,809 as of June 30, 2012.

In February 2010, the Board of Directors voted to approve $6,600,000 towards the next phase of development of Gateway Park in Worcester. The grant was subsequently reduced to $5,150,000 due to a reconfiguration of the project. The grant supports the development of WPI's Biomanufacturing Education and Training Center (BETC) and a new incubator for Massachusetts Biomedical Initiatives (MBI). For the year ended June 30, 2012, the Center expensed $2,447,395 of which $1,691,208 was not paid as of June 30, 2012 and is included in grants payable and accrued grants expense on the balance sheet. For the year ended June 30, 2011, the Center expensed $377,536. Remaining payments under the grant are $4,016,278 as of June 30, 2012.

In January 2011, the Board of Directors voted to approve $2,000,000 for the purchase of state-of-the-art equipment, renovations and related expenses to support the Center for Personalized Cancer Therapy at the University of Massachusetts at Boston and the Dana-Farber/Harvard Cancer Center. For the years ended June 30, 2012 and 2011, the Center did not incur any expense or make any payments under the grant. Remaining payments under the grant are $2,000,000 as of June 30, 2012.

In February 2011, the Board of Directors voted to approve $3,466,158 for thirty-two equipment grants for purposes of providing grants for purchasing or leasing equipment to train students in life sciences technology and research. For the year ended June 30, 2012, the Center expensed $482,780 of which all was paid prior to June 30, 2012. For the year ended June 30, 2011, the Center expensed $2,850,896. There are no remaining payments as of June 30, 2012 under the authorized grant.

In January 2012, the Board of Directors voted to approve $14,600,000 for the construction of the Bio-Manufacturing Center at the University of Massachusetts at Dartmouth to enable companies to set up small scale manufacturing operations for bio-processing operations. For the year ended June 30, 2012 the Center expensed $971,003 of which all was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. Remaining payments under the grant are $14,600,000 as of June 30, 2012.

In January 2012, the Board of Directors voted to approve $20,000,000 to three awardees under the Center's FY12 Capital Project Matching Grant Program. These grants will be used to fund the Molecular Cancer Imaging Facility at the Dana Farber Cancer Institute which systematically examines patient tumors and matches targeted therapy to specific molecular changes in cancer cells; the Transitional Center for the Cure of Diabetes at the Joslin Diabetes Center, which focuses on the acceleration of basic discoveries into clinical research and care; and the Hall of Human Life Exhibit at the Museum of Science Boston, allowing the public a view into the innovative work being carried out in the life sciences community and inspire the next generation of researchers. For the year ended June 30, 2012 the Center expensed $574,400 of which all was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. Remaining payments under the grants are $20,000,000 as of June 30, 2012.

In April 2012, the Board of Directors voted to approve $10,000,000 to construct and equip Nanomedicine and Nanobiomedical laboratories within the Emerging Technologies and Innovation Center at the University of Massachusetts at Lowell to be utilized for hands on student learning, research, development and industry partnership activities. For the year ended June 30, 2012, the Center did not incur any expense or make any payments under the grant. Remaining payments under the grant are $10,000,000 as of June 30, 2012.

In April 2012, the Board of Directors voted to approve $11,400,000 for the benefit of the University of Massachusetts at Dartmouth for the acquisition of land, improvements and related parking for the Advance Technology Manufacturing Center in Fall River from the Massachusetts Development Finance Authority in fiscal year 2015, pursuant to the Life Sciences Act. For the year ended June 30, 2012, the Center did not incur any expense or make any payments under the grant. Remaining payments under the grant are $11,400,000 as of June 30, 2012.

In May 2012, the Center's Board of Director awarded $500,000 in a Small Business Matching grant to one life sciences company in Massachusetts. To qualify for the program companies must have received a Phase II or Post Phase II small business innovation research (SBIR) or small business technology transfer (STTR) grant from federal agencies such as the National Institutes of Health (NIH), National Science Foundation (NSF), or Department of Defense (DOD). For the year ended June 30, 2012 the Center expensed $500,000 of which all was not paid as of June 30, 2012 and is included in grants payable and accrued grant expense on the balance sheet. Remaining payments under the grant are $500,000 as of June 30, 2012. In May 2010, the Board of Directors awarded $1,500,000 in Small Business Matching Grants to three life science companies in Massachusetts. In May 2011, the Center's Board of Director awarded $2,000,000 in Small Business Matching grants to four life sciences companies in Massachusetts. For the year ended June 30, 2011 the Center expensed $2,000,000. There no remaining payments under the grants as of June 30, 2012.

Total remaining payments for all capital program grants as of June 30, 2012 are $94,280,875.

**Facility Lease**

In December 2008, the Center entered into a 5 year noncancelable operating lease through March 2014 for its facilities in Waltham, Massachusetts. The lease agreement provides for certain months of nonpayment of rent ("free rent") and includes escalating rent payments. Rent expense is recorded on the straight line basis, and therefore, as of June 30, 2012 and 2011, deferred rent in the amount of $44,791 and $62,648, respectively, has been recorded. Rent expense under the operating lease was $159,256 for the year ended June 30, 2012 and 2011.

Future minimum lease payments under all operating lease agreements are approximately:

| | Amount |
|---|---|
| 2013 | $ 183,000 |
| 2014 | 141,000 |
| 2015 | - |
| 2016 | - |
| 2017 | - |
| Thereafter | $ 324,000 |

**8. Subsequent Events**

Management has evaluated subsequent events through September 26, 2012.

In July 2012, the Center disbursed $750,000 to one of the April 2012 Accelerator loan program awardees.

In August 2012, the Center disbursed $1,080,000 to two of the April 2012 Accelerator loan program awardees.

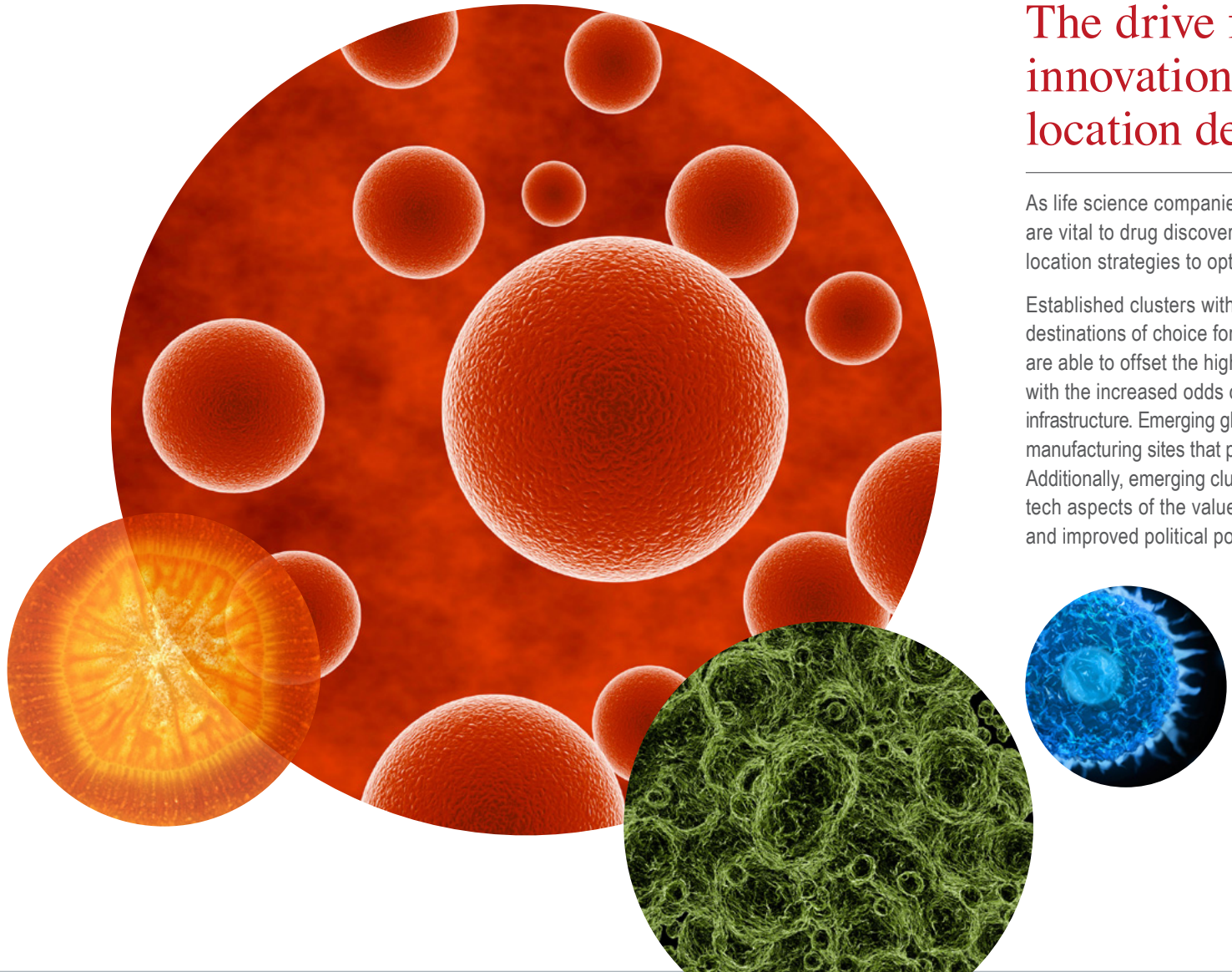
In September 2012, The Center entered into a Memorandum of Agreement (MOA) with the Economic Development and Industrial Corporation of Boston to operate an internship program. The MOA provides up to a maximum of $800,000 through March 2016.

Jones Lang LaSalle

*Real value in a changing world*

# Life sciences cluster report

Global . 2011



## The drive for discovery and innovation is shifting how location decisions are made

As life science companies determine which aspects of the business are vital to drug discovery and innovation, they are bifurcating their location strategies to optimize the cost versus output equation.

Established clusters within the United States and Europe remain destinations of choice for core aspects of drug discovery. Companies are able to offset the high costs of operating in established clusters with the increased odds of innovation due to deep, rich talent pools and infrastructure. Emerging global clusters, however, offer cost-advantageous manufacturing sites that provide both revenue and margin opportunities. Additionally, emerging clusters are becoming more competitive in high-tech aspects of the value chain, due to significant capital investments and improved political policies.

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# Life sciences cluster report

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# A message from Bill Barrett

***Complex macro and micro factors have forced the life sciences industry to re-examine traditional business models and location strategies.***

**William Barrett**
Executive Managing Director, Life Sciences

Impacts of the global economic recession, increased competition, pricing pressure, depleted new-product pipelines and heightened regulatory processes all strain profitability and influence the industry's facility and location decisions. They produce an environment of change and the opportunity that comes with it for all market clusters.

As life sciences companies seek to balance their operations among the three global regions of the Americas, Europe/Middle East/Africa (EMEA) and Asia Pacific, and they have to evaluate the financial equation surrounding innovation and production. By honing in on the efficiency of R&D and manufacturing models and determining what aspects of drug discovery are core and essential to a product's lifeline and which are not, companies can use this knowledge to influence their location decisions.

As we'll see in this report, expansion into emerging clusters around the globe is at the forefront of most companies' location strategies due to market share opportunities and favorable cost structures for manufacturing and other operations. Not to be discounted, however, are the plans to remain in critical established clusters where deep and mature talent pools increase innovation efficiency.

## *Focus of the report*

Given the importance of location, we thought it critical to examine industry-relevant global markets on a variety of data points that historically define a life sciences "cluster":

- Educated workforce
- Venture and investment capital
- Centers of excellence and innovation
- Industry-friendly political structures
- Institutions of higher learning
- Target economic development incentives
- Patent protection
- Other associations and supporting infrastructure

Although cluster infrastructure is not the only determinant of a city or country's viability as an industry hub, we think it serves as a good measuring stick and baseline point of comparison.

While we maintain a broad view of the life sciences industry, considering various sub-sectors such as pharmaceuticals, bio-technology, medical device technology, agricultural biotechnology and biofuels, the two most important sub-sectors for investment are pharmaceuticals and biotechnology. Consequently, we focus more of our attention on those two sub-sectors.

William Barrett leads the Life Sciences business at Jones Lang LaSalle. A seasoned veteran and leader in the pharmaceutical industry, Mr. Barrett is widely known as an expert in streamlining and transforming complex technical operations and for providing clients with overall global real estate and integrated facility management solutions.

Prior to his tenure at Jones Lang LaSalle, Mr. Barrett served over two decades with Pfizer, Inc., and its legacy companies, directing operations; research and development manufacturing operations around the world.

Mr. Barrett holds a Bachelors of Science in Chemistry from the University of Oklahoma and a JD from the John Marshall Law School. He is a member of the Illinois and Federal Bar Associations.

By Matt Jackson & Shannon Curley



# The drug and pharmaceuticals global direct investment landscape

*A focus on key areas with the greatest growth potential.*

The location footprint for drug and pharmaceutical companies has been under ongoing transformation for an extended period. In response to seismic shifts within the industry, companies have been on a journey to realign the enterprise operating footprint with the new realities for *a)* how revenue will be generated, and *b)* margin preserved. Combined with a heightened focus on improved asset efficiency and more effective research and development, these factors have led to a shift in how enterprises configure operations around the world. This structural shift is closely tied to expectations about how the industry will create shareholder value and reflects the need to rebalance the portfolio of assets among regions of the world.

Some countries have emerged during the last decade as major recipients of foreign direct investment (FDI), while in others, the industry talks of rationalization or consolidation. For investors, it is important to understand trends that affect the industry and how they transform facility planning and foreign direct investment in the drug and pharmaceutical sector.

## Focus of the discussion

The life sciences industry is commonly characterized as containing four major segments, including, *a)* agricultural feedstock and chemicals, *b)* drugs and pharmaceuticals, *c)* medical devices and equipment, and *d)* research, testing and laboratories. Within each segment, there are discrete sub-segments that span 27 industry classification codes. For purposes of this discussion, we will focus primarily on the drug and pharmaceuticals industry segment because of its size, its position with investor and the significant changes that companies have faced in recent years.

## Drivers of operating footprint transformation

Like all systemic changes in business, the core driver for a new location footprint for drug and pharmaceuticals is the ongoing search for ways to create increased shareholder value. The network of locations have been reconfigured to place greater emphasis on locations with the best potential for revenue growth, improved operating margins, improved return on installed assets, changes in technology and production lines, and investor expectations. This has led to a shift in facility configuration and adaptations leading to improved competitiveness.

## About the authors

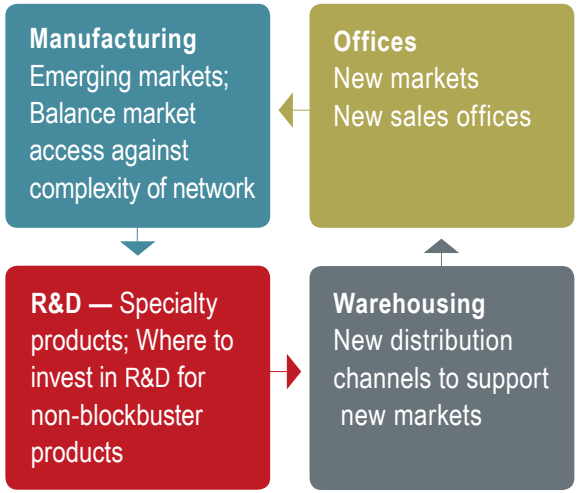
Matt Jackson serves as Jones Lang LaSalle's Strategic Consulting lead to the life sciences industry. He specializes in business configuration and cross border location strategy services and has worked for many leading companies in the life sciences industry.

Shannon Curley is a member of Jones Lang LaSalle's Strategic Consulting group and specializes in foreign direct investment strategy, cross border investment and business configuration.

### Revenue growth

To increase revenue, the industry has shifted its focus to regions and countries with the greatest growth potential. Less emphasis will be placed on sales in North America and Europe — which today represent about 70 percent of industry revenue — and more emphasis will be placed on areas likely to experience double-digit revenue growth, such as Asia, Africa and Latin America.

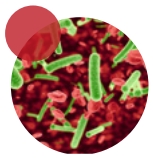
**Figure 1**
Revenue model impact on the location footprint




Growth in all three areas will result from increased health-care spending, demographic trends and shifting disease patterns. As a consequence, drug and pharmaceutical companies have rebalanced manufacturing, distribution, sales, and to some extent R&D operations among regions. Investments in Asia, in particular, have been significant. *(Reference, figure 1)*

### Operating margin

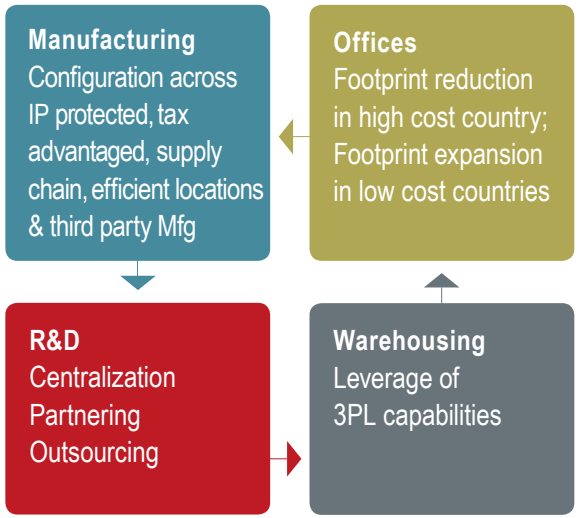
Drug and pharmaceutical facility locations and configurations have been altered as companies seek to improve or maintain operating margins (and net after tax profit) during a period characterized by patent expirations and an onslaught of generic drug alternatives. Notably, companies have invested in a number of low-cost platforms in efforts to preserve operating margins. An illustration of such a shift is the 80 percent share of global active pharmaceutical ingredient (API) now manufactured in India and China.



Companies in the sector are also reevaluating their businesses to identify core processes that must remain under their direct control, and non-core processes that can be performed by others. As a consequence, there is new emphasis on the use of third parties to reduce costs and improve margins across functional areas of the business in R&D, manufacturing, distribution and general and administrative processes. For functions that remain under direct control, companies seek alternative operating platforms to lower structural costs attributable to location. Many companies have migrated non-core activities and/or low margin products away from legacy Western European and North American locations to lower-cost destinations around the world (in particular India and China). Others have shifted to lower cost regions with shared services in support of the finance, tax, HR, IT, procurement and customer service organizations. While some companies in the industry have been slow to adopt shared service models, many companies now use low-cost locations to help support the business in high-cost countries.

Another approach has been to seek locations with a favorable tax structure. More companies seek locations in the attractive tax environments of Ireland and Singapore, for example, and there has been a corresponding move to divest assets in areas with poor or declining tax advantages. One example is Puerto Rico where there has been a significant decline in inward investment since 2007 as the tax benefits sunset for pioneer investors. It is fair to say that tax incentives were a powerful tool to develop the sector in countries where, a decade ago, the industry was embryonic. *(Reference, figure 2)*

**Figure 2**
Operating margin impact on the location footprint




### Asset efficiency

A turbulent decade has also led to more focus on asset efficiency, in particular for manufacturing and research and development operations. Whereas in a period of economic growth the industry was highly incented to install excess capacity to ensure there were no constraints to revenue growth, the economic downturn

**Figure 3**
Asset efficiency impact on location footprint

resulted in a notable decline in capacity requirements and entire buildings becoming idle. From a manufacturing perspective, the drop in throughput requirement, shift of production capacity to emerging markets and the decline in the number of doses patients require per day all reduced capacity utilization at many plants. This is not easy to resolve, partly because of the unique nature of drug and pharmaceutical manufacturing facilities and technologies, and partly because of the need to separate entities and manufacturing technologies within a country to reduce legal risk. Many companies have been forced to dispose of under-utilized manufacturing operations at a fraction of replacement cost. In contrast, in emerging markets with significant growth potential, there is evidence that companies are rethinking the use of third-party manufacturers to improve asset utilization and bring more capacity under the direct control of the company.

Research and Development is the other area of focus for asset efficiency. R&D portfolios have been consolidated, and in high-cost countries, more work has been reallocated to research hubs. Investments have been made in existing world-class locations, while satellite locations have been divested. At the same time, more R&D facilities have been established in low-cost countries such as India, China and Singapore, permitting overall cost reductions, or larger research headcounts at an equivalent cost. *(Reference, figure 3)*

## *Direct investment landscape*

Data compiled for this report demonstrates the extent of the shift in foreign direct investment (FDI) to include not only the United States and Western Europe, but also low-cost markets such as India and China. For this report, foreign direct investment data was analyzed for the period from 2003 to 2010, with a view of activity before and after the global economic downturn.

### The global view

Figures 4 and 5 provide an overview of the global investment landscape, comparing pre-downturn (2003–2006) with (roughly) post-downturn (2007–2010) investments. The United States, with the world's largest economy remains the number one country for attracting investment. While many of the largest drug and pharmaceutical companies have disposed of assets in the United States to diversify into the world's emerging markets, the available assets have been acquired by other United States companies, or European, Japanese and Taiwanese investors, among others. The result was that the United States received close to 20 percent of all global investment between 2003 and 2010. *(Reference, figure 4 & 5)*

Other countries representing a significant percentage of overall global investment included Ireland, China and Singapore, each individually attracting seven to nine percent of all global direct investment. Project experience suggests that China's emergence as a leading destination for FDI is due to both the revenue and operating margin opportunities there. Ireland and Singapore are sought-after locations because of their tax advantages. Ireland maintains a 12 percent flat corporate income tax rate, and Singapore offers a very desirable income tax-based incentive program that can reduce the rate to zero for a period of 10 years or longer for select investments.

The next group of top performers, with FDI of less than five percent of all global investment, includes India and Germany, with other locations of relevance including France, Spain, Puerto Rico (although declining) and Italy. The prominence of Ireland, Singapore and Puerto Rico in the top 10 list for both time periods is a clear indicator that tax-based incentives are a highly effective way to attract investment.

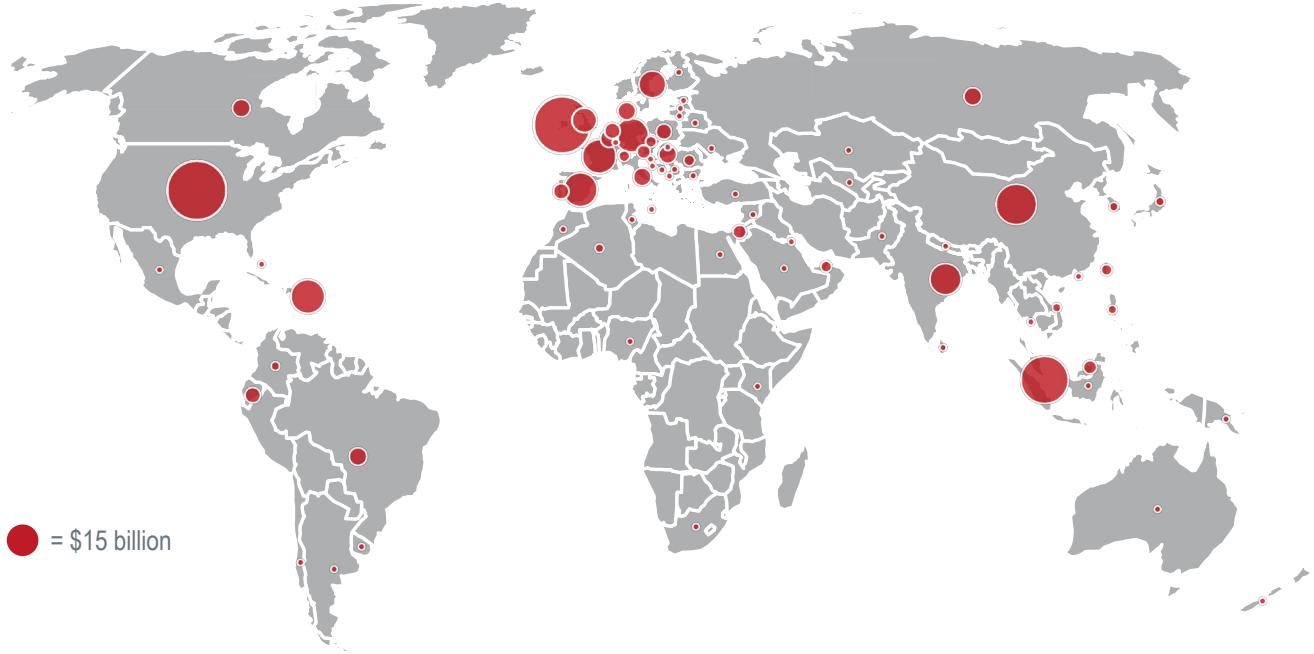



**Figure 4**
Drug and pharmaceutical inward direct investment flow by country
**2003–2006**

***Top 10 receiving countries***
(in billions)

**United States** $38.7
**Ireland** $37.1
**Singapore** $27.6
**China** $19.7
**Germany** $14.8
**Spain** $14.8
**France** $14.2
**Puerto Rico** $14.1
**India** $12.2
**Sweden** $8.6

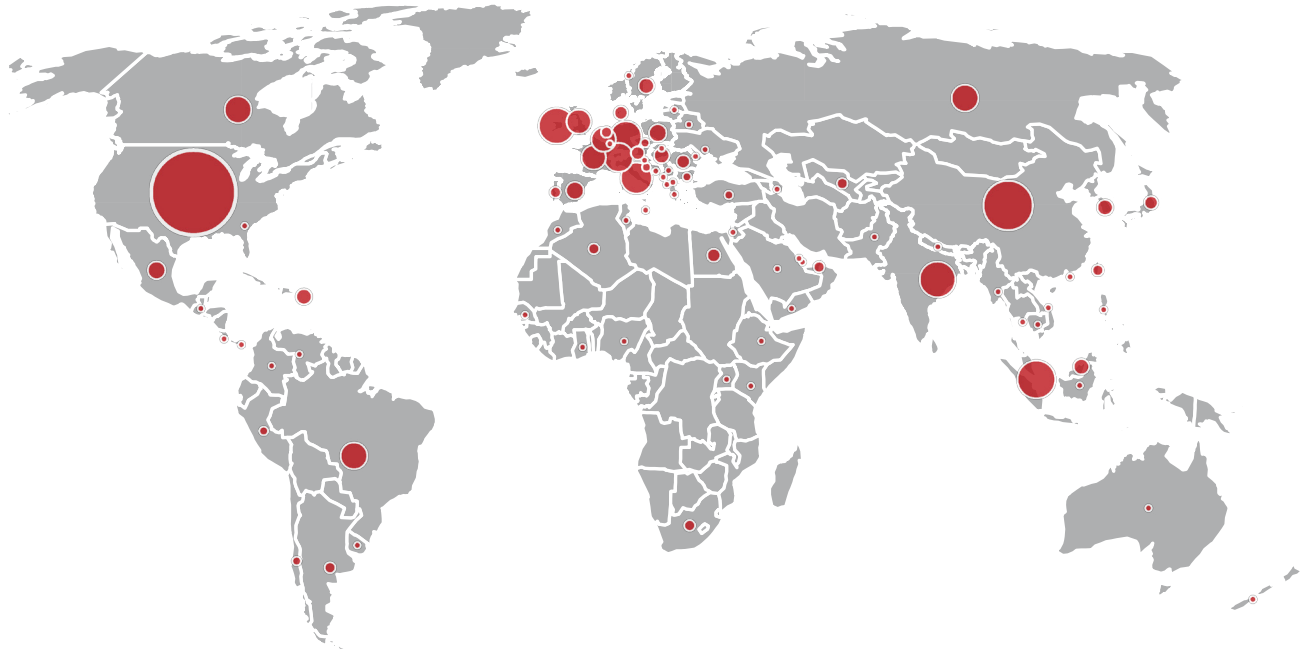


**Figure 5**
Drug and pharmaceutical inward direct investment flow by country
**2007–2010**

***Top 10 receiving countries***
(in billions)

**United States** $73.3
**China** $29.8
**Singapore** $17.7
**India** $16.8
**Ireland** $16.0
**Italy** $13.1
**Germany** $11.9
**Switzerland** $11.1
**Canada** $9.9
**Brazil** $8.9

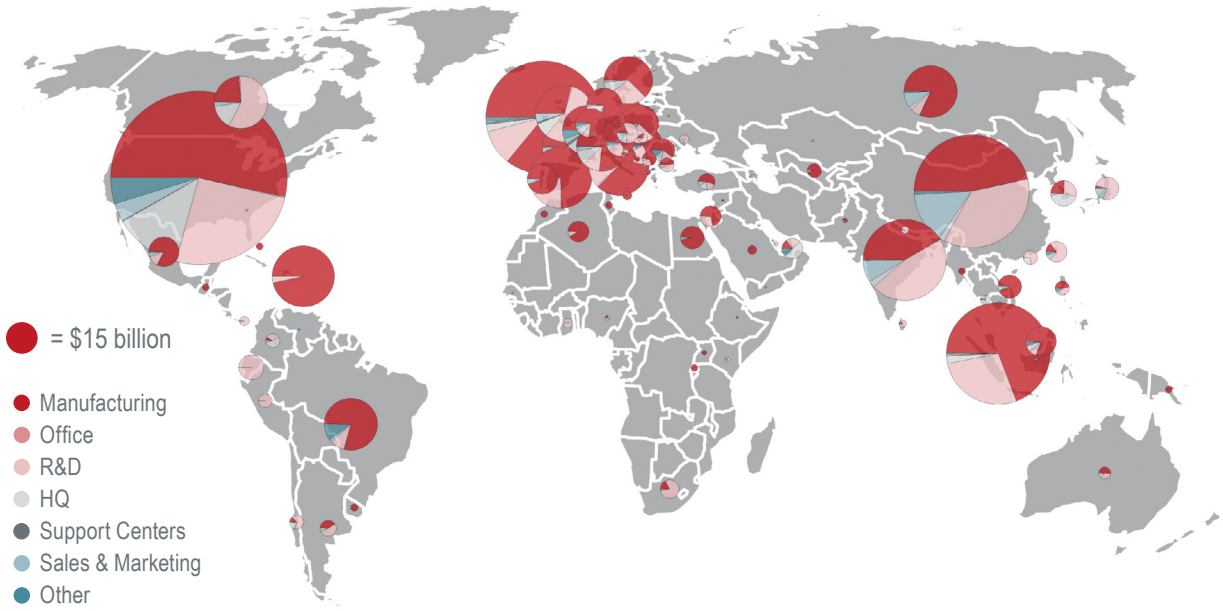
All monetary values in United States dollars

Source: FDI Intelligence from Financial Times Ltd, JLL analysis

In the period immediately following the global economic downturn (2007 to 2010), a noteworthy point is the significance of investment in Asia, where China, Singapore, and India are ranked second, third and fourth on a global basis. Only the United States received more inward investment. Switzerland, Canada and Brazil climbed into the top 10 global destinations for direct investment for the period. Also of note was the declining level of investment in Ireland, Puerto Rico, France and Spain, with the latter three falling out of the top 10 list during the period.

Manufacturing represents the most significant portion of direct investment flows. Manufacturing investment is also distributed to a larger degree than R&D, the other capital-intensive activity. The R&D investment landscape is significantly more concentrated in a few countries, with the United States, China, India, Singapore, Ireland, Canada and the United Kingdom representing the vast proportion of global activity. *(Reference, figure 6)*

**Figure 6**
Composition of drug and pharmaceutical direct investment by country
**2003–2011**




## *Regional patterns*

### The Americas

The United States was the leading destination for direct investment in the Americas (also globally), receiving more than $38 billion[1] in inward investment between 2003 and 2006 (13 times the global average for the period), and an even larger $73 billion between 2007 and 2010 (a figure 22 times the global average). The growth in the level of investment was 91 percent between 2003 and 2006, and a slower but still impressive (given the existing level of investment) 34 percent between 2007 and 2010. A somewhat unique characteristic of investment in the United States was the sizable levels of investment across the functional spectrum, with manufacturing representing only 54 percent of the total. Approximately 25 percent of the investment in the United States was in R&D, which translates to a notably large absolute figure given the total size of inward investment between 2003 and 2010.

Puerto Rico took second place in inward direct investment levels. Between 2003 and 2006, Puerto Rico received just over $14 billion in direct investment, a figure almost five times the global average. The growth between 2003 and 2006 was 68 percent. During the 2007–2010 period, investments dropped significantly, to just over $3.5 billion, the net result of lower inward investment and also divestiture activities by legacy drug and pharmaceutical companies. Manufacturing constituted 97 percent of all investment in Puerto Rico. Although Puerto Rico is trying to organize around R&D and advance its value proposition, the data suggests it has not yet been successful.

1. All monetary values in United States dollars

Source: FDI Intelligence from Financial Times Ltd, JLL analysis

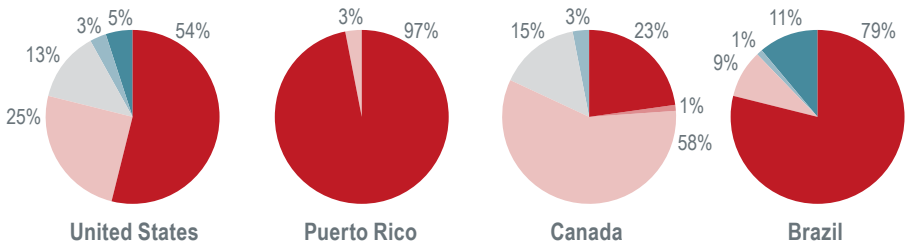
**Figure 7**
Composition of drug and pharmaceutical inward investment in the Americas

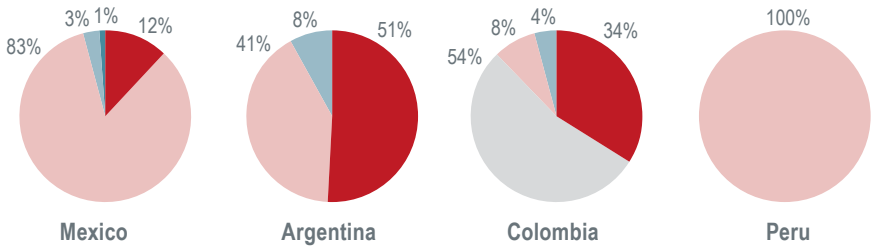
**Dominant Recipients**

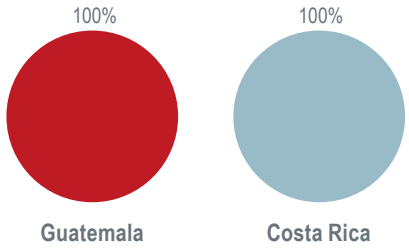
| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| Country | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 |
| United States | 38,669 | 73,322 | 13.04 | 22.51 | 91% | 34% |
| Puerto Rico | 14,068 | 3,630 | 4.70 | 1.12 | 68% | –18% |
| Canada | 4,052 | 9,850 | 1.33 | 2.82 | 33% | 143% |
| Brazil | 4,504 | 8,865 | 1.42 | 2.76 | –72% | 4,659% |

**Up & Coming Recipients**

| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| Country | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 |
| Mexico | 542 | 4,687 | 0.21 | 1.53 | 75% | 101% |
| Argentina | 308 | 1,488 | 0.12 | 0.49 | 751% | 554% |
| Colombia | 1,046 | 435 | 0.36 | 0.14 | 306% | 160% |
| Peru | 0 | 1,152 | 0.00 | 0.38 | 66% | 38% |
| Guatemala | 0 | 402 | 0.00 | 0.15 | 25% | 14% |
| Costa Rica | 0 | 28 | 0.00 | 0.01 | 0% | 0% |




- Manufacturing
- Office
- R&D
- HQ
- Support Centers
- Sales & Marketing
- Other

Canada was the next largest recipient of inward investment over the period, receiving just under $14 billion in direct investment between 2003 and 2010. Like the United States, Canada received more inward investment between 2007 and 2010 and in the prior period (close to 3 times the global average). Like the United States, Canada was a beneficiary of a large percent of R&D investment. While lower than the United States in total dollars, R&D represented a very large 58 percent of total inward investment.

Brazil rounded out the top four countries in the Americas with inward investment levels just slightly lower than Canada. Similar to Canada, Brazil received a notably larger amount of investment between 2007 and 2010 compared to the prior period. The more than $8 billion in inward investment between 2007 and 2010 represented roughly 2.75 times the global average. Like Puerto Rico, a significant percentage of Brazil's inward activity was for manufacturing, possibly a direct outcome of its mandatory market presence policy.

Investment levels decline significantly for the remaining countries in the region, with only Mexico achieving investment levels above the global average (for the period between 2007 and 2010). *(Reference, figure 7)*

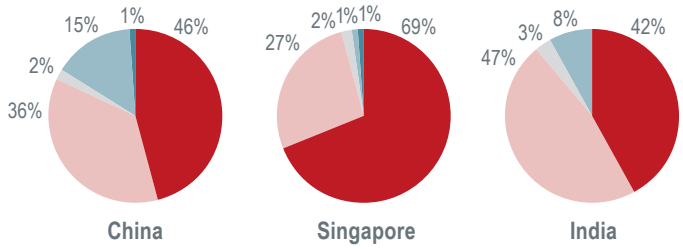
**Figure 8**
Composition of drug and pharmaceutical inward investment in Asia Pacific

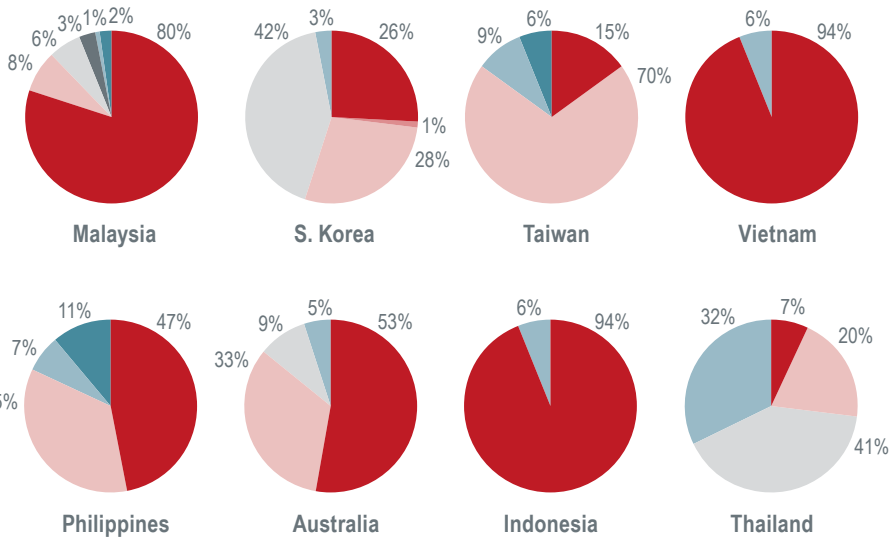
**Dominant Recipients**

| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| **Country** | **2003–2006** | **2007–2010** | **2003–2006** | **2007–2010** | **2003–2006** | **2007–2010** |
| **China** | 19,709 | 29,831 | 6.87 | 9.66 | 77% | 14% |
| **Singapore** | 27,540 | 17,738 | 9.53 | 5.59 | 24% | –5% |
| **India** | 12,166 | 16,814 | 4.46 | 5.61 | 109% | –3% |

**Up & Coming Recipients**

| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| **Country** | **2003–2006** | **2007–2010** | **2003–2006** | **2007–2010** | **2003–2006** | **2007–2010** |
| **Malaysia** | 1,995 | 2,776 | 0.69 | 1.06 | 66% | 1190% |
| **S. Korea** | 742 | 2,884 | .025 | 0.82 | –16% | 239% |
| **Taiwan** | 1,274 | 1,437 | 0.42 | 0.44 | –69% | 7630% |
| **Vietnam** | 867 | 656 | 0.28 | 0.22 | 146% | 45% |
| **Philippines** | 799 | 528 | 0.26 | 0.19 | –84% | 556% |
| **Australia** | 298 | 534 | 0.09 | 0.20 | –33% | 25% |
| **Indonesia** | 268 | 515 | 0.10 | 0.16 | –33% | 175% |
| **Thailand** | 223 | 410 | 0.08 | 0.14 | 4% | 336% |




- Manufacturing
- Office
- R&D
- HQ
- Support Centers
- Sales & Marketing
- Other

## Asia Pacific

Like the Americas, inward investment in Asia between 2003 and 2010 was concentrated in a few countries, with FDI in China, Singapore and India exploding onto the global landscape. Investment in other countries in the region was significantly lower, with only Malaysia, South Korea and Taiwan really seeing any activity of note.

China, from 2003 to 2010, saw increasing levels of investment. Between 2003 and 2006, inward flows amounted to just under $20 billion a figure approximately seven times the global average, and just under $30 billion from 2007 and 2010, a figure just over 9.5 times the global average. The growth in inward investment for the 2003 to 2006 period was a solid 77 percent, but slowed between 2007 and 2010 to 14 percent. Just over 36 percent of investment in China was for research and development, a figure second only to India.

Between 2003 and 2006, Singapore received more than $27 billion in inward flows (approximately 9.5 times the global average), and between 2007 and 2010, just under $18 billion (approximately 5.5 times the global average). A large percentage of investments in Singapore were in manufacturing, likely the direct result of its extremely positive tax incentives, but 27 percent of sector investments in Singapore were in R&D operations, an illustration of the success it is seeing in its push for R&D investment.

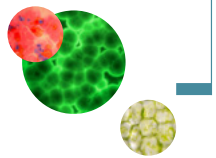
India ranked third for inward direct investment flows. Between 2003 and 2006, just over $12 billion was invested (a figure approximately five times the global average) and between 2007 and 2010, just under $17 billion was invested (a figure presenting more than 5.5 times the global average). India's growth over the first period was more than 100 percent, yet like other countries impacted by the global economic recession, India saw a decline in year-to-year investment levels between 2007 and 2010. Some 47 percent of investment in India went for R&D, one of the best research investment performances by any of the top FDI nations.

Investment levels declined significantly outside of the top three Asian countries. Even while some of the countries put up very sizable percentage growth figures, the absolute dollar value of the inward flows was a fraction of the top three countries. *(Reference, figure 8)*

**Europe, Middle East and Africa (EMEA)**

Ten countries in the EMEA region received significant investments in the drug and pharmaceutical sector. EMEA countries also generally received a larger percentage of R&D investment than those of countries in other regions.

Ireland was the largest recipient of inward direct investment in the region, receiving more than $50 billion from 2003 to 2010. From 2003 to 2006, Ireland received just over $37 billion in inward flows (approximately 14 times the global average), and between 2007 and 2010, just under $16 billion (approximately 5 times the global average). Direct investment in manufacturing facilities represented close to 90 percent of all investment in the country, probably because of related tax incentives.



Germany was the second largest recipient in the region with more than $25 billion in inward investment between 2003 and 2010. Like Ireland, Germany also received more investment between 2003 and 2006 than between 2007 and 2010, but when viewed from a global perspective, Germany received just over five times the global average between 2003 and 2006 and just under four times the global average between 2007 and 2010. Most investment in Germany was in the manufacturing sector.

France was third in the region for inward investment flows, receiving just under $23 billion between 2003 and 2010. Between 2003 and 2006, France received just over $14 billion in inward investment, a figure just over five times the global average, and approximately $8.5 billion between 2007 and 2010, a figure 2.75 times the global average. R&D investment represented just over 30 percent of total investment in France.

Spain and Italy rounded out the top five destinations for direct investment in Europe. Spain received a significant amount of inward investment between 2003 and 2006, but slowed notably after 2006. Italy was the opposite.

Other countries of significance in EMEA included the United Kingdom, Russia, Belgium, Switzerland and Sweden. While seeing lower levels of investment than the top five, each still received notable investment at levels generally above the global average. Of this group of countries, at more than 30 percent, the United Kingdom, Belgium and Sweden all stood out in terms of the total investment represented by R&D.

As a general rule, investment in the Middle East and Africa remains very low relative to other countries in the region. *(Reference, figure 9)*

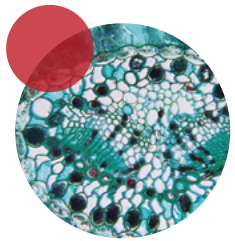


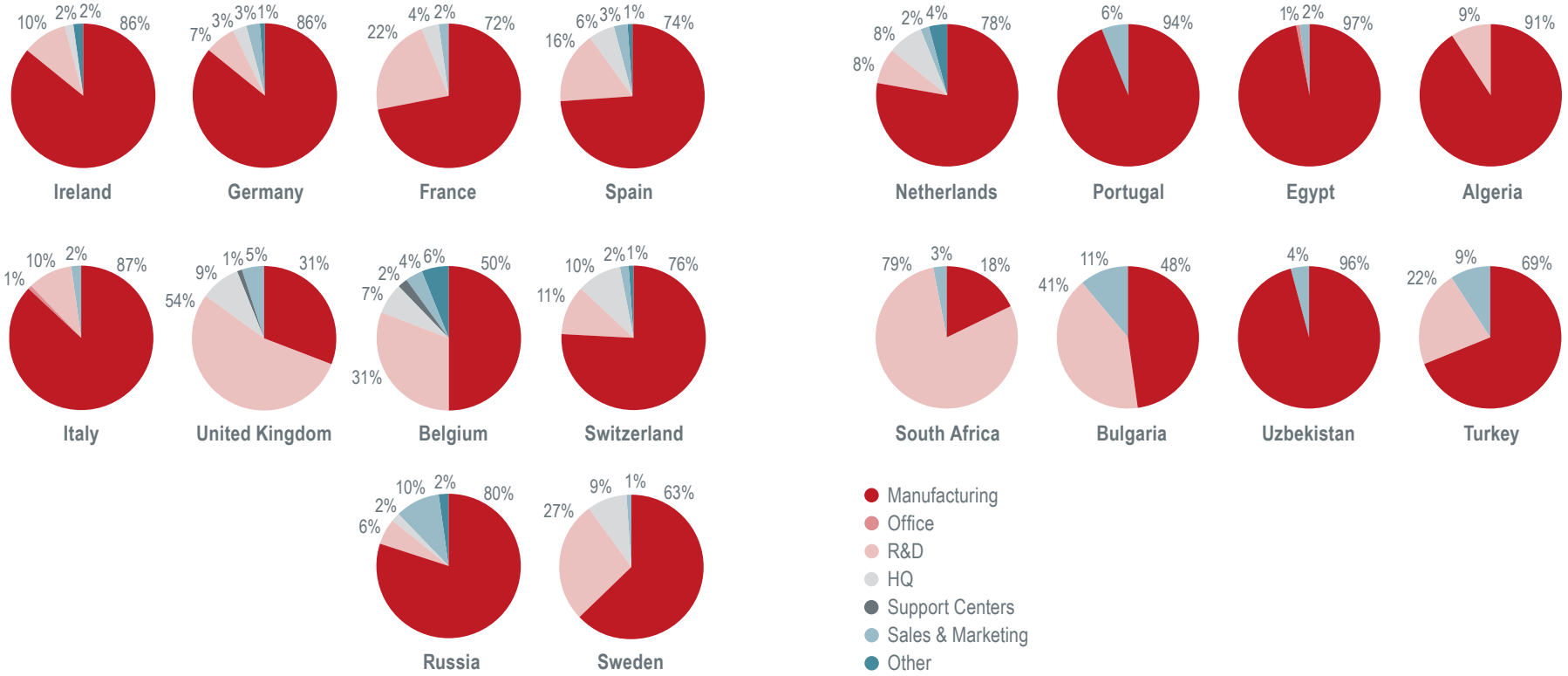
Figure 9
Composition of drug and pharmaceutical inward investment in Europe, Middle East and Africa

**Dominant Recipients**

| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| Country | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 |
| Ireland | 37,065 | 15,982 | 13.8 | 4.96 | 60% | −34% |
| Germany | 14,848 | 11,909 | 5.15 | 3.93 | −40% | 31% |
| France | 14,231 | 8,510 | 5.28 | 2.75 | 45% | −19% |
| Spain | 14,807 | 3,900 | 5.34 | 1.16 | −12% | −47% |
| Italy | 4,180 | 13,109 | 1.49 | 3.67 | 119% | 314% |
| United Kingdom | 7,454 | 7,349 | 2.6 | 2.34 | 30% | 6% |
| Belgium | 4,605 | 8,257 | 1.75 | 2.68 | 326% | 78% |
| Switzerland | 1,569 | 11,103 | 0.54 | 3.77 | 18% | 147% |
| Russia | 3,895 | 8,664 | 1.38 | 2.94 | 27% | 63% |
| Sweden | 8,557 | 3,238 | 3 | 1.04 | 116% | 116% |

**Up & Coming Recipients**

| | Total Investment (in millions) | | LQ (world average = 1) | | Growth (average annual) | |
|---|---|---|---|---|---|---|
| Country | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 | 2003–2006 | 2007–2010 |
| Netherlands | 2,937 | 1,930 | 0.94 | 0.64 | −59% | 33% |
| Portugal | 3,045 | 1,799 | 1.20 | 0.60 | −15% | 94% |
| Egypt | 458 | 2,499 | 0.18 | 0.74 | −9% | 1256% |
| Algeria | 822 | 1,900 | 0.29 | 0.69 | −61% | 85% |
| South Africa | 303 | 1,903 | 0.12 | 0.7 | 4% | 589% |
| Bulgaria | 389 | 1,009 | 0.15 | 0.32 | 33% | 445% |
| Uzbekistan | 21 | 1,320 | 0.01 | 0.45 | 33% | 400% |
| Turkey | 388 | 891 | 0.15 | 0.34 | 0% | 185% |



# Conclusion

As we emerge from a period of notable turbulence in the drug and pharmaceuticals sector, investment patterns would seem to illustrate how companies are now thinking about their global operating configuration and where new investments are likely to be made.

Asia is clearly an area of focus, particularly India and China. The scale and breadth of investment over the last decade in India and China suggests companies are looking to these countries as both revenue and margin opportunities, and as a destination for both manufacturing and R&D activities. Both have gained notable ground on the legacy Western European and North American locations over the last decade. Singapore is also a success story in Asia because of its targeted incentives and infrastructure development. The data also suggest that while companies are testing the value propositions of other countries in the region, only Malaysia, South Korea and Taiwan have emerged as locations of interest to the industry.

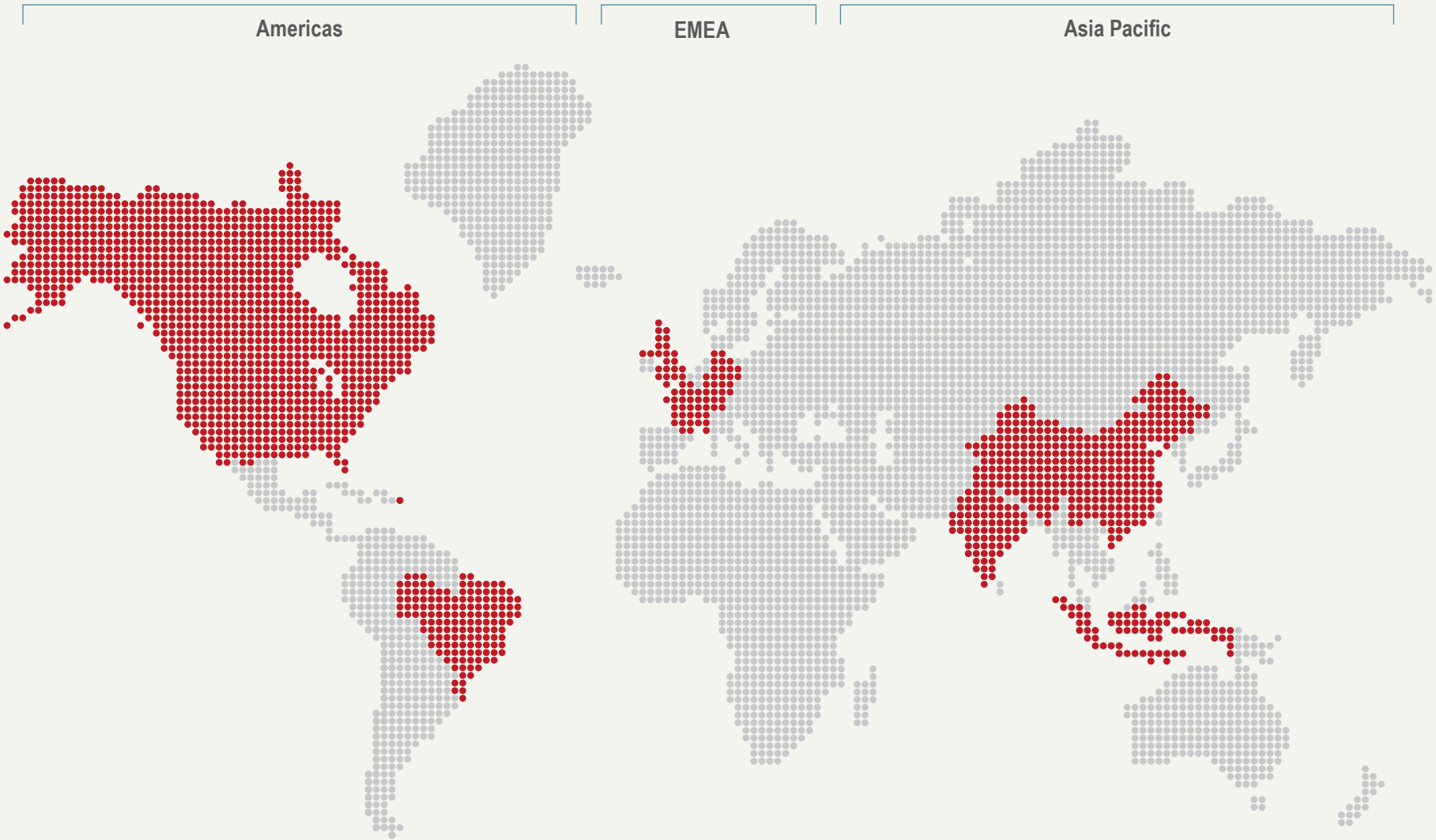
In the Americas, the United States is likely to continue to attract investment capital. Canada is emerging as a R&D location and Brazil for manufacturing. The data also suggests that Puerto Rico, the second largest investment destination in the region, struggles to retain a viable value proposition to companies with incentives that have, or are about to, end. Outside of these countries, only Mexico, Argentina, Colombia and Peru are being tested as platforms for either manufacturing or R&D, but all are far behind the others in investment activity.

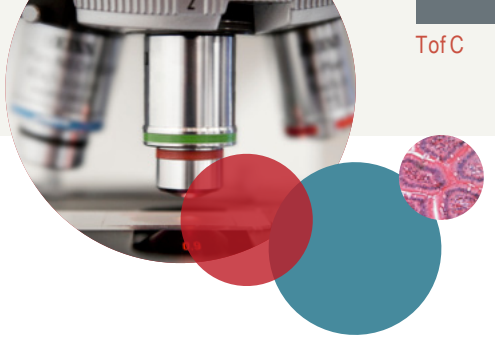
A number of the higher cost locations in EMEA are starting to see the balance of investment shift away from manufacturing to R&D. The United Kingdom is clearly such a location. France, Belgium and Sweden would also appear to be heading in this direction. The data also suggests that a broad number of European locations will continue see healthy levels of inward investment. Investment levels in the Middle East and Africa are however, nominal compared with Europe, and the data suggest the industry has not yet turned to either region as a platform for operating margin improvement or revenue growth.

***The scale and breadth of investment over the last decade in India and China suggests companies are looking to these countries as both revenue and margin opportunities, and as a destination for both manufacturing and R&D activities.***

# Global clusters

*A review of established and emerging clusters within the three global regions of the Americas, EMEA and Asia Pacific.*



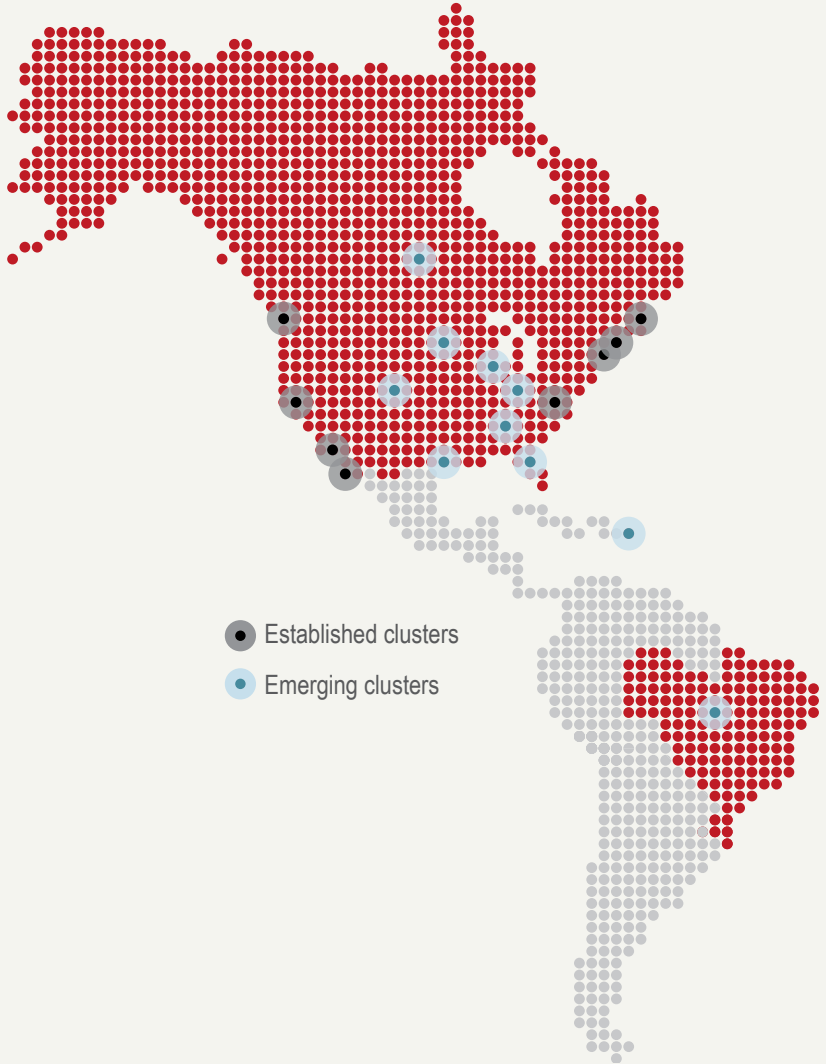


# Americas

***In this section we will review established and emerging clusters within the United States, Canada and Latin America.***

Within the United States, life science-focused clusters are at various stages in their evolution. While coastal hubs in the Northeast and California represent cornerstone locales and will forever play an important role as the headquarters cities for many of the industry's largest players, other markets are steadily emerging as locations of interest.

Canadian submarkets largely mirror those of emerging clusters within the United States due to comparable tenants, types of facilities and product types, while clusters in Latin America are more geared towards agricultural biotech and pharmaceutical manufacturing.




**United States**

| Established | Emerging |
|---|---|
| Bay Area | Atlanta |
| Boston | Chicago |
| Los Angeles | Denver |
| New York/New Jersey | Florida |
| Philadelphia | Houston |
| Raleigh-Durham | Indianapolis |
| San Diego | Minneapolis |
| Seattle | |
| Washington DC/Suburban MD | |

**Emerging**

**Canada**

**Brazil**

**Puerto Rico**

# Cluster methodology

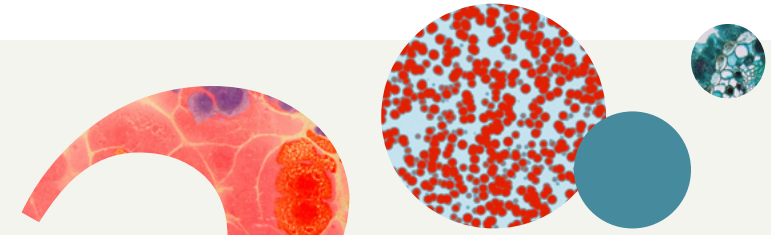
The determination of United States life science clusters as "established" or "emerging" was formed through an analysis of both quantitative and qualitative data. Data points reflecting key components of cluster development were gathered for each of the 16 clusters. Results were ranked with a score of "1" being most favorable to the industry and a score of "16" being least favorable. Each cluster's scores for the six data points were amalgamated to form a composite score. These scores were ranked and taken into consideration along with market intelligence to determine categorization.

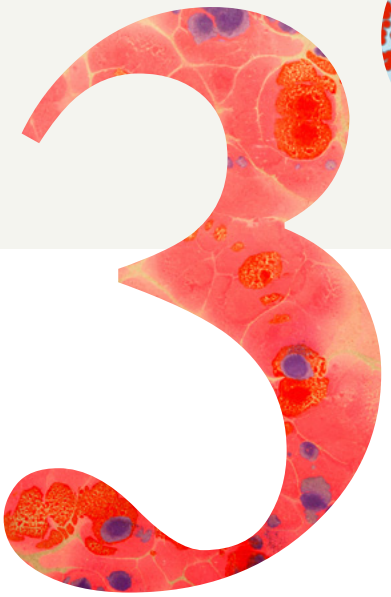
| | High tech research & hospital / medical employment (as percent of total employment)[1] | | Science & engineering graduate students (per 1,000 individuals aged 25-34)[2] | | NIH funding[3] | | Venture capital funding[4] | | R&D spend as % of GDP[5] | | Academic and research institute facilities (in thousands of SF)[6] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cluster | % | Score | # | Score | $ | Score | $ | Score | % | Score | SF | Score | Composite score | Ranking |
| Boston | 16.2% | 1 | 28.7 | 1 | $2,235,904,192 | 1 | $1,142,101,500 | 2 | 7.0% | 1 | 5,997 | 1 | 7 | 1 |
| New York / New Jersey | 13.2% | 5 | 15.0[7] | 4 | $1,639,384,464 | 2 | $306,152,900 | 4 | 4.2%[8] | 7 | 5,965 | 2 | 24 | 2 |
| Bay Area | 13.5% | 4 | 12.9 | 8 | $1,234,346,373 | 3 | $1,825,487,700 | 1 | 4.3% | 4 | 4,120 | 5 | 25 | 3 |
| Los Angeles | 11.6% | 13 | 12.9 | 8 | $1,001,160,022 | 5 | $250,165,900 | 6 | 4.3% | 4 | 4,000 | 6 | 42 | 4 |
| Washington DC / Suburban MD | 11.7% | 12 | 15.8 | 3 | $1,011,379,315 | 4 | $172,822,000 | 11 | 5.0%[9] | 2 | 3,307 | 10 | 42 | 5 |
| Philadelphia | 14.8% | 2 | 14.2 | 6 | $785,214,411 | 9 | $266,927,700 | 5 | 2.5% | 10 | 2,953 | 12 | 44 | 6 |
| San Diego | 11.9% | 11 | 12.9 | 8 | $823,714,571 | 6 | $560,717,300 | 3 | 4.3% | 4 | 2,821 | 14 | 46 | 7 |
| Minneapolis | 13.6% | 3 | 18.6 | 2 | $289,110,813 | 15 | $131,354,100 | 12 | 3.0% | 8 | 3,530 | 9 | 49 | 8 |
| Raleigh-Durham | 12.9% | 7 | 10.8 | 12 | $806,677,028 | 7 | $198,596,500 | 9 | 2.4% | 11 | 4,299 | 4 | 50 | 9 |
| Seattle | 12.5% | 8 | 7.1 | 16 | $805,613,160 | 8 | $201,399,800 | 8 | 4.9% | 3 | 3,668 | 8 | 51 | 10 |
| Chicago | 12.3% | 9 | 14.3 | 5 | $633,240,757 | 10 | $175,537,400 | 10 | 2.3% | 13 | 3,246 | 11 | 58 | 11 |
| Denver | 11.6% | 13 | 13.4 | 7 | $305,872,896 | 14 | $76,727,900 | 13 | 2.9% | 9 | 1,664 | 15 | 71 | 12 |
| Houston | 10.2% | 15 | 10.0 | 13 | $509,192,059 | 11 | $218,318,000 | 7 | 1.6% | 14 | 2,920 | 13 | 73 | 13 |
| Florida | 12.1% | 10 | 9.1 | 14 | $356,630,211 | 12 | $15,225,100 | 15 | 1.0% | 16 | 3,779 | 7 | 74 | 14 |
| Atlanta | 9.8% | 16 | 8.3 | 15 | $343,352,066 | 13 | $71,225,000 | 14 | 1.1% | 15 | 4,474 | 3 | 76 | 15 |
| Indianapolis | 13.0% | 6 | 11.5 | 11 | $126,527,940 | 16 | $4,356,000 | 16 | 2.4% | 11 | 1,353 | 16 | 76 | 16 |

**Footnotes:**

1. DemographicsNow/Business-Industry Report, by select Metro CBSAs, 2010
2. National Science Foundation/Division of Science Resources Statistics/SEI State Data Tool, 2011
3. National Institute of Health/Awards by Location, by select congressional districts, FY 2010
4. PricewaterhouseCoopers/MoneyTree Report, Biotechnology & Medical Devices and Equipment Industry Reports, 2010
5. National Science Foundation/Division of Science Resources Statistics, Survey of State R&D Expenditures, FY 2007
6. National Science Foundation/Division of Science Resources Statistics, Survey of Science and Engineering Research Facilities, FY 2009
7. Average of NJ (18.2) and NY (11.3)
8. Utilized NJ R&D % as most of this type of activity done in the state of New Jersey
9. Weighted average of MD (5.34%) and DC (4.17%)

# Bay Area





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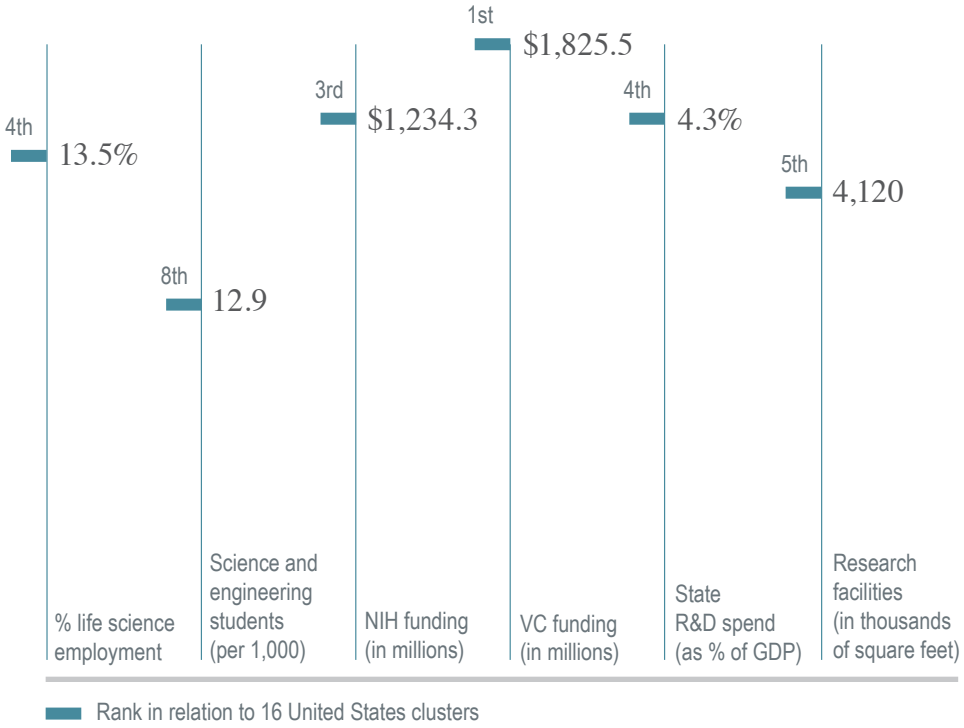
Overall rank based on quantitative data, among 16 United States clusters.




***Proximate to several world-renowned university research institutions and an impressive roster of tenants, the San Francisco Bay Area continues to reign as one of the premier locales for biotech and other life sciences companies.***

## *Overview*

The Bay Area cluster is made up of the three submarkets of San Francisco's Mission Bay/China Bain, South San Francisco and East Bay.

During the last decade, San Francisco's Mission Bay/China Basin submarket has undergone a significant transformation as one of the city's highest priority redevelopment areas. With the University of California at San Francisco anchoring the submarket with a world-renowned research facility and planned hospital, the area quickly generated demand among biotech and pharmaceutical companies. In 2010, Alexandria Real Estate

# Bay Area

Equities opened the doors to its most recent development, 455 Mission Bay Boulevard in San Francisco, and welcomed Nektar Therapeutics and Bayer Pharmaceuticals to San Francisco. They occupy 105,000 and 50,000 square feet, respectively. In 2011, Alexandria purchased 409–499 Illinois, a two-building life sciences asset 50 percent occupied by Fibrogen.

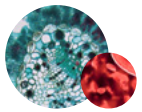
South San Francisco contains the highest concentration of life sciences companies in San Mateo Country and brightest talent pool in Northern California. The restoration of venture capital confidence has resulted in increased demand for space and expansion, spurring some hiring. The life sciences industry in South San Francisco remained resilient throughout 2010 despite heavy losses in employment in the tech industry, and was able to bounce back by the beginning of 2011. Top companies in South San Francisco include Amgen, Elan, Onyx Pharmaceuticals, Takeda Pharmaceuticals, among others. Swiss drug maker Genentech alone currently occupies approximately 5 million square feet in the area. Although there was much speculation as to the state of the South San Francisco submarket when the company was acquired by Roche in 2008, Genentech has expanded through recent construction of a new office building on their campus.

The East Bay's life sciences market is generally clustered in Richmond, Fremont, Newark, Berkeley, and Emeryville, and contains approximately 4.6 million square feet of inventory within office, flex and lab space. In 2009, Bayer's efforts to enlarge the Oakland Enterprise Zone to include Berkeley and Emeryville were paramount to retaining life sciences companies in the region, and should foster future growth in the industry. Significant life science companies include Abgenix, Novartis, Bayer HealthCare, and WaferGen Biosystems.

## *Industry framework*

**Intellectual capacity**

San Francisco's location, impressive business center and world renowned cultural attractions make the city one of the most attractive places to live in the United States. Both the Mid-Peninsula and Silicon Valley have been at the forefront of innovation and advancement in technology, attracting talent from all around the world. Major corporations such as Genentech continually support academic programs at local universities through grants, scholarships, and internship programs. Specific areas within Palo Alto are dedicated solely to research and development companies to encourage students to work locally once they graduate. The East Bay shares this talent pool, and University of California at Berkeley similarly draws students from around the world to its biology and chemistry programs.



*South San Francisco contains the highest concentration of life sciences companies in San Mateo Country and brightest talent pool in Northern California. The restoration of venture capital confidence has resulted in increased demand for space and expansion, spurring some hiring.*

# Bay Area

*Looking ahead, San Francisco can expect the transformation of Mission Bay to be one of its greatest success stories.*

**Innovation capital**
For more than 30 years, the University of California at San Francisco (UCSF), Stanford University, and the University of California (UC) at Berkeley have actively partnered with health-care, biotechnology, and pharmaceuticals experts to develop some of the most cutting-edge advances in medicine. Several large centers of excellence are hosted by the area universities, such as UC Berkeley's Cancer Research Laboratory and Stanford's Genome Technology Center.

**Fiscal & political resources**
In 1998, the City of San Francisco adopted the Mission Bay Redevelopment plan in an effort to transform the former rail and shipyard into a world class neighborhood and business center. With the development of UCSF's research campus in 2003, Mission Bay/China Basin became a highly coveted market for the biotech and pharmaceutical sectors, attracting tenants and developers to the area. In addition to UCSF, Alexandria Real Estate Equities, a premier life sciences developer, has made significant investments in the area.

The Oakland Enterprise Zone was developed by the California State Legislature in 1993 to stimulate business growth in the East Bay. Businesses located within the zone, which includes Berkeley and Emeryville, are entitled to a variety of tax incentives that promote hiring. Bayer is one of the largest biotech companies located within this enterprise zone and was a major force in expanding the zone in 2009, a move that ensured the retention of thousands of biotech jobs in the region.

San Francisco's Mission Bay community is today at the center of the biotechnology revolution. To support expansion of this flourishing industry and the creation of new jobs, the City of San Francisco offers a payroll tax exclusion for up to 7.5 years to San Francisco-based businesses engaged in biotechnology pursuits.

## *Outlook*

Recent transactions in the Mission Bay/China basin submarket that include new tenants, and the future development plans of UCSF and Salesforce.com, have provided a renewed surge of excitement for the area. Looking ahead, San Francisco can expect the transformation of Mission Bay to be one of its greatest success stories.

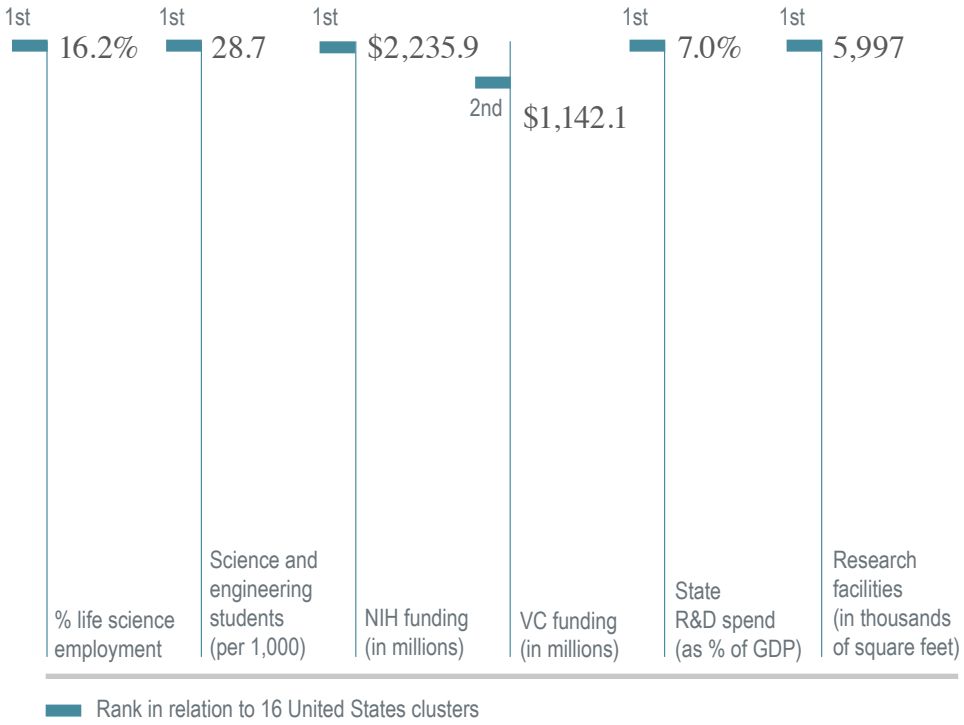
In the Mid-Peninsula, given the moderate leasing activity within the life sciences sector, new development has remained at standstill since 2008. Alexandria continues to be one of the major players in life science product with proposed development of 800,000 square feet in the South San Francisco submarket. In total, there are 6.4 million square feet of speculative space. However, without any genuine interest from a major company looking for at least 250,000 square feet, no progress is expected.

The future of the East Bay life science industry looks bright. The Lawrence Livermore National Laboratory, run by UC Berkeley, wants to expand in the East Bay by 45 acres and has narrowed the search to six sites. One of the sites, a former naval base in Alameda, is offered for free, indicative of the community's desire to foster life sciences research and development growth.

# Boston

1

Overall rank based on quantitative data, among 16 United States clusters.




***The Greater Boston area is home to major academic institutions and centers of life sciences excellence, all located within minutes of each other to create a global hub.***

## *Overview*

The Greater Boston area is a leading global industry cluster that supports all aspects of the life sciences industry including biotechnology, pharmaceuticals, medical devices, diagnostics and bioinformatics. Because of the industry's mature critical mass in the area, new companies and venture capital investments are common.

The cluster has a large life sciences industry focus and includes geographic submarkets that are both established and emerging. The Cambridge submarket is the core of the Massachusetts life sciences industry. Many start-ups begin here and grow until they are acquired or relocate as they outgrow space options.

# Boston

Others, however, choose to keep their headquarters and maintain operations in Cambridge as they see the value of co-locating with many other life science companies and prominent academic and research institutions. The most current and prominent example of this is Biogen IDEC's plans to relocate its headquarters back to Cambridge after only a short period in the suburban submarket of Weston. The company plans to occupy two new buildings in East Cambridge, totaling more than 497,000 square feet of office and lab space. Biogen's return will kick-start the development of top-class lab space in the Cambridge area. Biogen leaves the Route 128 submarket, which is home to notable life science tenants such as Genzyme, AstraZeneca, and UMass Medical Center. Despite Biogen's departure, the area will remain relatively stable with a new generation of companies available to backfill varying space options.

More emerging submarkets exist in Boston and Northwest of the city. Boston's Longwood Medical Area is hot spot for life sciences research organizations, and is home to renowned institutions such as Harvard Medical School, Brigham & Women's Hospital, Dana-Farber Cancer Institute, and Merck. The South Boston Waterfront, or Fan Pier, is a more recent development and is beginning to attract life sciences institutions. This year, Vertex Pharmaceuticals announced that it will relocate from Cambridge into 1.1 million square feet of office and lab space at the Fan Pier development. This is the largest private development project in Boston's history. As Vertex expands in Boston, other tenants are looking to the suburbs for more economic options. Many life science tenants seek space in the Northwest submarket in such towns as Lexington and Bedford. The Massachusetts Biotechnology Council rates these towns as Platinum BioReady Communities; in other words, these areas are highly supportive of the biotech industry due to expedited permitting and zoning polices. Notable tenants here include Millipore and Shire.

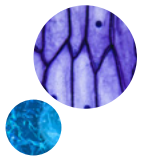
## *Industry framework*

**Intellectual capacity**

Because the industry is mature in Massachusetts, the labor pool is diverse and no longer merely consolidated to the twenty-somethings living in downtown Cambridge. The Boston MSA features more than 85,000 high tech research employees and more than 340,000 hospital and medical employees with job growth that continues to trend upwards and outpace other life sciences clusters. The area enjoys seven times the number of workers in biotech R&D than the national average.

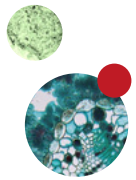
**Innovation capital**

Massachusetts receives 13 percent of all National Institutes of Health (NIH) funding and historically has trailed only California (the location of three of the country's largest life sciences clusters) as a recipient. Massachusetts is home to five of the top eight NIH-funded hospitals in the United States, and includes Massachusetts General Hospital, Brigham & Women's Hospital, Dana-Farber Cancer Institute, Beth Israel Hospital, and Children's Hospital, each global leaders in biotechnology research. The top five NIH-funded universities (Harvard, University of Massachusetts, Boston University, MIT, and Tufts) anchor this cluster and offer advanced degrees in biosciences, fuel employment in the industry, and add great depth to the development of innovative products.



***The Cambridge submarket is the core of the Massachusetts life sciences industry. Many start-ups begin here and grow until they are acquired or relocate as they outgrow space options.***

# Boston



*The area's life sciences sector is well positioned in comparison to its peers. It will continue to fuel employment and attract both companies and investors to the area.*

**Fiscal & political resources**

The State of Massachusetts provides significant tax incentives and other offerings to support the growth of the life sciences industry. The Massachusetts Life Sciences Center (MLSC) is an agency of the Commonwealth of Massachusetts and was designed to administer the state's 10-year, $1 billion life science initiative to support the life sciences cluster through job growth, economic development, and commercialization of treatments and cures.

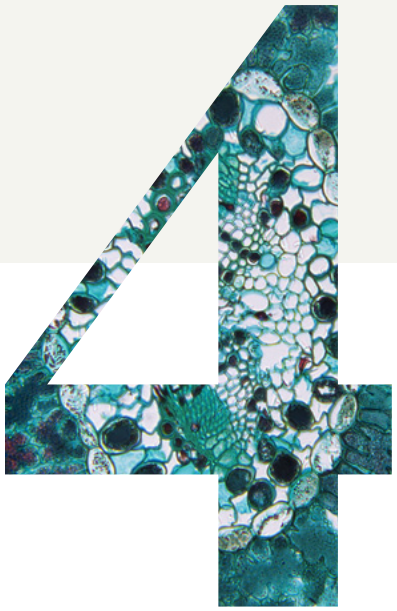
The initiative includes the following programs:

- Life Sciences Center Research Matching Grant Program: Matches funding for academic institutions
- Internship Challenge Program: Funds interns working at life science companies
- Accelerator Program: Provides capital for early-stage biotech companies
- SBMG Program: Matches funds for federal small business grants
- Tax Incentive Program: Creates incentives for companies to locate and expand in Massachusetts Corporate Consortium Program/Works to attract funds from both the private and non-profit sectors

## *Outlook*

The area's life sciences sector is well positioned in comparison to its peers. It will continue to fuel employment and attract both companies and investors to the area. As the market continues to tighten, there will be additional demand for top-grade laboratory space. As the rents increase in Cambridge, price-conscious life sciences tenants may look to South Boston or the suburbs for more economic options. However, in all areas, developers and owners stress the importance of flexibility of space. As the sociology of drug discovery continues to change, so does the need to design laboratory space to reflect and support collaboration and access to information. This emerging trend will strongly affect the way developers build space or rehab second-generation facilities in Cambridge, Boston, and suburbs.

# Los Angeles



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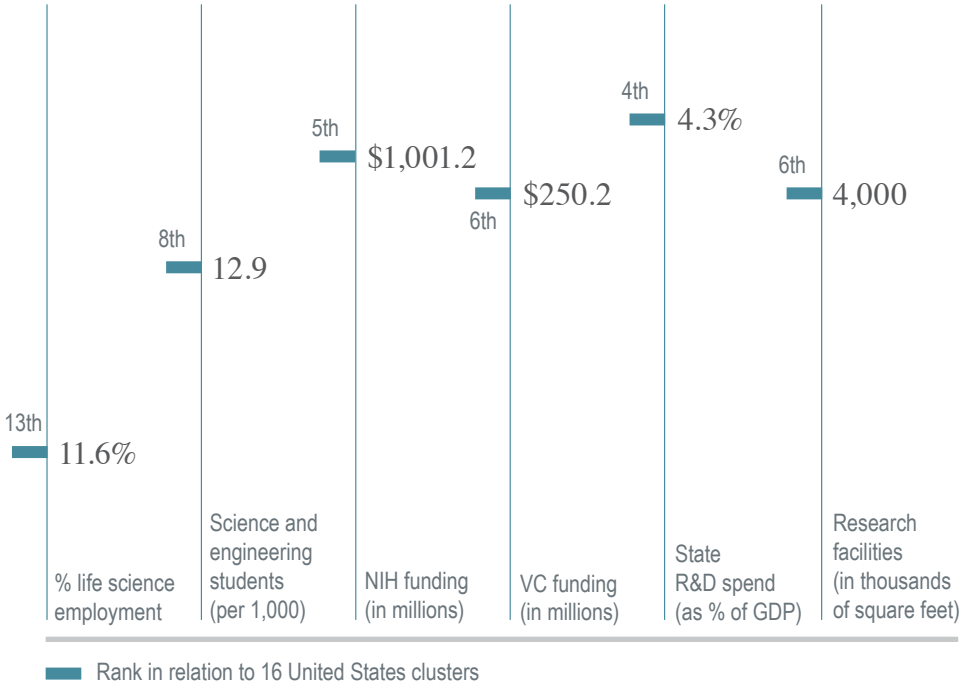



***The region's vast number of hospitals, universities and research facilities and its large college-educated population should help propel Los Angeles' growing biotechnology sector to complement its mature medical device presence.***

## *Overview*

The Los Angeles life sciences market covers approximately six million square feet spread across Los Angeles, Ventura and Orange Counties. Leasing activity among all three neighboring counties tends to be driven by smaller requirements in the private sector, typically from start-ups which have outgrown their initial premises. Public university research institutes have also driven space demand through late 2011 and represent larger requirements than the private sector.

# Los Angeles

Within Los Angles County, industry clusters can be grouped into five major submarkets: West Los Angeles, South Bay, Los Angeles North, San Gabriel Valley, and the Santa Clarita Valley. Each submarket varies significantly based on the composition of university and research facilities and life sciences companies operating in these submarkets. The five major submarkets are comprised of a variety of industry players in the medical device and biotechnology sectors, including Medtronic and Abraxis Bioscience, a subsidiary of Celgene.

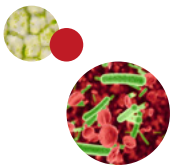
Two of the region's leading biotechnology companies are located in close proximity to each other in Ventura County. Amgen, headquartered in Thousand Oaks, operates from a sprawling, six-million-square-foot campus, and neighbor Baxter International operates facilities in Thousand Oaks, nearby Westlake Village, and other sites in Irvine and Los Angeles.

Within Orange County, several large pharmaceutical and medical device/technology companies are spread throughout the region including Allergan, Beckman Coulter, Peregrine Pharmaceuticals, Edward Life Sciences and Advanced Medical Optics.

## *Industry framework*

**Intellectual capacity**

Bolstered by world-class academic institutions and research facilities, Los Angeles maintains a highly educated workforce, often attracting global talent to the area. The region is home to some of the nation's top schools, including the University of California, Los Angeles (UCLA) and University of Southern California's schools of medicine, as well as several nationally recognized universities offering life sciences doctoral programs. Los Angeles has more than 45 health and biomedical sciences associations, education and research institutions. Nearly 7,000 professionals in the greater Los Angeles area work in life sciences related fields.



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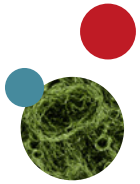
# Los Angeles



*Near-term lab space demands are expected to be sparse and come largely from large universities and research centers.*

**Innovation capital**
The area's three leading universities—UCLA, University of Southern California and UC Irvine—feature centers of excellence that deliver cutting-edge research and innovations.

UCLA is home to the David Geffen School of Medicine, which consistently ranks among the top 10 schools in the United States, along with its School of Nursing, School of Dentistry, and School of Public Health. The University of Southern California's Health Sciences campus is a major center for basic and clinical biomedical research; the USC Keck School of Medicine annually receives more than $275 million sponsored program awards. UC Irvine's Medical Center continues to be ranked as one of the top hospitals in the nation and spends nearly $60 million annually to fund ground-breaking research in the areas of neurodegenerative diseases, cancer and stem cell therapy.

**Fiscal & political resources**
The area is largely supported by the efforts and programs of the Southern California Biomedical Council, which helps to create public-private partnerships to tackle industry needs in the areas of capital-sourcing, public policy advocacy and links to nearby university and research centers.

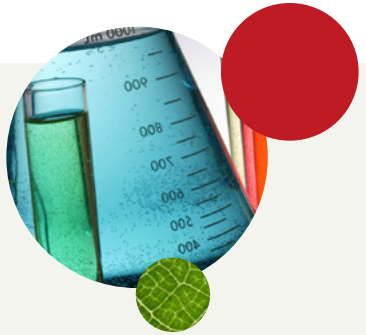
The Stem-Cell Bond Initiative, passed in 2004, provides research grants to California universities. The initiative authorized the sale of general obligation bonds to allocate $3 billion over a period of 10 years to stem cell research and research facilities.

Within Ventura County, the Economic Development Collaborative, with funding provided by the U.S. Economic Development Administration, created a new Business Loan Fund for entities located within the county. Companies in the county's six identified core growth business clusters (agriculture, high technology/communications, biomedical, plastics, environmental, and metals/machinery) that can demonstrate a need to hire a high percentage of dislocated defense-related workers may apply for a loan.

## Outlook

State government deficits may impact future public research funding in California, but no major existing programs had been reduced as of the 2011 fourth quarter. Near-term lab space demands are expected to be sparse and come largely from large universities and research centers. The development pipeline is extremely light with no large projects expected to be completed through late 2012.

# New York / New Jersey



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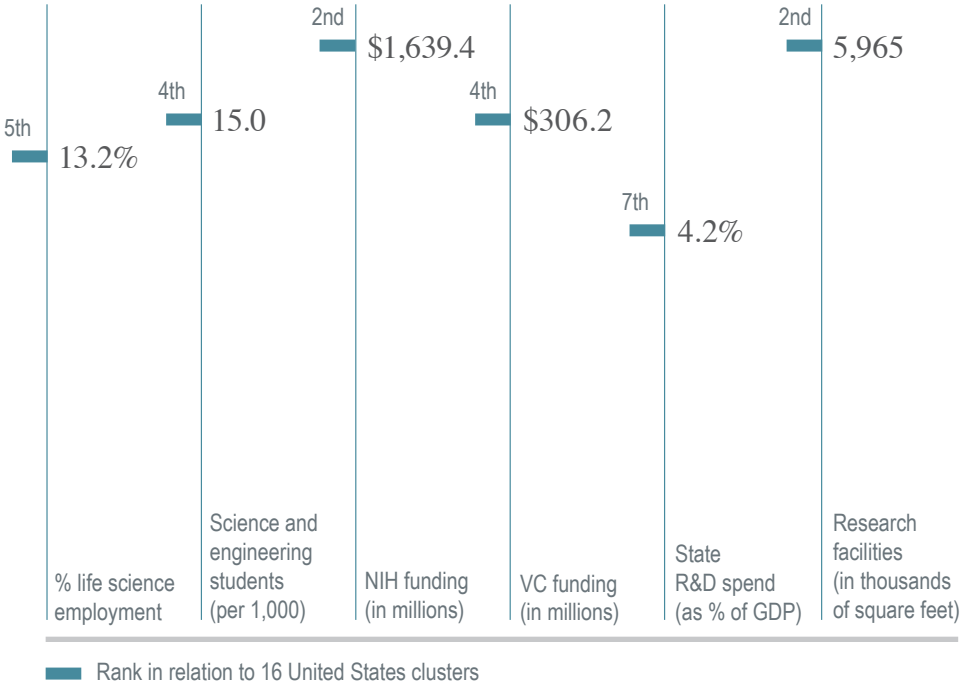
Overall rank based on quantitative data, among 16 United States clusters.




***The New York/New Jersey area boasts the highest concentration of college graduates in the nation and the world's largest concentration of academic institutions—a source of significant discovery and the first adopters of new products.***

## *Overview*

The New York/New Jersey life sciences market consists of the five boroughs of New York City, Westchester county and Northern and Central New Jersey.

In New Jersey, the life sciences sector is a major driving factor in the state's economy with many of the pharma-giants owning or leasing large amounts of space in the state. Some of the well-known names include; Pfizer, Merck, Johnson & Johnson, Imclone, Bayer, Celgene, and Novo Nordisk. Much of the related leasing activity in recent years has occurred within Somerset, Morris, and Mercer counties, including seven leases

# New York/New Jersey

in excess of 100,000 square feet since the start of 2010. Most recently, Novo Nordisk leased the entire building at 800 Scudders Mill Road in Plainsboro. The company will occupy the building in 2013 upon completion of the $215 million redevelopment of the 770,000-square-foot office building in the Princeton Forrestal Center, initially leasing 500,000 square feet with the option to take the remaining space at any time. Novo Nordisk's initial lease at the new address will expand its presence in the Princeton submarket by 150,000 square feet and marks the largest expansion by a pharmaceutical company in the Garden State in recent years. Year-to-date, pharmaceutical companies have accounted for almost one third of New Jersey's office leasing activity. However most larger leases have consisted of companies renewing in place or consolidating due to mergers and acquisitions.

Meanwhile, in New York City, Pfizer recently disposed of more than 660,000 square feet of its space at 685 Third Avenue. They sold the property to TIAA-CREF last year for $190 million as they cut or relocated more than 1,000 jobs. While New York City and Westchester don't house as many life sciences firms as New Jersey, there are some noteworthy tenants who call the area home, including Pfizer, Progenics, Regeneron Pharmaceuticals, and Bristol Myers Squibb.

Within Westchester County, two major construction projects were underway in the 2011 fourth quarter. New York Medical College began a $12.6 million redevelopment project of a vacant building into a biotechnology center, which could create as many as 215 jobs. Fareri Associates plans to build a $500 million, two-million-square-foot park for biotech and medical tenants and a children's health education center adjacent to the New York Medical College project.

## *Industry framework*

**Intellectual capacity**

The New York/New Jersey cluster supports almost 400,000 jobs in the life sciences industry with over 95,000 workers directly employed in high tech applications. Life sciences companies have an abundance of highly educated workers to choose from. The area has a large concentration of colleges and universities, many of which offer undergraduate and post-graduate programs in a variety of life sciences-related fields.

**Innovation capital**

There are numerous centers of excellence located within New York and New Jersey, such as the Cancer Institute of New Jersey and Montefiore Medical Center in New York City. The centers support high technology ventures through a collaborative approach among the states, academia, private venture capital companies, and other private and public sector parties. Established to encourage rapid commercialization of scientific breakthroughs, the centers specialize in nanoelectronics, bioinformatics, photonics, environmental systems, wireless applications and information technology.

In New York City, the city's first major bioscience office park, The Alexandria Center for Life Science, was completed in 2010 and provides laboratory and office space for companies such as Imclone, Abbott Laboratories, Novartis, and Celgene.

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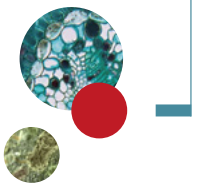
# New York/New Jersey



**Fiscal & political resources**

New York and New Jersey have worked aggressively to retain and lure large biotechnology and life sciences industry leaders to the area.

### New Jersey

- The Edison Innovation Centers of Excellence Federal Matching Program: Seeks to build research excellence at New Jersey's universities and research institutions to benefit the technology economy. Funds will be provided to match federal grants for research centers of excellence in the state's priority technology areas.
- The Technology Business Tax Certificate Transfer Program: Enables approved, unprofitable technology and biotechnology businesses to sell their unused Net Operating Loss Carryover (NOL) and unused Research and Development Tax Credits (R&D Tax Credits) to unaffiliated, profitable corporate taxpayers in the State of New Jersey for at least 80 percent of the value of the tax benefits.

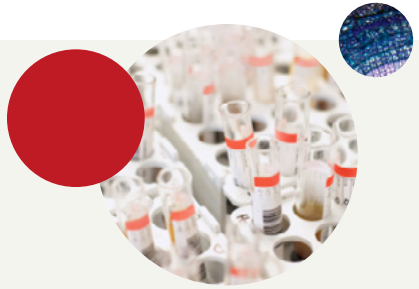
### New York

- New York State Qualified Emerging Technology Company Credit (QETC): Provides early-stage technology companies, including biotechnology, with a capital infusion of up to $1 million.
- Empire Zone Program: Provides New York State tax credits and tax exemptions to manufacturing and biotech companies located in an Empire Zone. Recipients must have growing employment and invest in real estate and equipment. New York City's primary biotech real estate, the East River Science Park (ERSP) and the Brooklyn Army Terminal (BAT), are located within the Empire Zones.
- New York City Biotech Tax Credit: Helps small biotech companies to accelerate commercialization by providing a refundable tax credit for facilities, operations, and training.
- Hudson Valley Economic Development Corporation & Westchester County Economic Development's NY BioHud Valley Campaign: Encourage investment and development in pharmaceutical and biotechnology projects since their inception in 2010. Recent efforts to expand and enhance Westchester's life sciences market range from intellectual development endeavors to leasing activity and construction projects.

## Outlook

The immediate future for the life sciences industry is bright in the New York/New Jersey area with only a handful of tenants' leases expiring within the next couple of years. Many of the large pharmaceutical companies that have been looking for new addresses will remain in the local area. With the majority of the consolidations now passed, and the economy slowly growing, some companies should begin to add jobs into 2013.

# Philadelphia



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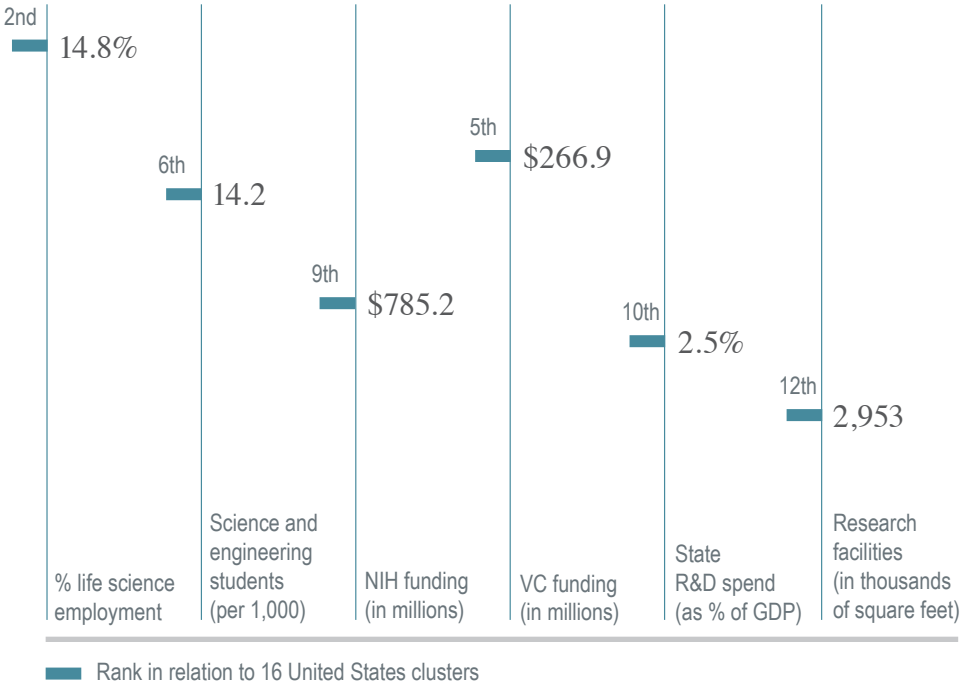



***The region's vast array of leading universities and research institutes have led to a collaborative environment and nearly $4 billion of venture capital funding during the last 10 years.***

## *Overview*

Philadelphia's large concentration of leading academic institutions and pharmaceutical companies has created a central life sciences hub in the Mid-Atlantic region. With close proximity to New York's financial markets and Washington D.C., the Philadelphia metropolitan Area is home to more than 1,200 companies, ranging from the industry's largest multinational companies, including AmerisourceBergen, AstraZeneca and Shire Pharmaceuticals, to the fastest growing firms such as Cephalon, NuPathe and Tengion.

Philadelphia's laboratory market has both an urban and suburban presence. Located due west of the Central Business

# Philadelphia

District, University City plays host to The Science Center, one of the largest urban research parks in the United States. The Science Center is strategically located proximate to several major universities and research institutions including The Children's Hospital of Philadelphia, Drexel University, the University of Pennsylvania, University of the Sciences in Philadelphia and The Wistar Institute. Serving as an incubator for many of the region's growing companies and research efforts, University City's Science Center has led to more than 40,000 jobs in the region and $64.5 million for the city and state in tax revenue.

The Philadelphia Navy Yard, a 1,200 acre, dynamic waterfront development, offers the Philadelphia region a unique and centrally located environment with more than 115 companies and 8,000 employees. The Navy Yard is a business incubator for both life sciences and technology firms. Since 2005, the Navy Yard has helped more than 100 entrepreneurs, attracted seven start-up technology companies, and advanced major Penn State University research programs and commercialization initiatives.

While lab presence is spread throughout the Pennsylvania suburban markets, the largest concentration is in the suburbs along the Route 202 Corridor that extends from King of Prussia/ Wayne to Malvern/Exton. The area is home to several of the region's largest pharmaceutical firms, including Amerisource-Bergen, Auxilium Pharmaceuticals and Endo Pharmaceuticals, as well as small biotech companies which have opted to co-locate for synergistic purposes. At year-end 2011, Endo Pharmaceuticals and Shire Pharmaceuticals are looking to build-to-suit options for 300,000–500,000 square foot facilities rather than renewing or relocating to second generation lab space, illustrating a current trend in the market.

Large companies have continued to increase their commitment to Philadelphia's life sciences hub. In the first quarter of 2011, GlaxoSmithKline (GSK) announced plans for its $81 million, 205,000-square-foot headquarters in The Navy Yard. As a result, GSK will be leaving the CBD's Market Street West for the build-to-suit project with Liberty Property Trust. Teva announced plans to locate its new distribution center in Northeast Philadelphia, a $300 million dollar project, and West Pharmaceutical Services' is constructing its new headquarters at Eagleview Corporate Center in Exton. The build-to-suit facility will consist of 130,000 square feet of office space and approximately 41,000 square feet of lab space.

## *Industry framework*

**Intellectual capacity**

With 100 colleges and universities and 25 medical schools, Philadelphia's institutions have fed the region's 432,000 jobs and $20.2 billion in earnings within the biotechnology and healthcare sectors, accounting for 26.5 percent of the regional workforce and nearly 15.0 percent of Philadelphia's economic activity, respectively.

Philadelphia hosts some of the nation's largest and oldest academic clusters, including Pennsylvania Hospital, America's first hospital, and the University of Pennsylvania School of Medicine, the country's first medical school and teaching hospital. The nearby presence of Princeton University, Jefferson Medical College, and Temple University further strengthens the area's rich talent pool.

***While lab presence is spread throughout the Pennsylvania suburban markets, the largest concentration is in the suburbs along the Route 202 Corridor that extends from King of Prussia/Wayne to Malvern/Exton.***

# Philadelphia

**Innovation capital**
With grants, university investments and venture capital funding, a number of collaborative efforts between the public and private sectors have driven the development of world-class science innovation centers in the area, such as the Wistar Institute, the Greater Philadelphia Bioinformatics Alliance and the Franhofer USA Center for Molecular Biotechnology.

Established by the state of Pennsylvania to stimulate growth through innovation, Ben Franklin Technology Partners provides risk capital and commercialization products to early stage companies, supporting the development of centers of excellence in the region. As a result of its efforts, companies such as Yaupon Therapeutics and Protez Pharmaceuticals, which was acquired by Novartis for $400 million in 2008, have achieved commercial success.

**Fiscal & political resources**
The Philadelphia region has a robust collection of incentives that attract life sciences companies and promote growth. Emerging companies are drawn by a supportive environment and the myriad of tax incentives, favorable policies and grants.

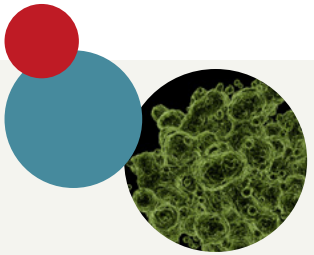
- Keystone Innovation Zones (KIZ): These state-created areas offer tax credits of up to $100,000 to companies based on revenue growth.
- KIZs in Chester County, The Navy Yard, and University City provide services, facilities, or funding to growing life sciences companies.
- University City's KIZ has attracted more than $100 million in venture capital, private equity, and grants for companies through universities and community partnerships.
- Keystone Opportunity Improvement Zones (KOIZ) New, growing businesses located in these regions may receive situation-specific packages of tax reductions, exemptions, abatements, and credits. Additionally, state and local sales and use tax exemptions may apply.
- The Navy Yard KOIZ provides tax savings for companies, typically ranging between $10 and $20 per square foot annually.
- Workforce Development: The Collegiate Consortium for Workforce and Economic Development assists life science businesses with customized workforce training, retention, and skill development programs.
- Industry-Focused Landlords: Large landlords, such as Liberty Property Trust, offer competitive incentive packages to attract life sciences tenants. In collaboration with the PIDC, Liberty attracted Iroko Pharmaceuticals to One Crescent Drive, a LEED Platinum building in its Navy Yard Corporate Center.

## *Outlook*

Recent acquisitions and consolidations by large companies could negatively impact employment and absorption in Philadelphia's leasing market. With Johnson & Johnson's $21.3 billion acquisition of Synthes, Teva's $6.8 billion acquisition of Cephalon, and Stryker's $316 million acquisition of Orthovita, office and flex market vacancies could increase. Continued acquisitions of local companies such as Cubist Pharmaceuticals may additionally bring second generation specialized lab space to the market in 2012. In the CBD, the announcement of GSK's new headquarters will significantly impact Philadelphia's office market in 2013, leaving nearly 825,000 square feet of space.

Despite industry shifts by large life sciences companies, the region's innovation hubs and academic institutions will continue to move the industry forward. With local, growing life sciences companies such as Neuronetics as well as international life sciences consulting firm The Triana Group locating in Philadelphia, the sector will continue to be important to the local economy.

# Raleigh Durham



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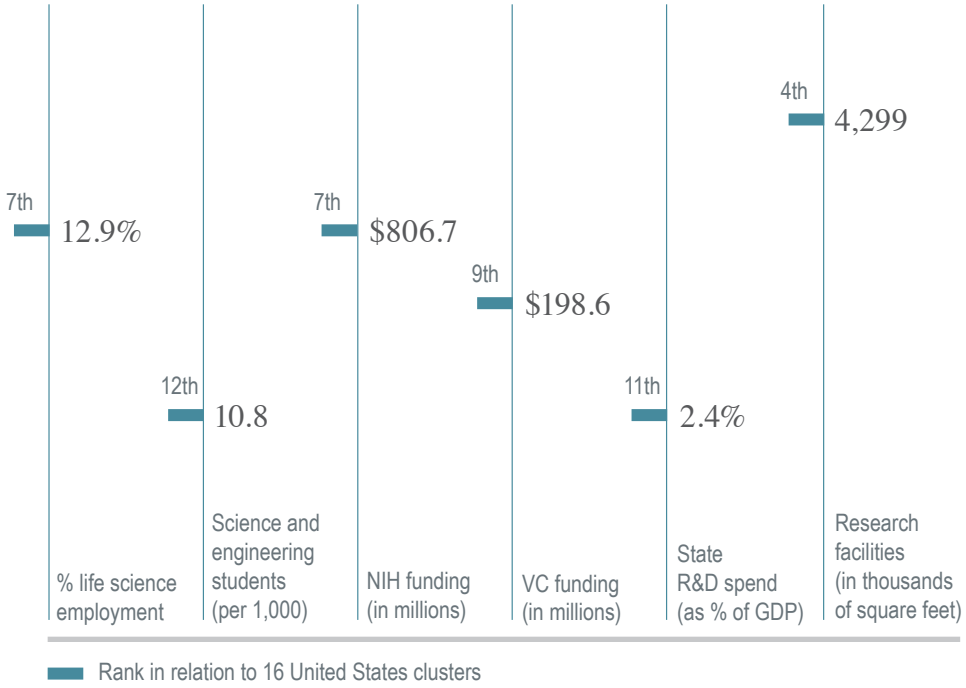
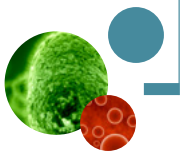



***Home to one of the largest research parks and the nation's highest concentration of contract research organizations, the Raleigh-Durham market has deep and mature innovation capabilities.***

## *Overview*

The Raleigh-Durham life sciences cluster is familiarly called the Research Triangle Region due to the geographic nexus of the area's three leading research institutions — Duke University, North Carolina State University and the University of North Carolina Chapel Hill. Squarely in the center of the region is Research Triangle Park (RTP), a 7,000-acre center of research created by the state to help coalesce R&D talent to the region. The broader area includes 13 counties anchored by the cities of Raleigh, Cary, Durham and Chapel Hill.

# Raleigh Durham



*The Raleigh-Durham life sciences cluster is familiarly called the Research Triangle Region due to the geographic nexus of the area's three leading research institutions—Duke University, North Carolina State University and the University of North Carolina Chapel Hill.*

The Raleigh-Durham life sciences market is fairly inelastic. Very few lab spaces are available for lease, particularly in the range where most users fall, 5,000 to 15,000 square feet. Conversely, several very large R&D facilities remain on the market, such as Wyeth's 108,000-square-foot facility that was vacated in 2010. There is little demand for a contiguous space of that size.

Some of the industry's largest players are situated in the Research Triangle Region and have fueled much of the activity in the marketplace. Merck is adding to its current footprint of roughly 600,000 square feet with a 200,000-square-foot manufacturing facility at its Varicella Bulk Facility. Merck is also building a 42,500-square-foot lab. In May 2011, the Hamner Institutes for Health Science announced plans to add six buildings to its current site in RTP, bringing its total footprint in the park to one million square feet by 2020. Hamner now has a 116,000-square-foot building and plans to begin the project with a 165,000-square foot building estimated to cost $68.2 million.

Alexandria Real Estate announced plans to develop a $13.5 million, 50,000-square-foot ag-tech center in Durham. The campus will feature 18,000 square feet of greenhouse space and is expected to be online by summer 2012.

## *Industry framework*

**Intellectual capacity**

The three research universities offer a variety of biomedical engineering degrees and professional science masters programs. The region is known for its highly educated workforce with more than 53 percent of the workforce holding a bachelor's degree or higher. However the region does fall behind other established clusters when looking at science and engineering graduates only. More than 500 life sciences companies are located in North Carolina, with the greatest concentration occurring within the Raleigh-Durham region.

**Innovation capital**

Home to the nation's largest concentration of contract research organizations (CROs) and more than $2 billion in annual research and development expenditures, the Research Triangle region is a global leader in innovation infrastructure. Research Triangle Park is the area's biggest innovation hub. The park offers five incubators and business accelerators to help support start-up companies. More than half of the park's 170 companies employ fewer than 10 people.

Additional centers of excellence and research facilities are anchored at area universities, such as Duke's Center for Biomolecular and Tissue Engineering (CBTE) and UNC Chapel Hill's Institute for Advanced Materials, Nanoscience, and Technology, among others.

# Raleigh Durham

**Fiscal & political resources**

The Research Triangle Region is home to multiple established organizations and leaders who, with area companies and universities, help move companies towards commercialization. These include:

- The North Carolina Biotechnology Center, a private, non-profit organization dedicated to biotechnology development. Through workforce development, and links among academic, business and civic leaders and funding programs, such as its Center for Innovation (COI) grant, the Biotechnology Center supports the commercialization of innovations.
- North Carolina Biosciences Organization (NCBIO) represents the interests of more than 150 companies in state and federal legislative and regulatory affairs.
- Biofuels Center of North Carolina works to expand production of liquid fuels.
- North Carolina Center for Innovation of Nanobiotechnology and Center of Innovation for Nanobiotechnology (COIN) are not-for-profit organizations that connect public and private resources and increase commercialization of nanobiotechnologies.
- Research Triangle Regional Partnership (RTRP) coordinates economic development for the region.

The state in 2004 created the One North Carolina Fund. It offers financial assistance to recruit and expand business in knowledge-driven industries. Additionally, several locally focused venture capital groups support the industry. These include Calvert BioCapital, Pappas Ventures, Golden Pine Ventures, Hatteras Venture Partners and Intersouth Partners, among others.

## *Outlook*

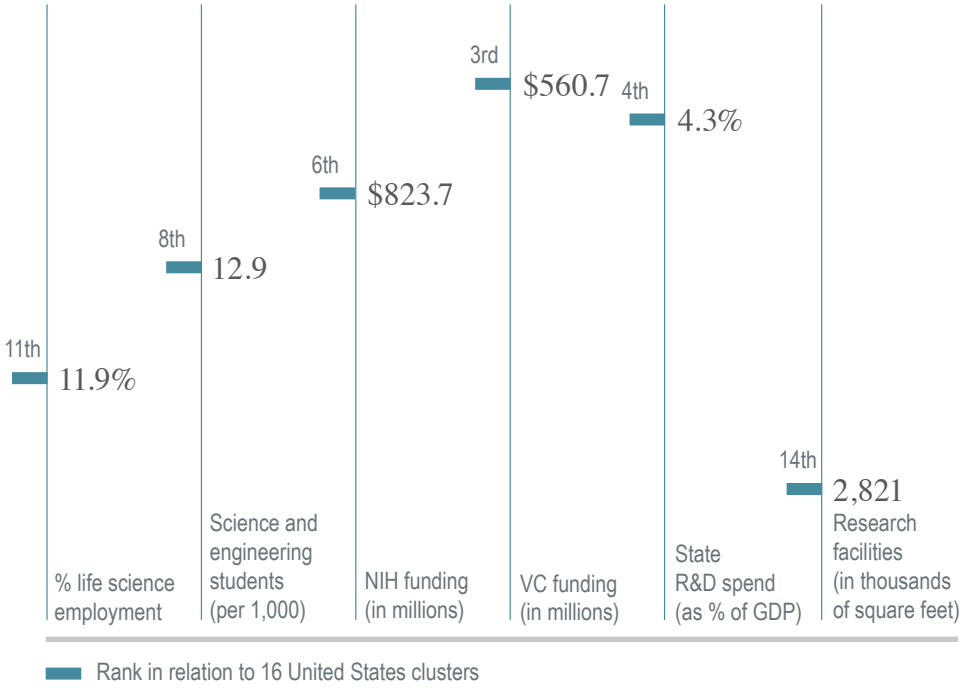
Overall the Research Triangle Region is expected to remain fairly stable during the coming quarters with fluctuations of expansions and contractions among the area's many tenants. The development of the Alexandria's ag-tech campus should bolster that sector. The region is already home to four of the top five ag tech companies including Syngenta, Bayer CropScience, BASF, and Monsanto.

As a mature, established cluster, the Raleigh-Durham area has the necessary infrastructure in place to support the life sciences industry. From a pure numbers standpoint, the region ranks behind other established clusters in the area of science and engineering graduates and R&D capital as a percent of state GDP. However, given the deep rooted presence of top industry companies, a favorable living environment that attracts out-of-state professionals and ample public/private interest groups in the area, the market has more than enough resources to sustain and grow the needs of the industry.

# San Diego

7

Overall rank based on quantitative data, among 16 United States clusters.




## *World-class research institutions and the highest per-capita concentration of holders of Ph.D. degrees define the character of San Diego's life sciences cluster.*

### *Overview*

The San Diego region is one of the largest life sciences clusters in the United States, anchored by prominent non-profit medical research institutions and R&D-oriented private companies such as The Scripps Research Institute, Sanford-Burnham Medical Research Institute, Synthetic Genomics, Pacira Pharmaceuticals and Althea Technologies.

At third quarter 2011, the majority of deals were being inked for spaces below 20,000 square feet, speaking to San Diego's heavy concentration of incubator and start-up companies. The labor markets and availability of capital—indicators that point to the continuance of today's increase in leasing activity—are strong and forecasted to end the year on a positive note.

# San Diego

Rents have bottomed and started to recover in select submarkets and size ranges. This trend is expected to continue into 2012 and beyond as vacancies tighten, thanks in part to a lack of new development.

San Diego's leading life sciences submarket, Torrey Pines, is home to the region's largest concentration of lab space with 5.3 million square feet of lab space. Of this total, more than half — or 2.9 million square feet — is owner-user space owned by Big Pharma and research institutes such as The Scripps Research Institute, the Sanford-Burnham Institute, Pfizer and the Salk Institute.

Torrey Pines has begun to experience a resurgence of activity among users that need more than 25,000 square feet of space. Companies are more amenable to the higher rents demanded by Torrey Pines owners as VC funding and overall market conditions within the more established biotech firms have improved. Verenium signed a lease for 59,000 square feet in Torrey Pines, the largest new deal the submarket has seen in over two years.

The UTC/Eastgate submarket, like Torrey Pines, is comprised of mature, publicly traded corporate tenants with late-stage product development. This submarket, which offers the most direct competition to Torrey Pines, has just over two million square feet of lab space and is located in San Diego's "Golden Triangle", offering an unbeatable amenity base. UTC, which has struggled with a high availability rate is anticipated to tighten. Celgene and Optimer are in negotiations to lease 175,000 square feet of space within the submarket.

Sorrento Mesa, which contains four million square feet of lab space, caters to San Diego's early and mid-tier biotech companies. Some of the largest lab tenants in the area include Gen-Probe, Vical, Arena Pharmaceuticals, Quidel, Nuvasive and Pharmatek Laboratories. Class A laboratory space in Sorrento Mesa is almost fully leased. Landlords, in turn, are beginning to re-position older/distressed assets in Sorrento Mesa and Sorrento Valley to cater to tenants' demands for higher-quality space.

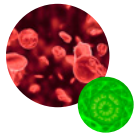
Sorrento Valley was developed as an ancillary submarket to Torrey Pines and continues to attract and retain many start-up biotech operations. With a base of older R&D buildings that have been converted to lab space, this submarket provides an economical alternative for early-stage companies. In 2011, Sorrento Valley experienced a surge in leasing activity by startup companies in the 1,000 to 3,000 square foot range.

## *Industry framework*

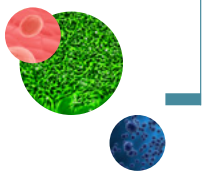
### Intellectual capacity

The emergence of the life science industry in San Diego dates to the 1960s, when the Torrey Pines Mesa was designated as an area for "scientific research and development activities," limiting manufacturing to "prototype fabrication and/or production of products requiring advanced technology and skills directly related to research and development activities on the premises."

Since that time, San Diego has continued to capitalize on its favorable collection of factors, including relationships with some of the nation's top scientific research institutions, access to venture capital and government funding, a concentration of suitable lab and R&D facilities, and, perhaps most important, a community and climate that attracts the best talent in the world. More than 25,000 professionals live in the San Diego region.



# San Diego



**Innovation capital**
The Scripps Research Institute, the Salk Institute, the Sanford-Burnham Medical Research Institute, and other outstanding regional universities—including three that offer life sciences doctorate programs—are centrally located within the regional life science cluster and provide much of the area's Innovation capital. As the life sciences network has grown, so too have grown the presence of venture capitalists, recruitment/technology staffing firms and patent attorneys, all intimately familiar with the needs of the life sciences industry.

**Fiscal & political resources**
Despite the comparably high cost to do business in California, companies are still flocking to "Americas Finest City." Although many of the business incentives offered by local government lie outside of the traditional life sciences submarkets, the real incentive for companies is not derived from these sources, but rather come from within the industry. Access to talent, investment capital, the research institutes, and an ever-growing group of industry-leading enterprises all make San Diego extremely attractive to life sciences companies.

The federal government supports the San Diego region through generous National Institutes of Health (NIH) grants, which are deployed to all stages of research and development. NIH grants in 2010 totaled nearly $1.2 billion, a 28 percent increase from the previous year and a 70 percent increase from 2008.

Although the investment sales market for biopharma-focused real estate cooled in 2011, it was red-hot in 2010 when the three major landlords—Biomed Realty, Alexandria Real Estate and HCP—increased their ownership by more than 1.2 million square feet. Together they now account for almost 50 percent of San Diego's life sciences property ownership. After the surge of investment activity in 2010, acquisition activity among those top firms is anticipated to continue into 2012. Both private owners and owner/users are anticipated to continue disposing of their real estate. Look for these owners to begin to push rates as the market continues to improve, the development pipeline remains closed, and their percentage of the competitive inventory grows.

## *Outlook*

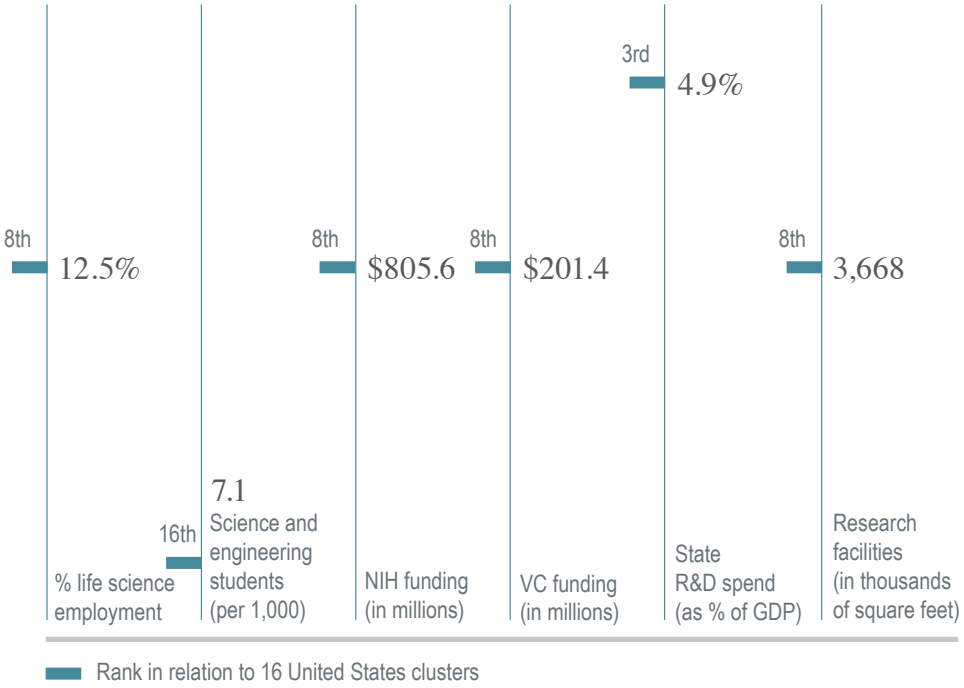
Thanks to ongoing investment in biopharma companies, the number of established and emerging businesses is growing, as evidenced by the average increase of the number of start-ups and the deployment of capital—both from government grants and venture-based groups. Mergers and acquisitions are expected to increase in 2012.

With more than one million square feet of tenants in the market for space (of which 414,000 square feet will be positive net absorption once the deals are signed), look for this industry sector to have a continued positive effect on the local commercial real estate environment. No speculative development is currently under way; new construction will be build-to-suit.

***With more than one million square feet of tenants in the market for space (of which 414,000 square feet will be positive net absorption once the deals are signed), look for this industry sector to have a continued positive effect on the local commercial real estate environment.***

# Seattle

Overall rank based on quantitative data, among 16 United States clusters.




***One of the distinguishing features of the Seattle-area life sciences market is that very little manufacturing is done in the region. Nearly all life sciences industry activities are based on research and development.***

## *Overview*

Overall, there are nearly five million square feet of life sciences facilities within the Seattle metro area. The two main hubs within the area are Bothell, located 20 miles northeast of the Seattle CBD, and the submarkets of the Seattle CBD, Lake Union, First Hill, and Queen Anne/Interbay, all located within the Seattle city limits. Most of the lab space within Seattle consists of newer, Class A facilities, although in some cases complete renovations of older structures have taken place. For example, the Lake Union steam plant renovated by Zymogenetics, now a wholly owned subsidiary of Bristol Meyers Squibb. Bothell offers more of a suburban campus environment, typically consisting of concrete tilt up buildings finished with lab space.

# Seattle

Typically, life sciences tenants in this market consist of research and development organizations, primarily focused on drug development. At, present, there is no large scale manufacturing, although there are several smaller, medical device makers. Most companies are usually in the early stages of drug development and are rarely profitable. Those that are successful are frequently acquired by Big Pharma. Examples include Zymogenetics (acquired by Bristol Myers Squibb), Immunex (acquired by Amgen), Corixa (acquired by GSK), Icos (acquired by Eli Lilly), and Corus (acquired by Gilead).

Most of the recent development or redevelopment of commercial real estate for life sciences use have taken place in the Lake Union submarket. Since 2007, more than 670,000 square feet of space has been placed into service for life sciences use. Examples include redevelopment of the former Washington Natural Gas buildings for the University of Washington (284,000 square feet), construction of the 96,000-square-foot Fairview Research Center occupied by Nanostring Technologies and Novo Nordisk, and Alexandria Real Estate's development 199 E Blaine Street for Gilead. In addition, Fred Hutchinson Cancer Research Center purchased 1100 Eastlake, originally developed for offices, and will convert the building to owner-occupied life sciences space.

An elevated vacancy rate in Bothell has reduced development work there. The most recent project was BioMed Realty's conversion of a 20-year old office building into life sciences space in 2008.

As in many markets, Alexandria Real Estate Equities and BioMed Realty Trust are major players in Seattle area life sciences properties in most submarkets, but there are several other prominent ownership entities as well. In Bothell, life sciences owners include Arden Realty, Bentall-Kennedy, TIAA-CREF, and regional and local players such as Schnitzer West and Washington Capital Management.

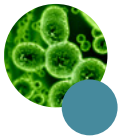
In the Lake Union submarket, prominent life sciences developers and owners include Vulcan Real Estate, Schnitzer West, Touchstone, Capstone, Washington Holdings, and Erlandson Development Group, and EOP.

## Industry framework

**Intellectual capacity**

Industry employment includes 19,000 people engaged in some form of research & development, with an additional 191,000 people employed in hospitals and the medical field.

University programs provide additional employment and education for future life sciences employees. The University of Washington (UW) located in Seattle is the leading educational institution in the region supporting life sciences, with additional educational programs provided by Washington State University, Western Washington University and Eastern Washington University.



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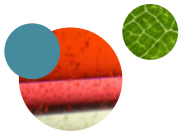
# Seattle



**Innovation capital**
The University of Washington is one of the nation's leading research institutions, receiving more research dollars from the National Institutes of Health than any other public university in the United States. UW Medicine has major academic and service affiliations with Seattle Children's Hospital, Fred Hutchinson Cancer Research Center and Cardinal Health in an innovative public-private collaboration designed to advance the use of molecular imaging in clinical investigations and trials.

The four primary academic institutions lead the state in funding for R&D expenditures led by the University of Washington, in conjunction with centers of excellence like the Institute for Systems Biology, Pacific Northwest Research Institute and Seattle Cancer Care Alliance.

**Fiscal & political resources**
Washington State has a "high tech" B&O tax credit which includes biotechnology R&D. The credit is allowed for eligible expenditures on R&D in excess of 0.92 percent of a company's taxable income, with the maximum amount of the credit at $2 million annually. In 2009, the last year for which statistics are available, 484 companies took advantage of the credit for a total of $23.8 million in credits claimed. Of that total, 78 companies claimed $2.46 million in the biotechnology.

In addition, Washington offers a sales/use tax deferral/exemption for investments in biotechnology manufacturing, although it is not widely used.

## *Outlook*

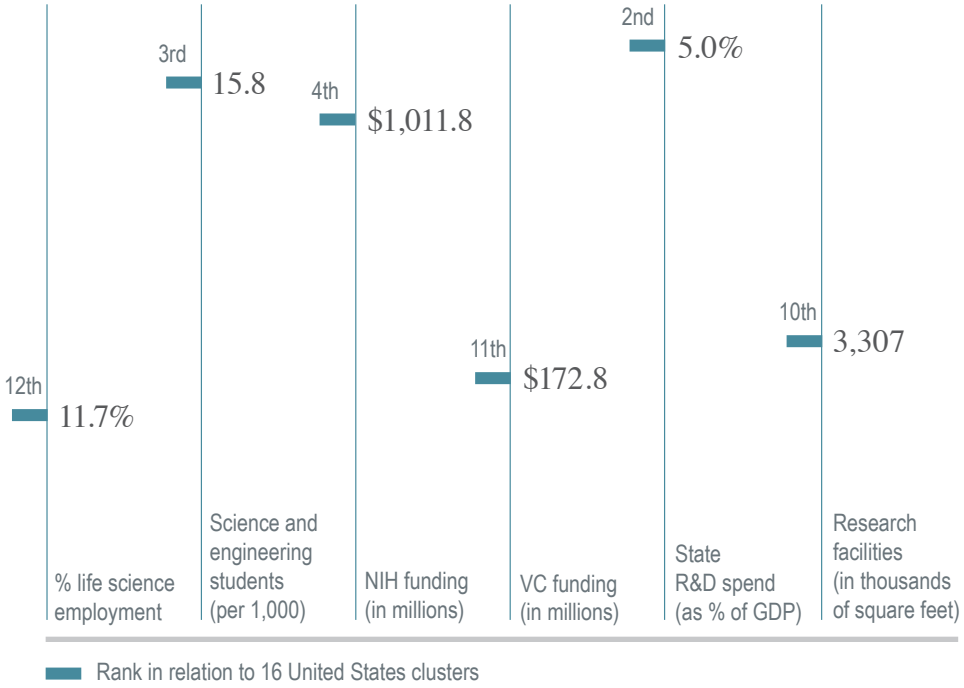
The life sciences industry is likely to continue as one of the drivers of Seattle area real estate, particularly in the Lake Union submarket and, potentially, in Bothell.

Limited speculative construction is likely to occur around Lake Union. This is due both to cost and the effects of the recent downturn. The most probable developments in the near term would be BioMed's 110,000-square-foot Fairview Research Center II or Alexander Real Estate Equities' (AREE) 165,000-square-foot Eastlake project. Both projects are located near to the Fred Hutchinson Cancer Research Center and University of Washington research facilities. The Bothell market is less likely to see near-term development due to ample existing space is available.

***The most probable developments in the near term would be BioMed's 110,000-square-foot Fairview Research Center II or Alexander Real Estate Equities' (AREE) 165,000-square-foot Eastlake project.***

# Washington DC / Suburban Maryland

Overall rank based on quantitative data, among 16 United States clusters.




***Fiscal and human capital support generated through close ties with government agencies and world-renowned academic research centers, such as Johns Hopkins University, sustain the Washington DC/Suburban Maryland cluster as a vital region for the industry.***

## *Overview*

The Washington DC/Suburban Maryland life sciences market has benefited tremendously from the area's large federal government presence. Government agencies such as the National Institutes of Health (NIH), and the Food and Drug Administration (FDA) have provided contracts for private sector companies as well as a critical mass of scientists who have gone on to start or staff many of the region's private bio-life companies.

# Washington DC / Suburban Maryland

Aside from its federal backbone, the market boasts a significant inventory of existing lab space which originated primarily from a decision by Alexandria Real Estate to invest in speculative space. The growth that rewarded Alexandria came largely from research into the human genome. The companies that led the region's development into a cluster included Human Genome Sciences, MedImmune, and Qiagen, all with strong ties to the federal government and an affinity for public-private research partnerships.

The life sciences are largely clustered among suburban Montgomery County, particularly along the I–270 corridor, known locally as "DNA alley." Within the I–270 corridor, a heavy concentration of bio-life companies is found in the Shady Grove micromarket. The J. Craig Venter Institute and Johns Hopkins (satellite campus) are both located there. Federal government facilities are found to the south in the Twinbrook, White Flint, and North Bethesda submarkets. The major landlords are Alexandria Real Estate and BioMed Realty Trust. BioMed has recently started buying product in the market, including the notable sale-leaseback of the J. Craig Venter Institute campus. BioMed also recently began speculative construction of more than 100,000 square feet in the Shady Grove submarket.

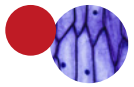
## *Industry framework*

**Intellectual capacity**

The Washington DC/Suburban Maryland cluster is distinctive in that it sources the vast majority of its intellectual resources from the federal government. The presence of groups such as the NIH, FDA and other agencies leads to a critical mass of top scientists who are hired by private sector companies, many of which were created by former federal employees. The region also benefits from proximity to a plethora of large educational institutions including Johns Hopkins, the University of Maryland, George Washington University, Georgetown University, George Mason University, and Catholic University.

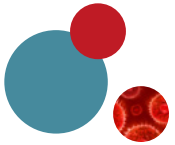
**Innovation capital**

Johns Hopkins University is particularly active in the cluster's development, helping to connect public and private ventures. The university is also influential through its real estate assets. As a large land-owner at the center of the dense bio-life submarket of Shady Grove, the university has influenced formation of companies by providing economical incubation space that includes federal and private sector access. Non-profits are also innovative. One notable example is Aeras; funded by the Gates Foundation, this group develops sustainable and affordable tuberculosis vaccines. Another prominent nonprofit example is the J. Craig Venter Institute, a conglomerate of research groups that is one of the leading innovators in genomic research.



***The Washington DC/Suburban Maryland life sciences market has benefited tremendously from the area's large federal government presence.***

# Washington DC / Suburban Maryland



***A wave of early startups has given way to mid-stage companies ripe for acquisition by major pharmaceutical companies.***

**Fiscal & political resources**

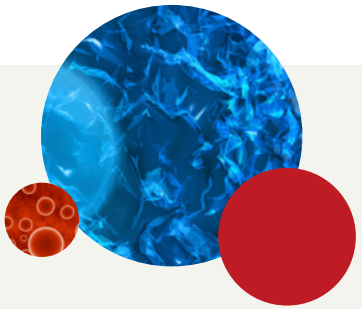
Several statewide programs and initiatives geared towards R&D, financial and employment support have helped to support growth in the region. Most originate with the Maryland Department of Business and Economic Development, assisted by development and advocacy efforts from organizations such as MdBio, a division of the Tech Council of Maryland.

- Research and Development Tax Credit: Provides tax credits to businesses with qualified R&D expenses
- Biotechnology Investment Tax Credit: Income tax credits to individuals or entities that invest $25,000 or more in a qualified Maryland biotechnology company
- Cellulosic Ethanol Technology R&D Tax Credit: Issues state income tax credits for businesses that incur R&D expenses related to cellulosic ethanol technology
- Economic Development Fund Grant/Loan Program: Funds private employers who retain and create jobs in Montgomery County, especially high technology and manufacturing
- Maryland Economic Adjustment Fund: Offers financial assistance to businesses with modernized manufacturing or that develop commercial applications for technology.
- Maryland Venture Fund: Provides direct investments in technology and life science companies and indirect investments in venture capital funds
- TEDCO Working Capital Loan Fund: Provides loans to early stage technology-oriented companies located in the State of Maryland

## *Outlook*

Although it is an established cluster, the Washington DC/Suburban Maryland life sciences industry is in an adolescent period. A wave of early startups has given way to mid-stage companies ripe for acquisition by major pharmaceutical companies. This market includes two of the hottest life science companies anywhere in the nation—Human Genome Sciences and MedImmune. In addition, the cluster is also home to Qiagen, Charles River Labs, SAIC, and the Henry M. Jackson Foundation—all established players. No large-scale developments are planned. While a climate of steady growth is likely, much of that growth can be accommodated by companies on or in their owned campuses and buildings.

# Atlanta



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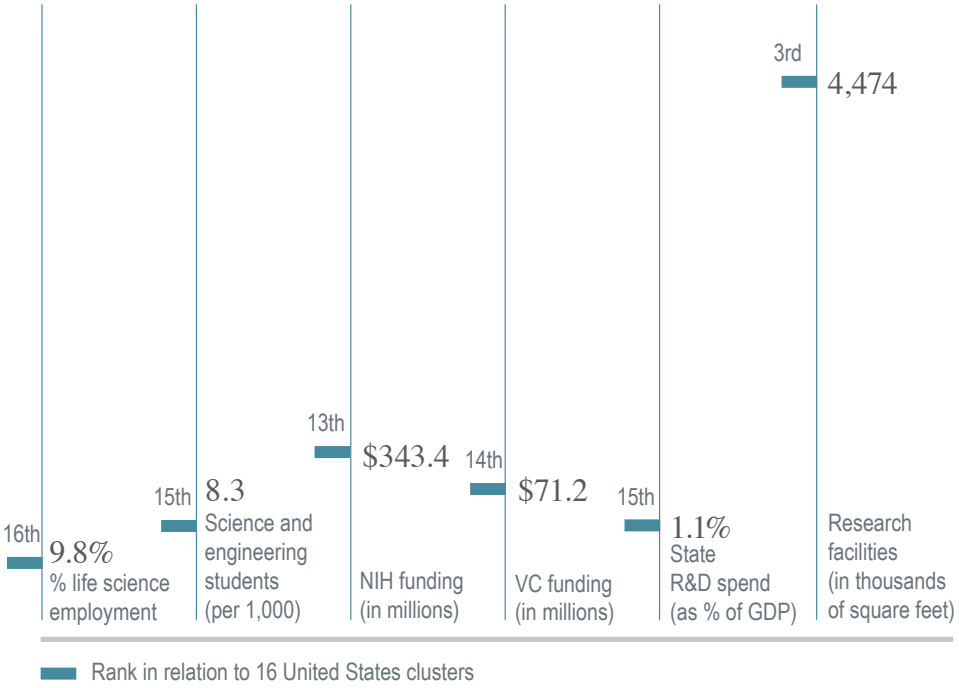


***Atlanta's growing bioscience community is centered around several academic research facilities and is bolstered by strong state economic incentives and the area's prominent make-up of closely-related health information technology companies.***

## *Overview*

Headquartered in Atlanta are large-scale health organizations like the Centers for Disease Control and Prevention, the American Cancer Society and Arthritis Foundation, among others. Their presence, along with first-rate research universities and a pro-business climate, encourage life sciences industry growth in Atlanta. Top employers include CIBA Vision Corp., Quest Diagnostics, UCB Inc., Covidien and the Centers for Disease Control and Prevention, which alone employs nearly 7,000 personnel.

# Atlanta

In a 2009 study by Georgia Bio and the Selig Center for Economic Growth, life sciences companies and life sciences-focused university research was found to account for more than 62,000 jobs throughout the state with an economic impact of $17.3 billion. Additionally, the bioscience industry grew more rapidly than any other sector in the state from the years 2001 to 2007. Civic leaders and institutions alike have planned accordingly. Recently, the Morehouse School of Medicine announced a $165 million expansion that will double the number of students in graduate-level biomedical science programs, while Georgia Health Sciences University has planned a new campus in Atlanta.

The city is also fast emerging as a center for healthcare information technology, with four of the top 25 HCI-100 companies headquartered in Atlanta. Many segments of the bioscience and health IT communities are symbiotic, and both sectors should benefit from proximity to one another as these industries grow.

## *Industry framework*

**Intellectual capacity**
There are eight academic institutions in the area that offer a range of life sciences-related degrees. Many of these schools benefit from the Georgia Research Alliance, an independent non-profit entity that facilitates research among industry and academic entities. Since 1990, a multitude of renowned scientists have been recruited to Atlanta through its Eminent Scholars program. Nearly 18,000 Georgians are employed in life sciences, with most of those jobs concentrated in Atlanta.

**Innovation capital**
The Georgia Institute of Technology and Emory University provide a joint biomedical engineering degree program that is ranked second in the nation and has become a model for successful and innovative research collaboration. Both schools anchor several centers of excellence including the Biomedical Technology Research Center and the Center for Behavioral Neuroscience. Along with Children's Healthcare of Atlanta, those same schools recently launched a first-of-its kind research center that links healthcare to engineering and is devoted to pediatric nanomedicine.

**Fiscal & political resources**
Georgia has embraced the life sciences industry because of its ongoing and positive economic impact. Multiple programs encourage growth. Atlanta and the state share a business-friendly reputation. Life sciences companies have access to tax credits, sales tax exemptions, job training, cash grants, and property tax relief.

Specifically targeted to the industry are services provided by the Georgia Bioscience Commercialization Center, a resource hub to assist entrepreneurs from bench to market. The Georgia Research Alliance launches companies around laboratory discoveries at partner universities through its VentureLab

# Atlanta

program. There is also the Georgia Medical Center Authority, which was established to advance the life sciences industry through research, development and manufacturing facilities and programs.

Specific available funding includes:

- Georgia Research Alliance Venture Fund: Private investment fund established to provide investment capital to companies that participate in the Georgia Research Alliance's VentureLab commercialization program
- Georgia Tech Edison Fund: Provides seed funding for early-stage biotechnology companies that have a close association with the school
- Georgia Tech Seed Capital Fund: Invests in Georgia-based entrepreneurial businesses pursuing innovation in bioscience and advanced technology
- Georgia Centers of Innovation Research and Commercialization Grant Program: Direct assistance that includes access to world-class research, product commercialization, state-of-the-art incubator space, connections to industry expertise
- Georgia Medical Center Authority: Issues up to $300 million in negotiable revenue bonds

## *Outlook*

The life sciences sector is likely to continue to expand in Atlanta. The city's concentration of research universities, IT backbone, superior transportation infrastructure and national health organization presence first catalyzed the industry's growth in Atlanta, and economic development initiatives that have followed should help to sustain it. However, Atlanta competes directly for regional tenants with the Raleigh-Durham market, where a thriving life sciences cluster is established around Research Triangle Park. Luring relocations is often a battle of economic incentives and both metro areas tend to be similarly aggressive.

***The city's concentration of research universities, IT backbone, superior transportation infrastructure and national health organization presence first catalyzed the industry's growth in Atlanta, and economic development initiatives that have followed should help to sustain it.***

# Chicago

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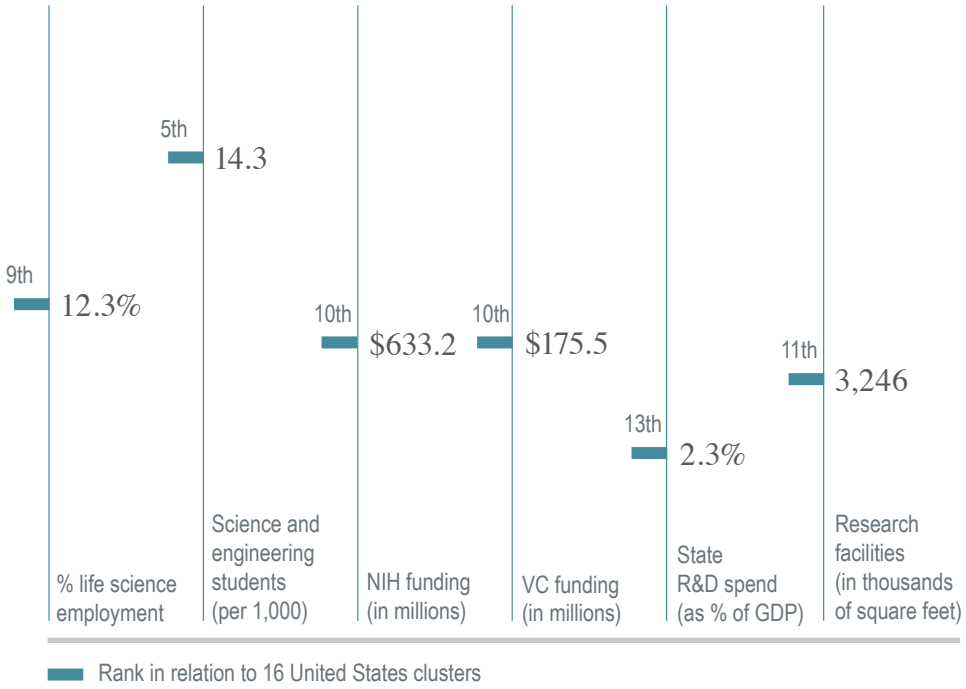



## *As a national leader in research and general manufacturing, the Chicago area is primed to expand its life sciences presence.*

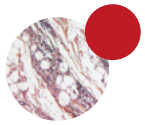
### *Overview*

Since the opening in 1946 of Argonne National Laboratory, the first national science and engineering research laboratory, the Chicago area has developed a reputation as a hub for research and innovation.

Headquartered in the Chicago area are large life sciences companies including Abbott Laboratories, Astellas, Baxter, Hospira, Takeda, and Walgreens. These companies, and many smaller life sciences firms, are located in the north suburban submarket.

Evidence of commitments by companies to the Chicago market includes recent build-to-suit headquarters' for both Astellas and Takeda Pharmaceuticals as well as a recent significant transaction by Sysmex. In 2007, Takeda completed its new

# Chicago



*Headquartered in the Chicago area are large life sciences companies including Abbott Laboratories, Astellas, Baxter, Hospira, Takeda, and Walgreens*

three-building, 630,000-square-foot world headquarters on 70 acres purchased from Baxter. Astellas has announced plans to follow suit and will deliver its new 445,000-square foot headquarters in 2012. Sysmex also executed two recent deals for its world headquarters, opting to lease 160,000 square feet of office and 146,000 square feet of industrial space in Lincolnshire. Further fueling activity was the September 2011 memorandum for collaboration between the Illinois Science and Technology Coalition, iBio and China's Shanghai Bio Pharmaceuticals Association.

Also underway, the Illinois Science + Technology Park in Skokie will be a 23-acre campus providing laboratory, office and conference space for life science-focused companies. Currently under construction by Forest City's Science + Technology Group, the site will eventually offer up to two million square feet of advanced facilities (660,000 square feet are immediately available).

## Industry framework

### Intellectual capacity

The area benefits from a large hospital system and life sciences-related employment of nearly 530,000 individuals, most of whom work in hospital or medical-related professions.

The metropolitan area is home to several leading universities and institutions. These include Northwestern University, the University of Chicago, the Illinois Institute of Technology (IIT), and the University of Illinois at Chicago (UIC). The area also attracts graduates from other schools in the state, such as the University of Illinois at Urbana-Champaign and Southern Illinois University School of Medicine.

### Innovation capital

The area's universities are among the factors that identify Chicago as a life sciences cluster. Research is a heavy point of emphasis at area centers like the International Institute of Nanotechnology at Northwestern, the Center for Pharmaceutical Biotechnology at the University of Chicago and the Medical Imaging Research Center at IIT.

The Illinois Medical District was created in 1941. Since then the area has become rich with hospitals, medical centers and research facilities including the biotech incubator, Chicago Technology Park. The 56-acre park features a 56,000-square-foot research center for emerging ventures and roughly 118,000 square feet of graduate and other facilities to accommodate more established companies.

### Fiscal & political resources

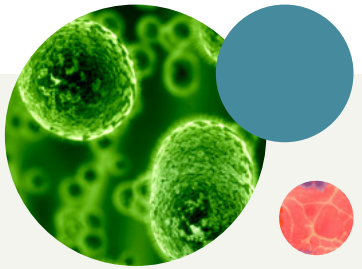
Founded in 2000, the Illinois Biotechnology Industry Organization, or iBIO, facilitates relations between public, private and academic sectors and advocates for favorable public policy for the industry. Its PROPEL program, launched in 2007, is specifically focused on increasing the number of life sciences start-ups in Illinois by providing entrepreneurs with access to funding, coaching and technical expertise.

Additionally, in 2010, efforts led by iBIO resulted in the state passage of the Angel Investment Tax Credit program. The measure grants investment tax credits to early-stage VC or Angel investors, capped at $10 million.

## Outlook

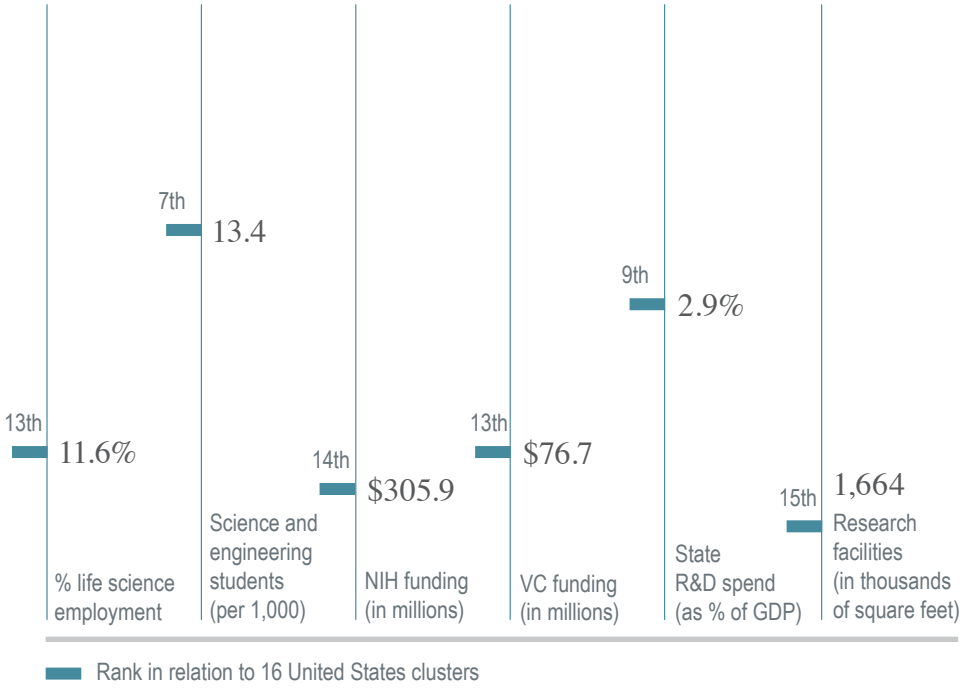
Although the State of Illinois is home to some of the top research universities and institutions in the United States, the area struggles to translate its innovation into start-ups, and further, to retain them in the state. Historically, the Chicago region has been challenged by the loss of its research graduates to coastal cities but has reversed this trend slightly during the past 36–48 months; more programming, expertise and fiscal attention will help the area overcome this hurdle and move the Chicago area into an established cluster.

# Denver



12

Overall rank based on quantitative data, among 16 United States clusters.




***After several years of stagnation, Denver area bioscience companies are benefiting from renewed interest from investors and partners.***

## *Overview*

While industry activity is spread throughout the entire metro Denver area, the Northwest submarket, encompassing the cities of Broomfield, Boulder, Louisville and Longmont, is the most prominent and home to nearly 100 life sciences companies. The submarket is predominantly made up by smaller companies. Although many closed their doors during the recession, a few local players are succeeding. Somalogic, miRagen and Biodesix are all recent recipients of cash infusions, and are poised to begin hiring additional workforce. With close access to the University of Colorado's research and laboratories and a growing critical mass of industry-related companies, the Northwest submarket will continue to lead life sciences activity in the Denver market.

# Denver

*The Northwest submarket, encompassing the cities of Broomfield, Boulder, Louisville and Longmont, is the most prominent and home to nearly 100 life sciences companies*

The Northwest submarket lacks any current development projects, however, the Fitzsimons Life Science District along with the Anschutz Medical Campus in Aurora, Southeast of downtown Denver, are among the largest life sciences developments in the country. Start-up companies and fully-developed companies alike are accommodated and have access to research, resources and facilities.

## Industry framework

### Intellectual capacity

High-tech research and hospital/medical industries employ nearly 188,000 people employed in the Denver area. Ten higher education institutions operate life sciences programs and research resources. Among them are Colorado State University, the University of Colorado at Boulder and the Colorado School of Mines. The largest research facility in Colorado is the Fitzsimons Life Science District in Aurora. With swift growth in the industry over the past few years, Fitzsimons has created a central hub for research dedicated to life sciences, healthcare and education.

The state is home to nearly 400 companies in the bio-related fields of medical devices, pharmaceuticals, agricultural and traditional biotechnology including the likes of Allos Therapeutics, Amgen, Array, Sandoz, Somalogic and Roche.

### Innovation capital

The University of Colorado offers the Colorado Initiative in Molecular Biotechnology, which cultivates research and development in life sciences. The initiative was established to attract exceptional students to integrate research and teaching in biotechnology development. The university's medical school also offers a new stem cell research center made possible by a $6 million grant from the Charles C. and June S. Gates Family Fund.

### Fiscal & political resources

The Colorado BioScience Association works to further Metro Denver and Colorado's life sciences community. Aiding this effort are Colorado programs such as grants, sales tax exemptions, and support for start-up companies.

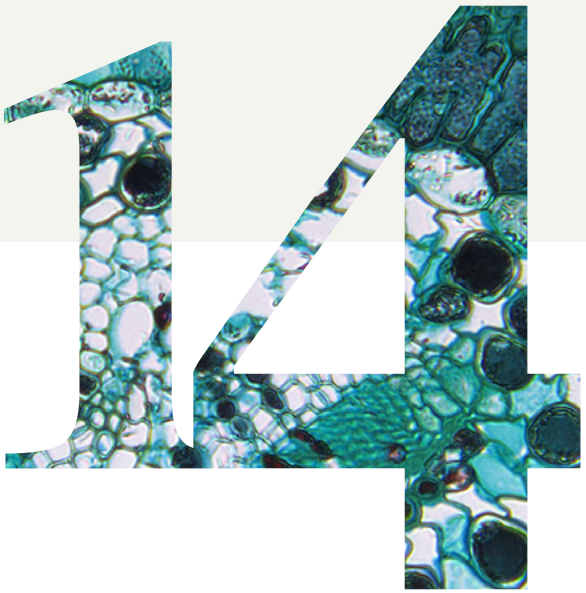
The state has five venture firms predominantly or solely focused on funding local life sciences companies as well as several other programs and grants available:

- Bioscience Discovery Evaluation Grant Program: Aims to foster growth of the state's bioscience industry by expanding bioscience research and accelerating development of new products and services. Program funding is disbursed through proof-of-concept grants, Early-State Bioscience Company grants, and research institution grants for infrastructure development.
- Biotechnology Sales and Use Tax Refund: Refunds are available for state sales and use taxes paid on the sale, storage, use, or consumption of tangible personal property to be used in Colorado directly and predominantly in research and development of biotechnology.
- Bioscience and Life Science Fund: A 5-year, $31.5 million grant from the state of Colorado aids start up companies and research institutions in Colorado.

## Outlook

Denver's life sciences industry is trending positively. Budding start-ups have the intellectual and innovation resources needed to develop into successful and solid companies, while established companies enjoy access to resources with the presence of the Fitzsimons Life Science District and the Anschutz Medical Campus. However, it is evident that the market requires investors and landlords who specialize in the development of research facilities. Many current facilities have been retrofitted, and having these types of facilities readily available will support forward momentum in Colorado.

# Florida



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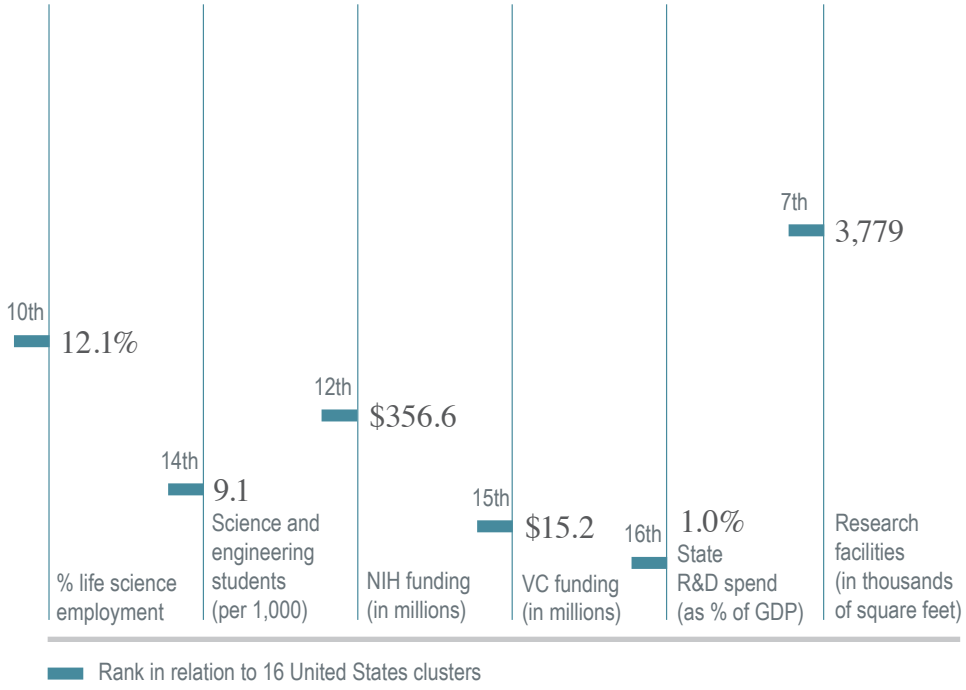



***Florida's commitment to an expanded bioscience community is evident through the many development projects, incubation centers and academic programs in the central and southern regions.***

## *Overview*

Central Florida, consisting of metro Orlando, Tampa Bay area and Gainesville, and South Florida, consisting of Miami, Fort Lauderdale, Boca Raton, Jupiter and Port St. Lucie, are regional hubs for the industry.

In Central Florida, a major bright spot in the life sciences is the development of the Lake Nona Medical City. Under construction by the Tavistock Group, the master-planned community will span more than 7,000 acres. Some tenants of the Medical City include the University of Central Florida College of Medicine, the Sanford-Burnham Medical Research Institute at Lake Nona, the Orlando VA Medical Center, Nemours Children's Hospital, MD Anderson Cancer

# Florida

Center, and the University of Florida Research and Academic Center. Sanford-Burnham was an early partner of the Lake Nona Medical City and occupies a 175,000-square-foot, state-of-the-art facility. The Orlando VA Medical Hospital, expected to open in 2012, will be a 134-bed hospital. Moreover, it will be the home to a new 35,000-square-foot training facility for a new medical simulation system called the Simulated Learning Enhancement and Advance Research Network.

Construction is also under way on the University of South Florida's Center for Advanced Medical Learning and Simulation (CAMLS) in the Tampa Central Business District. When completed, CAMLS will be a state-of-the-art, 90,000-square-foot medical conference facility. CAMLS will feature a 30,000-square-foot training center for USF Health's Graduate Biomedical Degree program, a 2,000-square-foot auditorium, a 6,000-square-foot laboratory, and a 10,000 square-foot Virtual Hospital.

In South Florida, the new science and technology park at the University of Miami is helping to shape a strong innovation community. The University of Miami Life Science & Technology Park's (UMLSTP) master plan includes up to five buildings totaling between 1.6 million and 2 million square feet of retail, lab and office space. Building One was recently completed and is 60 percent leased. Highlights from its tenant roster include medical device companies DayaMed and Emunamedica, Spanish technology company Andago, Community Blood Centers of South Florida lab facility, clinical research firm Advanced Pharma CR, and the UM Tissue Bank. Developed by Wexford Equities, the 252,000-square-foot facility includes both wet and dry lab space, in addition to office and retail. Building Two, also to be developed by Wexford, is in final design as a 12-story building that will also include a hotel and conference facility in addition to the research, office, clinical and retail space. Building Three is in the planning stage.

Outside of development projects, life sciences companies are expanding in both regions. In Central Florida, Nephron Pharmaceuticals, currently based in Orlando, plans to build a new 531,000-square-foot facility, add 100 new, high-wage employees with expansion estimated at a total of $100 million. Nephron has narrowed its site selection options to Orlando and Murray, Kentucky.

In South Florida, Teva Pharmaceuticals maintains a significant presence in Miami through its $7.6 billion purchase of Ivax. The Miami connection was reinforced in 2010, when Ivax founder Dr. Phillip Frost, was named Teva's chairman. Residing in Miami, Dr. Frost has built a significant biotechnology portfolio that includes NYSE-listed Opko Health. Also in 2010, BD Bioscience opened a 90,000-square-foot facility in Miami to produce cell culture media and in early 2011, HeartWare, a medical device manufacturer with its operating and manufacturing activities based in Florida, opened a new 131,000-square-foot facility. With recent news of high survival rates in recent trials for its miniaturized ventricular assist devices, the potential exists for additional growth over the near term.

***The University of Miami Life Science & Technology Park's (UMLSTP) master plan includes up to five buildings totaling between 1.6 million and 2 million square feet of retail, lab and office space.***

# Florida

## Industry framework

### Intellectual capacity

On the research side, Central and South Florida are home to nearly 43,000 high tech research employees and several large academic institutions including The University of Florida, University of Central Florida (UCF), University of South Florida (USF), The University of Miami (UM), Florida International University (FIU) and Florida Atlantic University. These universities provide incubator programs to support life sciences technology growth.

As a popular retirement destination, Florida is also a large healthcare market. Medical device and other life sciences companies actively establish relationships with hospitals and medical facilities throughout the area.

### Innovation capital

The Central Florida region benefits from seven life sciences-related centers of excellence and a number of incubators that help start-ups, including the UCF Business Incubators and USF's Tampa Bay Technology Incubator. Of particular note is the University of Florida's Sid Martin Biotechnology Incubator, which provides wet labs, small and large animal research facilities, common equipment labs, fermenters, greenhouses and other facilities and utilities needed by budding research companies.

In the South Florida region, the University of Miami Life Science and Technology Park includes a 25,000-square-foot Innovation Center with pre-built and furnished wet and dry labs, office suites, and shared equipment. The University of Miami also has developed its nationally recognized Launch Pad program that offers one-on-one facilitation to help students and alumni develop their ideas into a company and offers business plan evaluation, strategy and basic business guidance.

FIU's Applied Research Center is a university-wide stand-alone facility intended to foster multi-disciplinary research collaboration between research units. Scripps Florida houses five academic departments of its parent, the Scripps Research Institute, in addition to the Translational Research Institute. Additionally, the South Florida region is home to the Vaccine and Gene Therapy Institute, the Torrey Pines Institute for Molecular Studies in Port St. Lucie and the Max Planck Florida Institute, currently under construction at Florida Atlantic University's McArthur Campus.

### Fiscal & political resources

BioFlorida, the state's bioscience industry association, represents companies and research centers to help facilitate innovation, foster collaboration and create a business-friendly environment for life sciences companies.

Several local programs and measures have been developed to further foster industry growth, such as grant funding for high tech businesses and industry tax exemptions, quick response training grants and Enterprise Zone sales tax credits, offered throughout Orlando, Tampa and Miami.

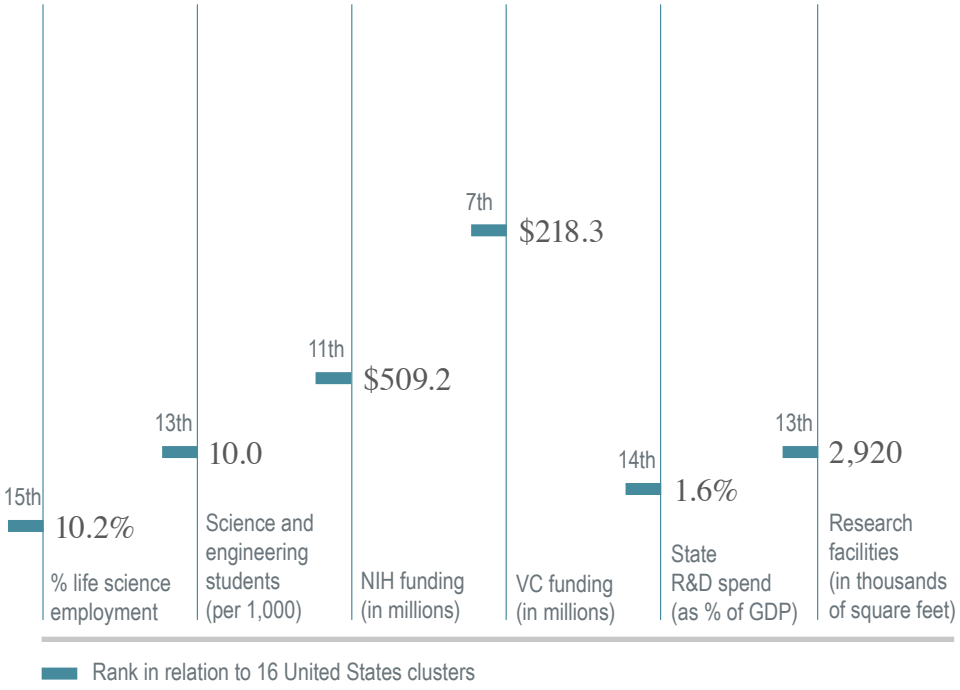
## Outlook

The Central and South Florida development projects will have a tremendous impact over the next 10 years on the region's life sciences community. These and related projects are expected to create more than 6,000 jobs and add significantly to the local economy. Expansions such as these significantly enhance the area's medical and research community, increases in direct funding will further support this active market and cement Florida's viability as a life sciences cluster.

***The Central and South Florida development projects will have a tremendous impact over the next 10 years on the region's life sciences community.***

# Houston

Overall rank based on quantitative data, among 16 United States clusters.




***Houston's rich research resources and life sciences community are strongly rooted in the infrastructure provided by the Texas Medical Center.***

## *Overview*

Houston's emerging life sciences cluster revolves around innovation at the Texas Medical Center (TMC) located just outside of the Houston central business district. TMC has planned more than $7 billion in capital projects through 2014.

Current activity around the TMC has been dominated by two developments in the 100-acre University of Texas Research Park. The first is GE Healthcare's $55 million joint development of the Center for Advanced Diagnostic Imaging at the University of Texas Research Park. The center conducts imaging research and encourages commercialization of new medical technologies. Additionally, MD Anderson's new 85,000-square-foot, $125 million Proton Therapy Center offers state-of-the-art radiation therapy to cancer patients.

# Houston

## *Industry framework*

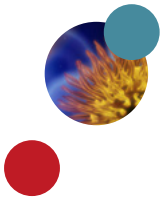
**Intellectual capacity**
With more than 42 colleges, universities and other degree-granting institutions, Houston benefits from an extensive pool of academic talent and resources. Top schools such as Baylor University, Rice University, the University of St. Thomas and the University of Houston all fuel local innovation. According to 2009 rankings by the National Science Foundation (NSF), the State of Texas held the first, second and third rankings for number of doctorates conferred in agricultural sciences, natural resources, health sciences and life sciences and biological/biomedical Sciences.

Houston has more than 275,000 employees in the high tech research and hospital and medical fields, more than 75 hospitals and clinics and representation from some large companies such as Alcon, Bruker, Bayer, US Oncology and Sigma Life Science.

**Innovation capital**
Located in Houston, the Texas Medical Center is the world's largest research and applied medical center, featuring a network of 49 leading non-profit and government institutions, including 13 hospitals and annually conducts more than $1.2 billion in research.

The Richard E. Smalley Institute for Nanotechnology at Rice University provides the infrastructure, community and leadership necessary to promote nanotechnology research. Also at Rice University, the Rice Alliance for Technology and Entrepreneurship supports entrepreneurs and early-stage technology ventures with education, collaboration and research assistance. Additionally, the University of Houston Center for Life Sciences Technology serves the region as an impartial academic and research organization designed to facilitate the education and training of people to work in life sciences research and biotechnology organizations of the region and state.

**Fiscal & political resources**
In 2003, the state of Texas authorized the $295 million Texas Enterprise Fund (TEF). As of December 2010, $77 of the $97 million awarded went to life sciences companies in Houston, with an estimated employment impact of more than 7,200 jobs. More recently, the state of Texas approved a $3 billion cancer research institute, which will distribute up to $300 million in annual research funds over the next decade.



***According to 2009 rankings by the National Science Foundation (NSF), the State of Texas held the first, second and third rankings for number of doctorates conferred in agricultural sciences, natural resources, health sciences and life sciences and biological/biomedical Sciences.***

# Houston

BioHouston, a non-profit organization founded by area research institutions, works for partnerships with the business community to commercialize research among the area's centers of excellence.

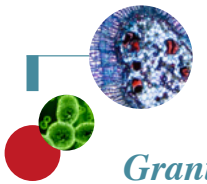
Specific available funding includes:

- Texas Emerging Technology Fund, which helps expedite development and commercialization of new technologies and recruits the best available research talent in the world
- Gulf Coast RCIC, processor of applications for Commercial Awards from the Texas Emerging Technology Fund
- BioHouston has established a match-making program to introduce emerging Texas life science companies to local and national venture capital firms and established life sciences companies
- Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) offers advice and information on applying, as well as a visual step-by-step overview for small business applicants.
- Various support networks for emerging companies include the Houston Angel Network, Rice Alliance for Technology and Entrepreneurship and the Texas Coalition for Capital

## *Outlook*

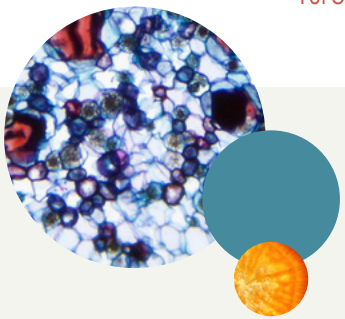
The city of Houston, with assistance from state government, has made great strides in recent years to promote and bolster the city's research institutions. Grant programs, industry-minded organizations and steady venture capital funding have helped the Texas Medical Center and its affiliates to develop a deep research capacity.

Outside of the institutions, companies, and facilities associated with TMC, however, Houston currently lacks the established commercialization infrastructure needed to move innovation out of the laboratory. Its geographic separation from mature coastal life sciences clusters is a challenge for the region as is the competition it faces from surrounding Texas cities.



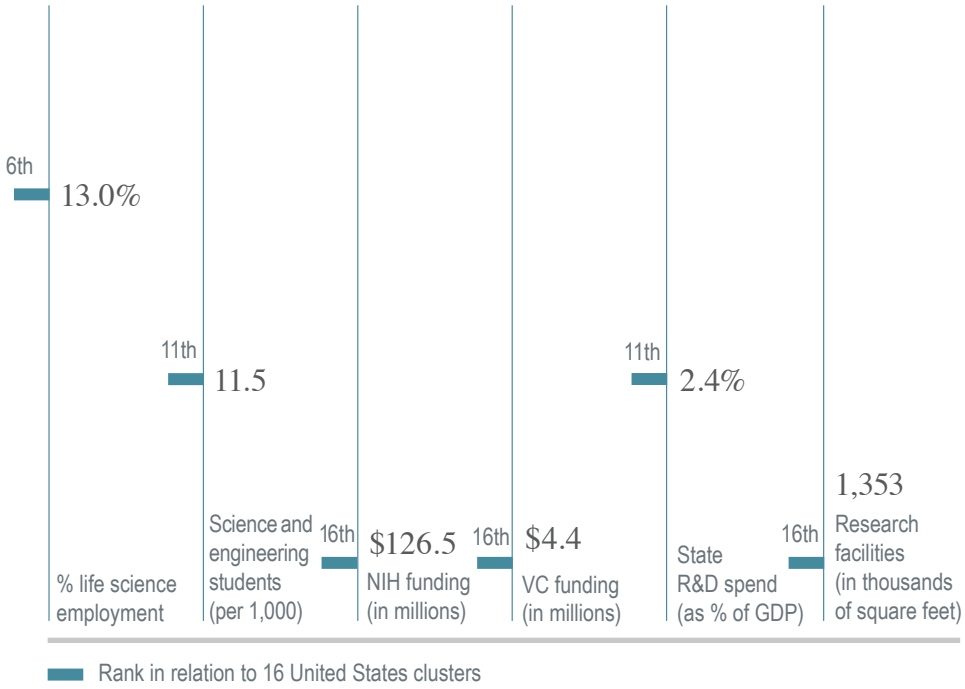
***Grant programs, industry-minded organizations and steady venture capital funding have helped the Texas Medical Center and its affiliates to develop a deep research capacity.***

# Indianapolis



16

Overall rank based on quantitative data, among 16 United States clusters.




***The city of Indianapolis and surrounding areas have made enhancements to the cluster's emerging life sciences sector a priority via development project funding, grant programs and aggressive business-friendly incentives to improve its viability in the global marketplace.***

## *Overview*

Indianapolis's life sciences community has grown dramatically during the past decade, thanks in large part to the collaborative efforts of the state government, industry-focused organizations, area universities and leading area employers.

Eli Lilly, one of the industry's largest pharmaceutical makers, is based in Indianapolis, and several of the largest medical device manufacturers, including Zimmer, Biomet and DuPuy Orthopedics, are headquartered in northern Indiana. Also in the area is medical manufacturer Cook Incorporated of Bloomington near Indiana

# Indianapolis

University's main campus. Roughly 18 percent of the state's economic output is tied to life sciences, with more than $13 billion in economic activity generated from central Indiana, where Indianapolis is located.

Eli Lilly owns and/or occupies more than 10 million square feet of office, lab and industrial space throughout metro Indianapolis, including a 120-acre campus downtown. In mid-2011, the company announced plans to enhance its downtown campus, adding green spaces, connections to bike/walking trails and other projects to improve accessibility. This is in addition to the $155 million, mixed-use-development project 'North of South' currently underway by Eli Lilly and local developer Buckingham Cos. to replace more than 10 acres of Lilly parking lots with a hotel, YMCA branch and apartments. The company hopes the redevelopment project will not only enhance downtown Indianapolis, but also serve as a recruiting tool for young talent interested in living in a vibrant downtown setting.

In June 2011, a master plan was announced for up to one million square feet of development and redevelopment north of the IUPUI campus. Develop Indy, a public and privately funded economic development group, in collaboration with the City of Indianapolis, named the project '16 Tech', and plan to turn the area into a work, live and play district for biotechnology, research and other high-tech companies.

## *Industry framework*

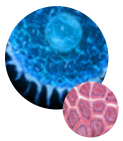
**Intellectual capacity**

The metro area is home to several large universities including Indiana University, Indiana University-Purdue University Indianapolis (IUPUI), the IU School of Medicine and Purdue University. The IU School of Medicine is the second largest-medical school in the United States and was designated by the National Institute of Health as a Clinical and Translational Sciences Institute for Translational Research. Purdue offers several top engineering programs and its School of Pharmacy is the second-largest in the county.

The state of Indiana is home to more than 800 life science-related businesses, with the largest representation in medical devices and pharmaceuticals.

**Innovation capital**

Regional universities are home to several centers of excellence including the Indiana University (IU) Medical Center, the IU Simon Cancer Center and the Alfred Mann Institute for Biomedical Development.



***Eli Lilly, one of the industry's largest pharmaceutical makers, is based in Indianapolis, and several of the largest medical device manufacturers, including Zimmer, Biomet and DuPuy Orthopedics, are headquartered in northern Indiana.***

# Indianapolis

In addition, several incubator programs have been established, to use university and private sector relationships to accelerate the growth of emerging companies. These include:

- Purdue Research Park of Indianapolis, now under development. The 1,500-acre project will provide state-of-the-art facilities and business accelerator resources to support emerging companies.
- Indiana University's Emerging Technology Center is an incubator for emerging life science, biotechnology and bioinformatics companies by promoting university-industry partnerships.

**Fiscal & political resources**

Among U.S. life sciences clusters profiled, Indianapolis receives the lowest amount of National Institutes of Health (NIH) funding and had the lowest amount of venture capital funding in 2010. Because of this, local government and organizations have tried to improve the area's structure of financial incentives and programs.

BioCrossroads is the most notable public-private partnership and, to date, it has raised more than $250 million in funds for life science initiatives managed through three separate funds. The Indiana Future Fund and the INext Fund were established as venture capital umbrella groups, while the Indiana Seed Fund provides capital to newly forming companies.

Statewide, life science companies made nearly $1.8 billion in capital investments from 2005 to 2010. One of Indianapolis's largest companies, Eli Lilly, also makes philanthropic grants to area research universities and institutes.

The state of Indiana is extremely business-friendly, with no inventory or gross receipts taxes and a flat, low corporate adjusted gross income tax based on in-state sales only. Indiana is one of only a few states that has not enacted general tax increases in recent years. Several other programs or incentives have been created to benefit the industry. These include:

- The Venture Capital Investment tax credit
- Indiana 21st Century Research and Technology Fund, with financial support to entrepreneurial ventures focused on the commercialization of innovative technologies
- Patent Income Tax Exemption, which exempts taxpayers from certain income related to utility and plant patents
- Research and Development Tax Credit for increases in the increase of Indiana R&D
- Research and Development Sales Tax Exemption, which exempts a business from 100 percent of the sales tax on R&D equipment

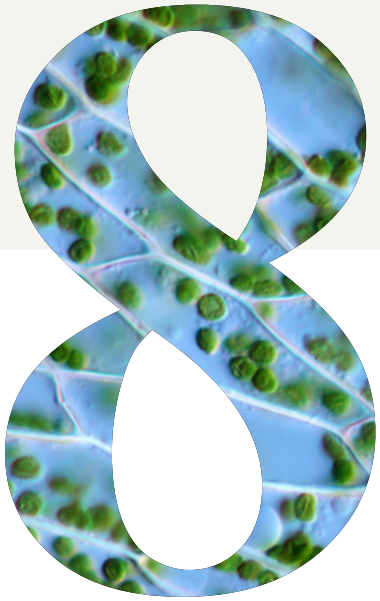
## Outlook

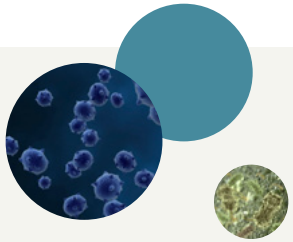
While Indianapolis's life sciences industry has made great strides in recent years, the area needs to further solidify relationships between university programs and established companies in the industry. As the emerging cluster's companies continue to innovate and advance their offerings, they will need a highly educated workforce with specialized graduate degrees to staff future companies. Development projects like North of South and 16 Tech are expected to attract emerging companies to the area; proximity to universities, research centers and established companies like Eli Lilly should bolster budding ventures.

Additionally, the area will need to keep venture capital and grant programs active. Given the area's NIH and venture capital shortcomings, local government and organizations will need to develop ways to fill this gap and fund early stage innovation.

*Development projects like North of South and 16 Tech are expected to attract emerging companies to the area.*

# Minneapolis





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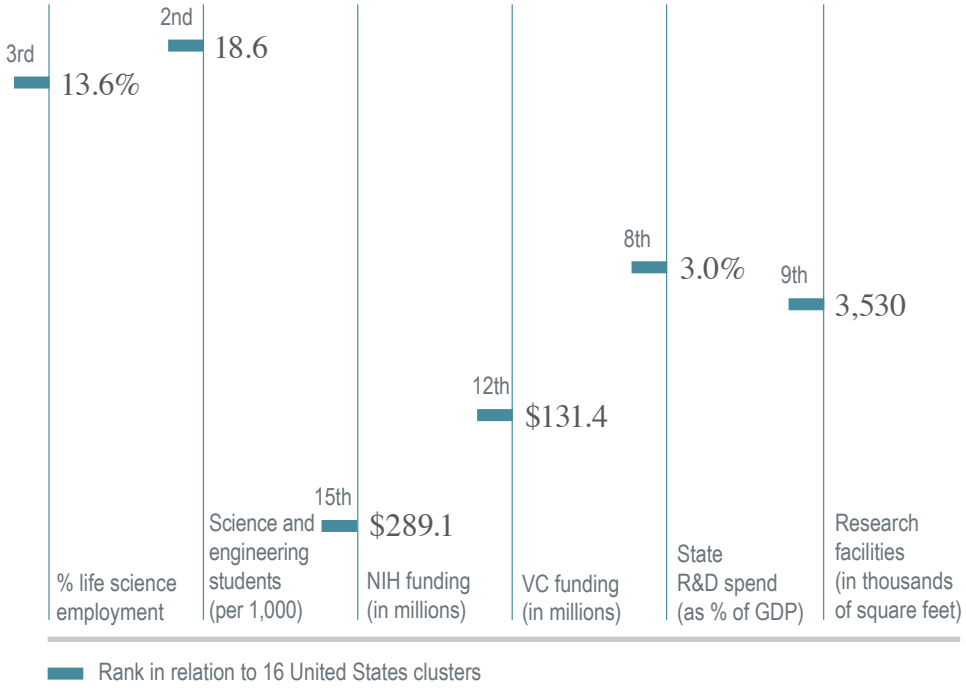


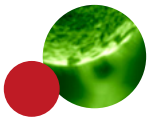

***Despite a lack of innovation-friendly incentives and programs, Minneapolis's deep intellectual resources prime the region for growth and development.***

## *Overview*

Minnesota's economy is about 24 percent more dependent on the life sciences than the national average. Ventures in the area compete in a variety of industry sectors such as medical devices, biopharmaceuticals, animal health, agricultural biotechnology and biofuels. Over the past five years, Minnesota has outpaced the nation in the growth of its biobusiness technology industry. The workforce has increased by 20 percent with growth led by the medical devices sub-sector.

Success in life sciences is anchored in the state's agricultural and medical technology industries, but is made possible by the strength of its high-technology industries. In partnership with government and academia, these segments of the state's industrial sector

# Minneapolis



*The Twin Cities currently employs about 28,000 workers in medical technology and is home to med-tech giants such as Medtronic Inc. St. Jude Medical Inc. and 3M Healthcare, among others.*

historically have worked together to create an economic environment that has positioned Minnesota as one of the top emerging life sciences clusters. The Twin Cities currently employs about 28,000 workers in medical technology and is home to med-tech giants such as Medtronic Inc. St. Jude Medical Inc. and 3M Healthcare, among others.

## Industry framework

**Intellectual capacity**
Solid funding in education and infrastructure has contributed to high-quality life sciences jobs in Minnesota. Among the 16 United States markets examined in this report, Minneapolis scored second in the number of science and engineering graduate students and third for the percent of high tech research and medical/hospital-related employment.

**Innovation capital**
The University of Minnesota, one of the top public research institutions in the country, has made a significant investment scientific research through its Biomedical Discovery District. The district is a cluster of five state-of-the-art research facilities. Within the Biomedical Discovery District, nearly 1,000 people, including 165 faculty researchers, work in 700,000 square feet of flexible research space to find new cures, treatments, and preventions.

Outside of the University of Minnesota, the Twin Cities has no significant research parks or R&D centers of excellence, nor are there any development plans in the near future. Non-profit organizations and public committees, such as the Minnesota Science and Technology Economic development Project Committee, have supported development through enhanced incentive programs.

**Fiscal & political resources**
Minnesota adopted an expanded R&D tax credit in early 2010. It includes:

- 10 percent refundable credit for first $2 million spent on qualified R&D expenditures
- 2.5 percent for all qualified expenditures over $2 million
- Expansion of qualifying companies to include S corporations, partnerships, and individuals
- Refundable: if the amount of tax credits qualified for exceed a company's Minnesota tax liability, the balance will be paid as a tax refund

The improved R&D tax credit will support further growth of research and development in Minnesota by encouraging expansion of existing companies and location/relocation of R&D facilities from companies based elsewhere.

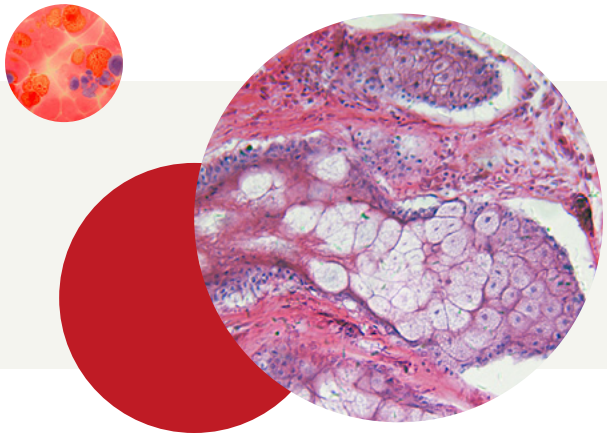
Unlike many states, Minnesota has no incentives for angel investors and no state funds for seed, early stage or gap funding.

## Outlook

The life sciences industry in Minnesota seeks to reprioritize funding, partnerships and political support. Unlike nearly 30 other states, Minnesota has not developed, funded, or implemented a major, comprehensive science and technology initiative to support recruitment and retention of top talent, develop and maintain infrastructure, encourage research, and attract external financing critical to Minnesota's competitive position in the growing knowledge-based economy.

To counter this reality, both public and private parties are taking action. Minnesota's two largest non-profit organizations representing the life science industry, LifeScience Alley and The BioBusiness Alliance of Minnesota, have announced a strategic affiliation to strengthen the state's economy and leadership in the life sciences.

# Canada



| 1.9% | 4,260 | 18.0% | 10.9% | 11 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2006) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***Strong flows of intellectual and Innovation capital drive development of Canada's life sciences industry. Increased financial resources are needed to commercialize the nation's biotech research.***

## *Overview*

Canada's life sciences-related research and development expenditures accounted for roughly 1.95 percent of GDP nationally in 2009 and are currently valued at over C$80 billion ($81 billion)[1]. Realizing the growing industry's potential impact on the Canadian economy, incentives and grants are being built-in at the federal, provincial and local levels to ensure that life sciences industry has a significant chance of flourishing.

Nearly all members of Big Pharma have Canadian operations and/or partnerships with local companies and represent some of the nation's largest spenders on life science R&D. These include Pfizer, GlaxoSmithKline, Merck, Novartis, Sanofi and AstraZeneca. Also ranking high among the nation's R&D-spenders are several regionally headquartered companies such as Apotex, Neurochem and Biovail, which recently merged with fellow-national Valeant Pharmaceuticals. Other large Canadian companies include Nordion, Paladin Labs, Atrium and Theratechnologies.

The current Canadian landscape has given rise to growing research communities with universities, research parks and incubation centers driving much of the development of the biotech and life sciences sectors. Although activity is spread throughout the nation, clusters are forming around areas where theses key resources are already in place, namely within major cities in the provinces of Ontario, Quebec and British Columbia.

# Canada

## *Industry framework*

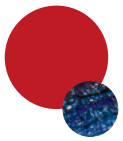
**Intellectual capacity**
Research and development-related employment reached nearly 160,000 people in 2008, including professionals, technicians and support staff. Upwards of 5,200 life sciences-related companies are located throughout the country, including roughly 600 biotech development companies, 200 biotech supplier and engineering providers, 100 medical technology companies and 200 public sector biotechnology organizations.

Research facilities at the country's top universities play an integral role in the industry. These include McMaster University, the University of Ottawa, and the University of Toronto in Ontario; Université Laval and McGill University in Québec; the University of Alberta and the University of British Columbia.

**Innovation capital**
Since 1989, the Networks of Centres of Excellence (NCE) has helped mobilize and engage some of the best academic research talent in Canada while supporting partnerships from the private sector, the three tiers of government and non-profit groups. Support from granting agencies, such as the Natural Sciences and Engineering Council, the Canadian Institutes of Health Research and the Social Sciences and Humanities Research Council, is a central component of the NCE's efforts. Much of the research conducted in the life sciences industry is driven by Canadian universities in collaboration with the NCE. Combined, there have been more than 36,000 skilled personnel trained and more than 100 spin-off companies created since the partnership's inception.

Some prominent centres of excellence in Canada include Centre for Commercialization of Regenerative Medicine in Toronto, Ontario, the Centre for Drug Research and Development in Vancouver, British Columbia and the Institute for Research in Immunology and Cancer — Commercialization of Research in Montreal, Quebec.

**Fiscal & political resources**
Canada offers federal tax credits for Scientific Research and Experimental Development (SR&ED) expenses. The credits vary depending on R&D spending totals, with C$3 million ($3.05 million)[1] as the threshold. Additional sums are available for small Canadian-controlled private companies. British Columbia, Ontario and Quebec offer additional credits of varying sizes, again determined by the type and size of corporation.



***Ranking high among the nation's R&D-spenders are several regionally headquartered companies such as Apotex, Neurochem and Biovail, which recently merged with fellow-national Valeant Pharmaceuticals.***

# Canada

Ontario provides additional incentives, including:

- Ontario Business Research Institute Refundable Tax Credit, which provides up to C$4 million ($4.07 million)[1] for pre-clinical research
- The Next Generation of Jobs Fund, which grants a maximum of 15 percent of a company's R&D budget for those that invest a minimum of C$25 million ($25.5 million)[1] or create at least 100 jobs
- Ontario Venture Capital Fund, with C$160 million ($163 million)[1] in capital and a planned expansion to C$270 million ($275 million)[1]
- The Ontario Innovation Development Fund, offering grants of up to C$4 million ($4.07 million)[1] per company over a two-year period to certain early stage companies

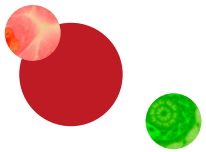
Further, the Canadian Biotechnology Strategy (CBS), launched in 1998, is the federal government's biotechnology plan. More than C$65 million ($66 million)[1] per year is spent on projects and includes The Canadian Biotechnology Strategy Fund, the Canadian Regulatory System for Biotechnology and the intramural Genomics Research and Development Program.

## *Outlook*

Investment capital will be the biggest hurdle for Canada's emerging life sciences sector. The recession reduced spending in the sector and although venture capital returned in 2011, remains in short supply. The recent announcement that the expansion of MaRS (research incubator) Phase II has resumed suggests that there is demand for such facilities.

Partnership and venture capital from foreign investors will be an important component of Canada's future life sciences growth. This will require a more investment-friendly tax environment to encourage additional foreign participation.

1. Six month average conversion rate of C$0.98 per US dollar, as of October 2011.



***Partnership and venture capital from foreign investors will be an important component of Canada's future life sciences growth.***

# Brazil

| 1.1% | 657 | 14.0% | 9.0% | 44 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2007) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***The Brazilian government hopes to grow its innovation capabilities in agricultural and human-use biotechnologies, leveraging current representation in manufacturing aspects of the industry.***

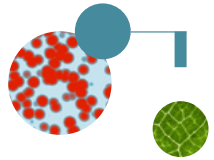
## *Overview*

Brazil has enjoyed one of the fastest growing economies over the past few decades and could continue its upward momentum as a leading South American economy. Advancements to its national healthcare system and national interest in the life sciences will funnel economic growth to the industry.

Brazilian-national companies continue to attract interest from foreign investors and players, predominantly in the manufacturing aspect of the value chain. Most recently, the Pall Corporation announced an agreement to acquire its Brazilian distribution partner, Engefiltro. Earlier this year, Amgen purchased the Brazilian pharmaceutical firm Bergamo and re-acquired several products from Hypermarcas for distribution in the Brazilian market.

Brazil has welcomed advancements in clinical trials, generics, agricultural biotech and biofuels. During the past few years, large industry players such as Sanofi, Pfizer, Valeant and Watson pharmaceuticals each made acquisitions or partnership deals with Brazilian generic-makers. Brazil is also a leading producer of genetically modified crops and draws upon renewable sources to meet its energy needs thanks to its strong agrarian roots. As the world's largest producer of sugarcane (used to make ethanol), the country will continue to play an important role in biofuels.

# Brazil



*Brazil invests roughly one percent of its GDP on research and development with plans to increase such investments to 1.5 percent.*

## Industry framework

### Intellectual capacity

The University of São Paulo and the State University of Campinas host a majority of the country's research and related degree programs. Although these universities are not world class, they are working to enhance their programs with the help of many government-funded incentive programs. Brazil is home to 90 biotech companies.

On the production end, Brazil is challenged by a relatively weak labor quality. The workforce is largely unskilled for life sciences purposes particularly in the areas of quality assurance, production and logistics. Only one technical school, the Institute of Science, Technology and Industrial Quality (ICTQ), has programs to meet the technical needs of the industry.

### Innovation capital

The Butantan Institute, affiliated with the São Paulo State Secretary of Health, is a research development and training center and is the largest producer of immunobiologics and biopharmaceuticals in Latin America.

In March 2011, the São Paulo state government announced plans for the country's first plasma fractionation plant. Located within the Butantan Institute, the plant is being built to respond to World Health Organization (WHO) standards that call on every country to have production facilities for blood by-products and vaccines. The São Paulo government enlisted the advisory services of GE Healthcare and expects the plant to be operational by mid-2012, with product commercialization to begin in 2013.

### Fiscal & political resources

Over the past two decades, the Brazilian government has encouraged development of the nation's innovation industries.

With the passage of the intellectual property laws in 1996, patents on pharmaceutical products were granted for the first time, marking a major turning point. Since that time, the government has added protections for innovation.

- The Innovation Law of 2004 offers incentives for developing partnerships between private companies, research institutions and universities, incentives for universities and research institutions to participate in innovation, and incentives to promote innovation within private institutions.
- The Law of Goods offers private sector incentives to invest in R&D.
- The government's industrial policy prioritizes the development of domestically owned private pharmaceutical manufacturers. Most notably, the Profarma-Innovation program, operated by the government's development bank, Banco Nacional de Desenvolvimento Econômico e Social (BNDES), is investing about R$2.5 billion ($1.5 billion)[1] in the industry through 2012.

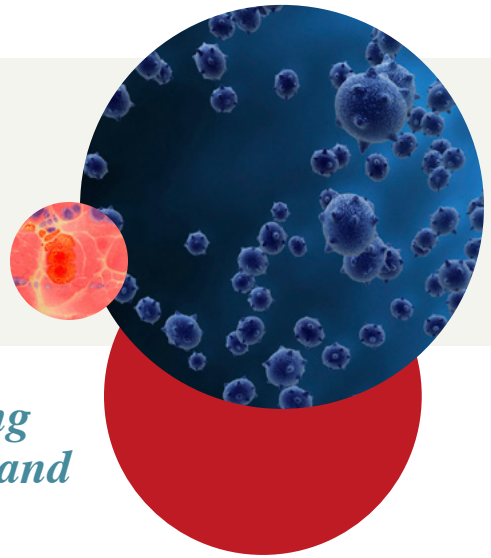
Brazil invests roughly one percent of its GDP on research and development with plans to increase such investments to 1.5 percent. More than half of the R&D spending is publicly funded; many of the aforementioned efforts aim to increase private sector investment in the industry.

## Outlook

Perhaps one of the biggest challenges for Brazil's future as a biotechnology hub is the inability to bring to market its discoveries. Although life science and healthcare disciplines account for more than 25 percent of the research conducted at Brazilian universities, they represent 3.2 percent of patent registrations in the country, according to a study by Prospectiva Consultoria. Lack of seasoned industry professionals and R&D facilities combined with leery foreign and domestic investors will continue to challenge Brazil's development of a high-tech hub.

1. Six month average conversion of R$1.64 per US dollar as of October 2011.

# Puerto Rico



***Over the past five decades, many of the industry's leading players have moved manufacturing operations to the island to take advantage of incentives and reduced taxes.***

## Overview

The Commonwealth of Puerto Rico has deep-seated roots in pharmaceutical and medical device manufacturing. Puerto Rico is home to more than 140 FDA, EMA and MHLW-approved pharmaceutical and device plants and produces products for distribution in the United States, European Union and Japan.

Puerto Rico enjoys representation from some the industry's largest companies, including Eli Lilly, Merck, Pfizer, Johnson & Johnson, Novartis, GlaxoSmithKline, Bristol Myers Squibb, Abbott Laboratories and AstraZeneca. Big Pharma's presence is rooted in the offshore manufacturing sites established since the 1960s. Investment since that time has been focus on modernization, with a few high-tech labs and R&D facilities.

At mid-year 2011, Monsanto announced plans to construct a 20,000-sqare-foot R&D lab to replace temporary facilities with permanent ones in the southern town of Juana Diaz. The expansion is valued at $4.3 million and is expected to create nearly 50 jobs. In June 2011, Legacy Pharmaceuticals announced a $34 million expansion project over the next five years at its Humacao complex, adding 300 jobs. Legacy will receive more than $1.5 million in job-creation incentives from the Puerto Rico Industrial Development Company (PRIDCO).

Additionally, Merck, Sharp & Dohme, the British-based subsidiary of Merck & Co., announced a $65 million investment plan at its Barceloneta site. The company will build a new plant and employ an additional 200 people.

## Industry framework

**Innovation capacity**
The primary academic research institution is the University of Puerto Rico (UPR), which features multiple locations throughout the island including the UPR Medical Sciences Campus in San Juan. Other academic institutions include the Ponce School of Medicine and the San Juan Bautista School of Medicine.

**Innovation capital**
One of the largest groups working to develop the island's capabilities is the Puerto Rico Science, Technology and Research Trust. Beyond its efforts to build the territory's talent pool and transfer technology from the workbench to the marketplace, the trust's flagship initiative is its San Juan Knowledge Corridor. The planned 2,000-acre "science city" will encompass a mix of educational, commercial, laboratory and residential space. The campus will connect to existing

# Puerto Rico

infrastructure at UPR's Rio Piedras Campus, Medical Sciences campus and the future UPR/MD Anderson Comprehensive Cancer Center and Molecular Sciences Complex, in addition to 11 area hospitals.

Also working in close collaboration with the Science, Technology and Research Trust is the Puerto Rico Industrial Development Company (PRIDCO) and the Pharmaceutical Industry Association of Puerto Rico (PIA PR).

**Fiscal & political resources**

Puerto Rico's life sciences industry began as a destination of choice for offshore manufacturing due to low local corporate income taxes (no higher than seven percent) and no U.S. federal income tax.

Other financial incentives include a 200 percent tax credit for R&D and job training costs, accelerated depreciation for investment in buildings, machinery and equipment and tax credits and deductions applicable for 10 to 25 years, depending on eligibility. Puerto Rico also boasts a foreign trade zone status, which means raw materials, components and finished goods may be stored and transported tax free, U.S. duties are deferred and no U.S. duties and Puerto Rico excise tax payments on products exported to foreign markets.

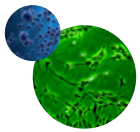
In October 2010, a four percent tax was introduced under Law 154, impacting all offshore companies with manufacturing operations in Puerto Rico. Although the measure received heavy criticism from the industry at the outset, the new law seems to be benefiting U.S. pharma companies In March 2011, the Internal Revenue Service announced that U.S.-based parent companies with Puerto Rican manufacturing operating that are subject to Law 154 may claim a federal tax credit against the levy. The lack of industry involvement during the legislative process has been called into question and such lack of transparency may discourage drug makers from expanding operations on the island.

As a United States territory, Puerto Rico benefits from national funding programs and grants. In 2010, the National Institutes of Health granted $59 million to the Commonwealth of Puerto Rico. Although this amount was well below other emerging life science markets in the United States, it does represent an important funding source for the island and its research institutions. Additionally, its territory status means operations on the island benefit from the same intellectual property protection and FDA rules as on the mainland.

## Outlook

In recent years, the local government has become more interested in life sciences innovation and R&D. However, Puerto Rico faces an uphill battle. The advantage once held by lower-cost operations is being challenged by developing countries throughout Asia and other parts of Latin America, while on the R&D front it competes with other emerging markets in the United States. The island is not as well positioned for successful innovation as most U.S. markets.

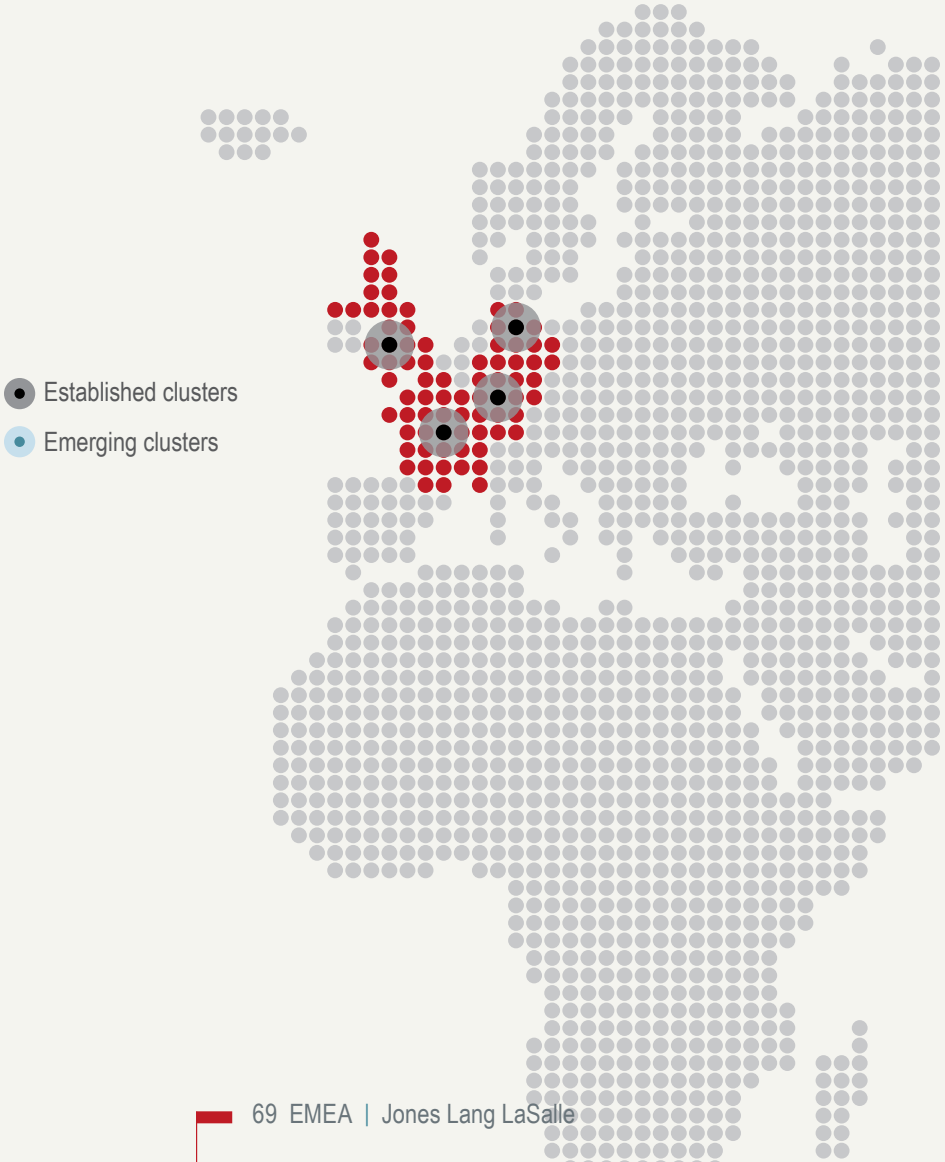
Despite Puerto Rico's line-up of top industry names, facilities on the island receive a disproportionate amount of warnings and citations from the FDA when compared to other facilities in the United States. A University of Ohio report in September 2011 found that quality issues are more likely to occur at offshore sites, citing challenges in the transfer of knowledge and language and cultural barriers as the reasons.



***The Commonwealth of Puerto Rico has deep-seated roots in pharmaceutical and medical device manufacturing.***

# EMEA

***In this section we review established clusters in Europe that are home to a range of pharmaceutical, biotechnology and medical device companies.***




A rich mixture of factors, including high-quality infrastructure, stability, a history of innovation, ease of doing business and some of the world's best educational establishments, continue to attract investment in the region.

Like the United States and other mature life science markets, Europe is increasingly facing challenges to its primacy from emerging markets across the globe. But despite the challenges and changing geographic scope of global life science companies, major established European clusters are sure to remain critical for the industry going forward.

**Established**

**France**

**Germany**

**Switzerland**

**United Kingdom**

# France

| 2.0% | 3,496 | 23.0% | 11.7% | 17 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2007) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***France is one of the leaders in the life sciences industry, thanks in large part to the size of its market. It is first in Europe in terms of medicine production by volume and among the main global pharmaceutical exporters.***

## *Overview*

France's life sciences industry produces yearly revenue of about €47 billion ($66.5 billion)[1] and reinvests more than €1 billion ($1.4 billion)[1] each year. The country is acknowledged for the quality of its research and for its history of therapeutic innovation and it benefits from the best health system in the world, according to the OECD.

The French landscape is clearly dominated by the Paris region due to its strategic location and its high education level, important concentration of prestigious hospitals and high-tech research. Consequently, Paris and its closest suburbs host most of the largest pharmaceutical headquarters. Even though there are no easily identifiable submarket clusters, it is nonetheless possible to spot some higher concentrations of laboratories in the first western inner suburb which include Roche, Ipsen and Pierre Fabre at Boulogne, Servier at Suresnes, Bayer Schering at Puteaux, AstraZenexa, Bristol-Meyers Squibb (BMS) at Rueil Malmaison, and to a lesser extent in the south outer suburb.

The ambitious plan for "Grand Paris", a major urban planning project to reinforce the position of Paris as a leading city on the international scene, also involves a dedicated cluster located in the Villejuif/Evry submarket. This cluster will specialize in healthcare and life sciences, capitalizing on high-level research institutes specializing in a variety of treatment arenas.

# France

Pharmaceutical production is spread among several big urban areas, essentially in the Paris region, the centre of France (Centre) and the south east (Rhône-Alpes).

The life sciences market in France, like many mature life sciences markets globally, is in the midst of significant change. Restructuring of operations, consolidation, mergers and acquisitions are all impacting the overall shape and geography of the sector, leading many industry participants to challenge and re-think the way they structure and coordinate their different activities.

There is a clear trend towards outsourcing, especially of pharmaceutical production, to better focus on the most strategic activities. An important concern of life science companies is cost reduction via the rationalization of the real estate portfolio. Many larger groups are looking at multi-site consolidation options and lease renegotiation.

Business rationalization is also having a clear impact on space utilization and translates directly into real estate strategies. A move away from working in cellular offices has been evident, with several companies now introducing more open plan designs for headquarters. Many industry participants have also increased densities and have restructured portfolios as part of wider rationalization. Sanofi, Merck and Roche provide good recent examples of this trend of restructuring and rationalization.

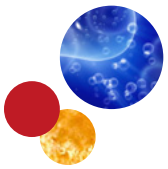
To optimize resources, sale-lease back operations have also been favored. Merck and BMS are two recent examples of companies that have chosen this route to raise capital and increase occupational flexibility.

## *Industry framework*

**Intellectual capacity & innovation capital**

The biopharmaceutical sector in France involves more than 104,000 employees. Education is also an important asset, with more than 18,000 new highly qualified graduates produced by the French higher education system each year.

The sector benefits from significant investment, with about €4.9 billion ($6.9 billion)[1] spent annually on R&D, according to 2008 figures. The biotech network is especially dynamic in France, with strong leaders operating in niche markets and growing on the international scene including BioAlliance, Nicox and ExoHit.



***The French landscape is clearly dominated by the Paris region due to its strategic location and its high education level, important concentration of prestigious hospitals and high-tech research.***

# France

Several dedicated research centres focused on high-tech biology or new therapies have been created both within Paris, and throughout France, these include:

- Lyonbiopôle, Rhône-Alpes. Dedicated to infectious pathologies, vaccines and nano-biotechnologies
- Medicen Paris Région, Ile-de-France. Dedicated to infectious pathologies, central nervous system, cancer.
- Alsace BioValley, Alsace. Dedicated to therapeutic innovations.
- Nutrition Santé Longévité, Nord Pas de Calais. Specialized in the impact of nutrition on health.
- Cancer Bio Santé, Midi-Pyrénées. Dedicated to research on the cancer and innovative therapeutics.
- EuroBioMed, Provence-Alpes-Cote-d'Azur et Languedoc Roussillon. Focusing on rare diseases.
- Atlantic Biothérapie, Pays de la Loire. Specialized in cellular and tissue engineering and immunotherapy.

**Fiscal & political resources**

The life sciences industry in France benefits from a significant commitment from the French government. The strategic council for the health industries, chaired by the President, includes government agencies and industry leaders to establish specific measures such as tax credits for research, more efficient clinical testing, or budgets that include funds to assist biotech companies.

Industry growth is also based on strong partnerships with the public sector, enjoyed by a full range of market participants, from big international companies to smaller businesses, start-ups and academic research laboratories.

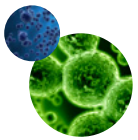
## *Outlook*

The French life sciences industry remains one of the largest in Europe. It has won and maintained its leading position in pharmaceutical production for 15 years. Like other mature markets in Europe, this record is now challenged by regional and global competitors.

The life sciences sector is mature, with traditional pharmaceutical companies facing growing competition from generic drugs, which are actively encouraged by health care cost reduction efforts. Vigilance from local and international health authorities continues to impact the number of new products, and a growing pressure on costs, in the context of the economic crisis, is reducing the resources available for investment in healthcare.

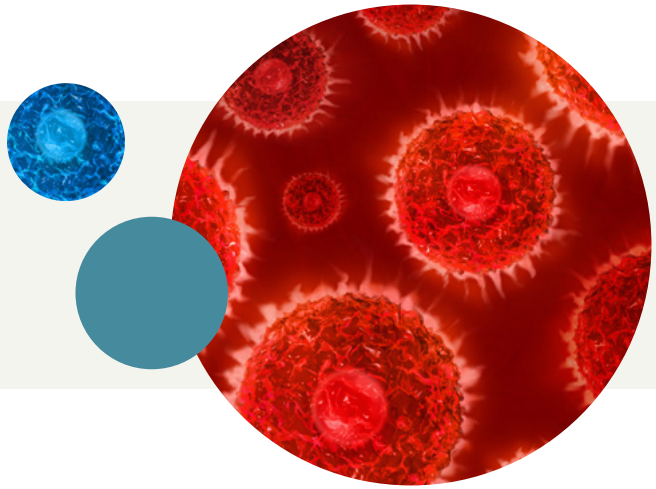
However, the outlook for the life sciences sector within France remains solid. Strong existing clusters, a deep presence from established international life science companies, renowned centres of research and a favorable incentive program for new investment from the French government will continue to support growth in the sector.

1. Six month average conversion rate of €0.71 per US dollar, as of October 2011.



***The life sciences sector is mature, with traditional pharmaceutical companies facing growing competition from generic drugs, which are actively encouraged by health care cost reduction efforts.***

# Germany



| 2.5% | 3,532 | 16.0% | 11.3% | 7 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2007) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***Germany's increasing consumer demand as a result of healthcare reform and a government push for high-tech industry growth will support activity in the country in the near-term.***

## *Overview*

The life science sector in Germany continues to grow in importance and is one the largest in Europe. The German pharmaceutical sector's export ratio grew from 36 percent in 1995 to more than 50 percent in 2009, and rising life expectancy and increasing health awareness in the country with Europe's largest population (82 million) also drives consumer demand. Germany is the fifth largest location for dedicated biotechnology companies within the OECD.

Even during the economic crisis, the life sciences industry in Germany showed resilience. In 2009, the pharmaceutical sector grew by 5 percent, while the broader manufacturing industry saw a decline by 18 percent. This stability was also reflected in employment statistics, which fell by less than 1 percent in 2010. However, investment spending by research-based pharmaceutical companies fell by 14 percent in 2010.

The life sciences industry has a number of industry-relevant clusters across Germany, the largest of which are located around Munich, Berlin, the Rhine Neckar triangle and Ruhr area. One of Europe's most important biotech clusters, the BioRegion Ulm, comprises 60 biotechnological, pharmaceutical and medical-technology companies, while the Munich Biotech Cluster is made up of more than 200 companies, employing some 16,000 people.

Half of Germany's newly formed companies in 2010 were located in the Munich area, in the Federal State of Bavaria. Various chemical parks in Germany also provide specific

# Germany

*The life sciences industry has a number of industry-relevant clusters across Germany, the largest of which are located around Munich, Berlin, the Rhine Neckar triangle and Ruhr area.*

location advantages to companies and investors, and the logistics infrastructure, often combining various transport modes in one location, ensures Germany's international connectivity.

## Industry framework

**Intellectual capacity**

The pharmaceutical industry employs around 126,000 people and is growing. In addition to global companies such as Merck KGaA and Boehringer Ingelheim, Germany supports a large number of smaller life sciences companies. About 92 percent of pharmaceutical manufacturing companies in Germany employ fewer than 500 people. In the commercial biotechnology sector, the number of employees grew by three percent to 32,500 in 2010. Germany ranks first in Europe for production of chemicals and biopharmaceuticals.

**Financial & political resources**

The life sciences industry is considered the leading sector for innovation in Germany. €1.2 billion ($1.7 billion)[1] were given in grants from 2006–2009 for innovations in biotechnology, pharmaceuticals and medical technology as part of the federal government's "High Tech Strategy"[2], and federal grants of more than €5.5 billion ($7.8 billion)[3] have been dedicated to the health care sector's research during the period ending in 2016. Only the United States exceeds this volume of support. In terms of intellectual property protection and planning and operating security, Germany is one of the best locations globally, according to the World Economic Forum. The industry also benefits from a number of renowned universities and research institutes, including the Max Planck Society and the Leibniz Association. Life sciences and biomedical engineering programs are offered by more than 60 national universities.

Healthcare reform in Germany is also likely to boost areas of the life sciences industry. Generic drugs and health management are two areas that will be promoted in the course of healthcare reform that became effective in 2011. Special provision is also being made for the pharmaceutical and biotechnology industries.

The National Research Strategy BioEconomy 2030 and the Health Research Framework Programme, both of which were implemented by the German federal government in 2010, provide further political support for the industry. Funding of about €8 billion ($11.3 billion)[3] is available for allocation over the next years as part of this programme.

## Outlook

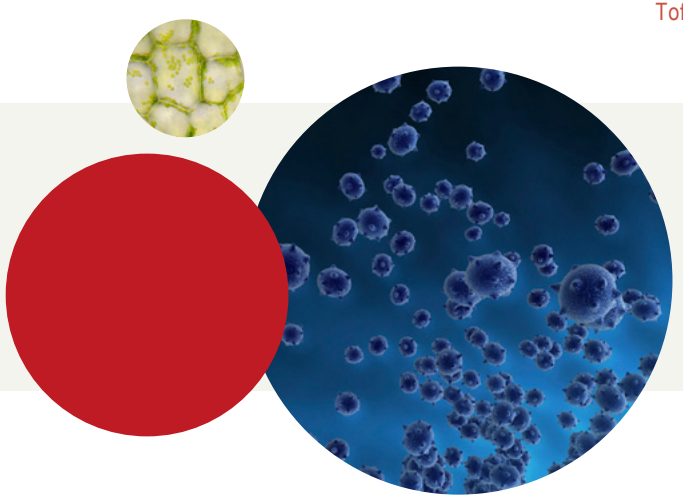
Similar to fellow Western European markets active in life science, Germany will continue to be subject to global competition as the life sciences sector restructures its operations and real estate portfolio to fit the new realities of emerging markets in Asia and Latin America. In the short term, economic uncertainty and Eurozone concerns will also dominate news flow.

However Germany remains one of the most important markets for life sciences in Europe, and a productivity rate 10 percent above the average of Europe's 15 core economies makes Germany one of the more attractive business locations in Europe. Additional positive factors include the positive R&D environment and partnerships with universities and research centres.

1. Six month average conversion rate of €0.71 per US dollar, as of October 2011.
2. The Government's "High Tech Strategy aims at reaching the Lisbon/ Barcelona objectives of the EU, that is to increase R&D expenditures to at least 3 percent of the GDP until 2010. This aim has not yet been achieved.
3. See footnote 1.

Tof C

# Switzerland



| 2.9% | 3,436 | 25.0% | 11.3% | 1 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2004) | Researchers in R&D (per million people, 2003) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***Academic excellence, high-profile education programs and the high quality of life render Switzerland not only very competitive in the global market for life sciences talent, but increasingly at the entrepreneurial level too.***

## *Overview*

Switzerland is one of Europe's most established life sciences locations. For the second year running, Switzerland was rated number one in the World Economic Forum's Global Competitiveness Report 2010–2011, reflecting its advantages for the life science industry and other research, production and service companies. Switzerland is also a leader in education and is one of the world's most active countries in research.

The density of biotech companies in Switzerland is unparalleled world-wide. Its life sciences companies range from large multinational corporations such as Merck Serono, Novartis and Roche to innovative start-ups.

The main clusters of life science activity can be found in Basel (BioValley), Zurich (Greater Zurich Area) and in Geneva (BioAlps). There, the highly concentrated presence of the life sciences industry, universities and government assistance for spin-offs support the vibrant life sciences activities in these areas.

Aided by the proximity of top pharmaceutical companies such as Roche and Novartis and by the strong financial sector in Zurich, academic excellence in the biomedical sciences serves as a motor for innovation in the biotech and medtech sector.

Joint activities of universities and private companies provide favorable conditions for young start-up companies. Benefits such as low-cost rental space at the university's labs during the first years and the availability of biotech parks and business incubators in and around Zurich also support life sciences growth.

# Switzerland

## Industry framework

**Intellectual capacity & innovation capital**
Switzerland has a strong record of creativity and innovation. In the 2010 Innovation Union Scoreboard—a comparative analysis of innovation performance among the countries of the European Union—Switzerland ranked first, confirming its position as Europe's leader in innovation.

Swiss universities and institutes of technology conduct research at the highest level, working closely with the international research community. The country's scientific research institutions rank amongst the world's best.

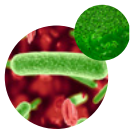
The Swiss Federal Institute of Technology Zurich, the ETH Zurich, is the top-ranked university in continental Europe, and the University of Zurich, with its University Hospital, is among the top five European universities in biomedical science. Synergies between the two institutions abound, greatly advanced by physical vicinity and complementary research as well as by advanced degree programs.

**Fiscal & political resources**
Life sciences are the dominant start-up industry in Switzerland and benefit from good access to private sources of capital. In the past decade, the sector has emerged as the dominant investment field among innovative start-up firms both in numbers of transactions and in total amounts of investment. After the dot-com bubble burst in 2001, life sciences raced ahead of all other sectors in terms of venture capital investment. Its share has risen from about 20 percent to more than 70 percent since 2004. Even in such a well-developed entrepreneurial ecosystem as Switzerland's, life sciences have become the most important destination for venture capital.

## Outlook

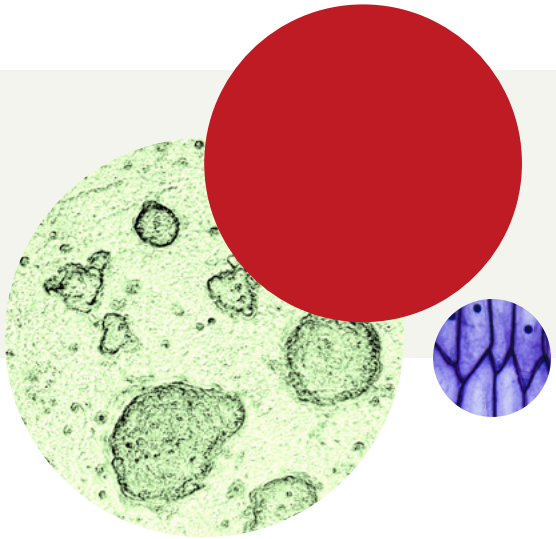
In the short term, the massive appreciation of the Swiss franc, as a result of broader global macroeconomic uncertainty and Switzerland's safe haven status, is likely to lead to a reduction in nominal exports. This, in turn, means estimated short-term growth rates for the main life science sectors (especially pharmaceutical and chemical industry) remain at 1.8 percent, behind the forecast for overall economic growth of approximately 2 percent.

Despite facing emerging competition from a number of global markets, over the long term, Switzerland is likely to remain one of the world leaders in life sciences innovations. The dynamic mix of academic institutions, high concentration of life sciences corporations and leading infrastructure will ensure the long-term success of the industry.



***The massive appreciation of the Swiss franc, as a result of broader global macroeconomic uncertainty and Switzerland's safe haven status, is likely to lead to a reduction in nominal exports.***

# United Kingdom



| 1.9% | 4,269 | 23.0% | 9.3% | 13 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2008) | Researchers in R&D (per million people, 2008) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***The United Kingdom's long-established and strong science base is one of the significant factors driving investment and development in the life sciences sector.***

## *Overview*

The life sciences sector in the United Kingdom is among the largest in the world, and includes more than 3,500 medical and biotechnology companies that, combined, generate annual revenue of £15 billion ($24.2 billion)[1]. When combined with pharmaceutical exports of £18 billion ($29.0 billion)[1], the United Kingdom (U.K.) is a major supplier of life sciences products and services across the globe.

### *Cambridge*

Cambridge is one the United Kingdom's leading clusters based upon the strengths of Cambridge University. Cambridge University alumni account for 20 percent of the world's Nobel Prize winners in medicine and chemistry. The cluster is home to around 25 percent of Europe's biotechnology companies and the world's largest medical research charity, the Wellcome Trust, also has a base there.

Due to consistently high demand for lab and office space in Cambridge, the availability of large or self-contained units can be limited, although pockets of smaller space are more widely available. Rents range from £16.00 per square foot per annum ($25.78)[1] for shell and core lab space, to £26.00–£28.00 per square foot per annum ($41.89–$45.12)[1] for fully-fitted space.

### *South East of England*

The South East of England is an important cluster for a wide range of life sciences companies. Benefiting from proximity to London and the world's busiest international airport Heathrow,

# United Kingdom

the South East region is a mature cluster that provides research sites for three of the top 10 major global pharma companies and a number of biotechnology firms.

Oxford is another cluster of importance for life sciences within the broader south-east region, with more than 100 biopharmaceutical/healthcare companies taking advantage of close links to the city's Oxford University. Much of the office and lab space is located out of town in science and business parks. The Oxford real estate market is stable with limited new construction keeping supply relatively limited. Conventional Grade A office space is available at £22.50–£25.00 per square foot per annum ($36.25–$40.28)[1], with fitted lab space available at similar rents. Availability of office space is greater in the broader south east, and the Western Corridor region, west of London, remains popular with life sciences companies.

### *London*

Although many larger pharmaceutical and biotech companies base their operations outside Central London, the cluster has representation of more than 100 bioscience businesses, not to mention 28 universities and five renowned medical schools. It is also home to UCL Partners, one of Europe's largest academic health science partnerships of hospitals and medical research centres.

London's West End is one of the most expensive office markets in the world. Although some life sciences companies maintain a small office presence in the exclusive areas of Mayfair and St. James', for practical purposes most locate in or around submarkets such as Paddington and Kings Cross near to the major hospitals, universities and research facilities. Reasonable quality Grade A office space in these hubs is available from £40.00–£45.00 per square foot per annum ($64.45–$72.51)[1].

### *North West of England*

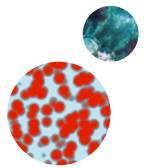
North West England is the United Kingdom's third largest bioscience cluster, with a number of global life sciences companies operating there. Manchester University is one of Britain's largest universities and recently collaborated with GlaxoSmithKline and AstraZeneca on a new research centre. AstraZeneca is one of the global pharmaceutical companies with a large base in the area.

The North West of England is further supported by the strong academic research capabilities of the Universities of Liverpool, partner hospitals and locally based national support facilities such as the National Biomanufacturing Centre. Prime office space in Manchester city centre is available at £28.00 per square foot per annum ($45.12)[1].

### *Scotland*

Scotland, is another important hub in the United Kingdom life sciences sector, with more than 500 life sciences companies, increasing by an average of 20 percent a year.

Edinburgh is a hotbed of life sciences innovation, with particular achievements in recent years in the field of stem cell research The Queen's Medical Research Institute brings together four world class research centres specializing in Cardiovascular Science, Inflammation Research, Reproductive Biology and Regenerative Medicine. The Institute houses more than 600 researchers and aims to tackle a wide range of diseases at the most fundamental cellular level. The supply of prime office space in Edinburgh is limited, and currently costs around £27.50 per square foot per annum ($44.31)[1], with incentives still generous at around 32–36 months achievable on a 10-year term.



# United Kingdom

## Industry framework

The United Kingdom's life sciences industry has a record of cutting-edge research and is renowned for developing innovative, effective solutions to global and local health issues. It has also served as a hub for scientific and business collaboration, bringing together funding from private and public sources to support innovation and create routes to market. According to U.K. Trade & Investment (UKTI) figures, United Kingdom industries spend around £7.5 million ($12.1 million)[1] each day on R&D, and have attracted major R&D investments from a range of the world's top life sciences companies. As a direct result, the United Kingdom has created one in four of the world's top 100 medicines and 45 percent of all pipeline products in Europe.

The United Kingdom is home to a number of outstanding universities, four of which consistently rank among the world's top 10. Their expertise and engagement with the industry support innovation and generate a wide range of new discoveries and patents every year. The creation in May 2011 of the Manchester Collaborative Centre for Inflammation Research (MCCIR)—by GSK, AstraZeneca and the University of Manchester—represents one of the most recent examples of this trend, and is aims to establish a world-leading translational centre for inflammatory diseases.

The United Kingdom-based pharmaceutical industry directly employs 72,000 people, of whom 26,000 work in R&D. It is the most popular location in Europe for investment in biotechnology and healthcare. Government policy is to support growth in life sciences with a range of incentives and tax relief measures are available for new investors.

## Outlook

Despite the recent stock market turmoil and uncertainty linked to the Eurozone debt crisis, the life sciences sector has continued to show resilience and stable performance in the United Kingdom. Overall private sector employment in the United Kingdom is growing, and the government has recently announced a strong commitment to encourage growth in high-tech and R&D-led industries with a number of tax credits and incentives.

Restructuring and productivity gains from United Kingdom operations remains an important focus for life sciences companies as they adapt functions and locations in response to strategic pressures. Such rationalization has fueled some disposal activity and selective head count reductions in some locations. But a significant level of new investment has also been seen through 2011, with a range of companies committed to expand and increase investment in facilities in the United Kingdom and other mature European markets. This combination of selective investment and continuing efforts to optimize productivity from existing operations is likely to dominate the outlook for life sciences over the next 12–24 months.

1. Six month average conversion rate of £0.62 per US dollar, as of October 2011.

***The life sciences sector in the United Kingdom is among the largest in the world, and includes more than 3,500 medical and biotechnology companies that, combined, generate annual revenue of £15 billion.***

# Asia Pacific

***In this section we discuss four clusters in the Asia Pacific region that are emerging at the forefront of industry activity.***

Emerging clusters in Asia have extremely high growth potential for a variety of reasons. Factors such as growing economies, large populations, rising personal income levels and progressive political policies encourage growth and direct investment from industry leaders.

In the coming years, market demand in population-dense Asian Pacific clusters is expected to exceed demand from the mature markets in the United States and Europe. Thus, we examine four emerging clusters in the region.

**Emerging**

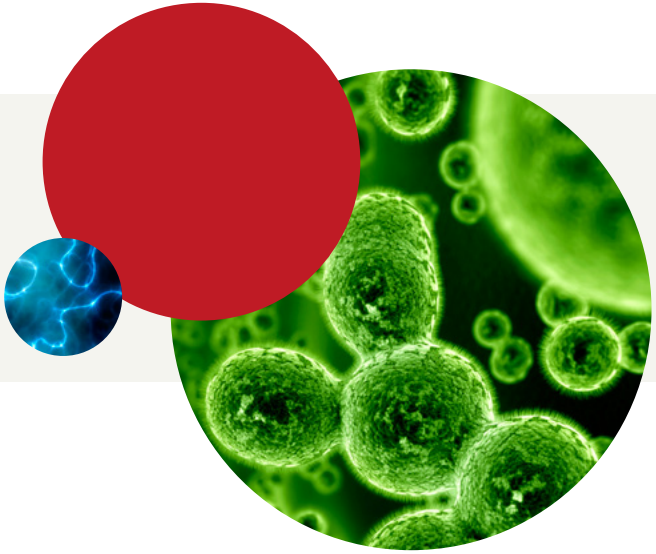
**China**

**India**

**Indonesia**

**Singapore**

# China



| 1.4% | 1,071 | 31.0% | 4.6% | 29 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2007) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***The People's Republic of China is quickly emerging as a top destinations for life sciences investment due to its huge market potential (large population, improving public health care systems, increasing healthcare expenditure as a percentage of GDP) and low cost manufacturing sector.***

## *Overview*

China's pharmaceutical industry has enjoyed massive growth over the past decade. The country's emergence onto the radar screen of multi-national life science companies parallels its growth into one of the world's dominant economies with a significant and growing middle class, an increasingly open and inviting marketplace and waves of foreign investors lined up to take part.

Certainly, one reason for interest in China was its low-cost manufacturing capabilities. Historically, Western pharmaceutical makers enjoyed a 30 to 50 percent cost savings by relocating the manufacturing of intermediates, APIs, starting materials and some finished drugs to China. The focus is now on expanding capabilities beyond manufacturing into more high-tech R&D functions. Multinationals are taking bolder steps as highlighted by AstraZeneca's recent announcement to invest $200 million on a new plant in China (its biggest-ever investment in one production facility) that will turn out injectables and oral drugs for the domestic market.

With the world's largest population and second-largest economy with a growing middle class, China's prospective consumer base is unmatched by any country worldwide. Additionally, the Chinese government is trying to entice foreign and domestic investment in a local life sciences industry, spending billions on the advancement of science and technology as outlined early 2011 in the 12th Five-Year Plan.

# China

*With the world's largest population and second-largest economy with a growing middle class, China's prospective consumer base is unmatched by any country worldwide.*

The life science industry is scattered throughout several cities and provinces primarily located in China's eastern and southeastern regions. It is closely aligned with the country's geographic distribution of population and wealth. Clusters have formed around the sources of the best talent, so the key R&D bases for pharma have been in Shanghai and Beijing, where the top five universities in the country are. Other clusters include the cities of Tianjin and Guangzhou within the provinces of Hebei, Shandong, Jiangsu, Zhejiang and Guangdong.

China is estimated to have roughly 4,500 pharmaceutical manufacturers and 8,000 distribution companies, with a fairly even distribution among state-owned, private domestically owned and foreign-owned enterprises. The market is fragmented, with no dominant domestic companies.

Chinese pharmaceutical manufacturers largely focus on non-branded generics. Large foreign companies have so far been interested primarily in manufacturing as well. However, state funding and a return of domestic talent from abroad have fueled the rapidly growing biotechnology sector. Domestic start-ups and multinational companies compete in this growing market. Domestic companies involved in bio and pharma R&D include C&O Pharmaceutical Technology headquartered in Hong Kong, NYSE-traded Wuxi AppTec in Jiangsu Province, Shijiazhuang Pharma Group from Shijiazhuang in the Hebei Province, state-owned Harbin Pharmaceutical Group, NASDAQ-traded Sinovac Biotech in Beijing and Zensun Sci & Tech Co. in Shanghai.

In March 2011, Pfizer announced plans to relocate its antibacterial research unit from Groton, Massachusetts to Shanghai. The company said the move will bring it closer to important hubs for science and technology and give it better access to the Chinese drug market. Other large pharma companies with research operations in China include Eli Lilly, Roche and Novartis.

## *Industry framework*

### Intellectual capacity

Similar to most emerging markets, the lack of a workforce with specialized knowledge and skills relevant to the industry poses a real challenge. To combat this, the Chinese government works to attract expatriates. Financial incentives and modern laboratories offered by the Chinese government as part of the five-year plan have successfully attracted 150,000 Chinese professionals and with them, the education and industry experience gained from abroad. Today, the talent availability is excellent. Companies can hire increasing numbers of science graduates who have globally-competitive skills.

### Innovation capital

Several research parks, a few of which are funded by the government, are located throughout the country, supporting budding science and technology enterprises.

- Zhangjiang Hi-Tech Park: The park is located in Shanghai and was established in 1992 as China's state-level high-tech industrial development zone. A multitude of national industries are based here in addition to start-ups and other companies looking to benefit from its incubator program. Earlier this year, EMD Millipore opened a 28,000-square-foot Biopharmaceutical Technical and Training Center in the park to support manufacturers in the area with GMP compliance.
- Suzhou BioBay: Located in Dushu Lake Science & Innovation Education District, the park spans over nine square miles and offers innovation incubator and accelerator support.

# China

- Zhongguancun (ZGC) Life Science Park: The professional science park is being developed by the Beijing Municipal Government and includes a two-phase master plan that will cover over 615 acres. Phase I of the project includes a new enterprise incubation center, small business development center, as well as research and development facility, industrial production facility and medical service area totaling 5.8 million square feet, while Phase II includes 8.9 million square feet of medical care and commercial space that integrates clinical, research and teaching resources of Chinese Academy of Medical Sciences and Peking Union Medical College.

**Fiscal & political resources**

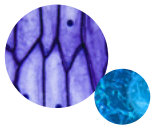
Recognizing the potential of its emerging life sciences industry, the Chinese government is working on multiple initiatives to encourage development. As part of its economic stimulus package, the government allocated over 850 billion yuan ($132 billion)[1] to healthcare improvements and aims to offer insurance coverage to more than 90 percent of its citizens by year-end 2011. As part of this effort, price controls were put in place on several hundred drugs by the National Development and Reform Commission (NDRC). The goal was to make them more affordable. Biotech, including agricultural biotechnology, bio-manufacturing and fuels, is one of seven strategic emerging industries identified in the 12th Five-Year Plan. The plan calls for government spending of over 12 billion yuan ($1.9 billion)[1] to support growth of biotechnology through 2015.

New Good Manufacturing Practices (GMP) rules became effective in March 2011, rolling out elevated standards and greater emphasis on pharmaceutical quality control systems. While the new GMP rules are expected to raise manufacturing and production costs, the enhanced standards will level the playing field. Multinational companies and Chinese manufacturers already operating at high GMP standards will be largely unaffected.

## Outlook

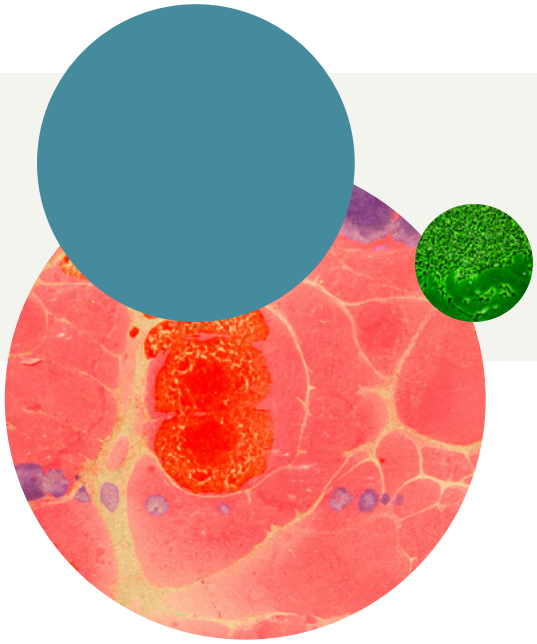
China's cost advantage has been eroded by inflation, rising wages, currency appreciation and challenges to the many tax reductions and rebates that China has traditionally offered to its own exporters. The various pressures will certainly reduce China's ability to undercut foreign markets. Balancing these trends, current talent availability, improved funding environment via government support and the increase in quality facilities change the manner in which China competes in the industry. China no longer has to be viable as a low-cost destination in order to attract industry interest and investment. Certainly, the outlook for life sciences in this immense and growing economy is good. Challenges faced by pharmaceutical companies include China's still-weak protections for intellectual property, and GMP compliance.

1. Six-month average conversion rate of 6.43792 yuan per US dollar, as of October 2011.



***China no longer has to be viable as a low-cost destination in order to attract industry interest and investment.***

# India



| 0.8% | 137 | 9.0% | 4.2% | 38 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2007) | Researchers in R&D (per million people, 2005) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***India's pharmaceutical market is largely driven by its domestically-produced generic drugs, and while the life sciences industry has achieved double-digit growth in many areas, it remains proportionately small for a nation of a billion people.***

## *Overview*

A self-reliant industry with low costs of production, the industry in India produces a full range of products and meets around 70 percent of the country's demand for the full suite of pharmaceutical products. India's life sciences industry is predominantly made up of manufacturing entities, contract manufacturing organizations (CMOs), and has a small, but growing, representation in biotechnology.

The production of generics, for both domestic and global use, is India's most robust sector of the industry. Domestic demand for pharmaceuticals has increased in recent years due to improved access to medical care and a rising average income. On the export front, India produces more than 20 percent of the world's generics and continues to gain the interest of global companies due to cost savings and the large presence of United States FDA and European Medicines Agency-approved facilities.

# *India*

The life sciences industry is largely situated among three of India's twenty-eight states: Maharashtra, Andhra Pradesh, and Gujarat, with smaller representation in the states of Goa and Karnataka. Formation of these clusters was aided by the government's designation of sector-specific Special Economic Zones (SEZ).

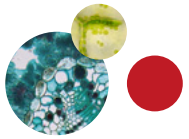
Gujarat, with concentration in the cities of Ahmedabad and Ankleshwar, lists more than 5,000 manufacturing licenses and more than 50 biotechnology companies. Companies in the area support a range of industry functions including bulk manufacturing and R&D, like large domestic companies Zydus Cadila and Intas Pharmaceuitcals.

Life science-focused cities within the Maharashtra cluster include Mumbai, Pune, Nashik and Aurangabad and account for roughly 18 percent of the country's output of pharmaceuticals by value, says the Maharashtra Industrial Corporation (MIDC). Industry players represent nearly the full spectrum of the value chain including APIs, formulations, bulk manufacturing and R&D. On the manufacturing side, the state lists more than 3,000 manufacturing licenses. Global industry players with facilities in the state include GlaxoSmithKline, Johnson & Johnson, Pfizer, Abbott and Sun Pharmaceuticals.

The cities of Hyderabad and Medak in the Andhra Pradesh cluster are highly active in formulations, R&D and bulk generic manufacturing and are home to Dr. Reddy's and Aurobindo Pharma. Hyderabad is home to Genome Valley, a biopharmaceutical zone spread across several suburbs. Genome Valley has several centers of excellence including the Centre for DNA Fingerprinting and Diagnostics and the United States Pharmacopeia in addition to smaller research parks like the IKP Knowledge Park and the Alexandria Knowledge Park.

The Indian life sciences industry is highly fragmented and competitive with more than 20,000 registered companies. In fact, the domestic leader, Cipla, barely exceeds a five percent market share. However, the industry structure is quickly changing. Similar to other global markets, India has begun to experience consolidation.

Domestic competitors include Ranbaxi, Lupin, Mankind Pharma, Alkem Labs, Sun Pharmaceutical and Dr. Reddy's Laboratories. Globalization among domestic companies is well underway. Many of India's largest players are expanding into clusters outside of the region. Zydus Cadila, for example, is headquartered in Ahmedabad but is active across the United States, Europe, Japan, Brazil, South Africa and many other emerging clusters.



***The production of generics, for both domestic and global use, is India's most robust sector of the industry.***

# India

## *Industry framework*

### Innovation capacity

India benefits from a well-educated, English-speaking labor force and enjoys a sizable share of chemists, all crucial components of its robust manufacturing business. Low levels of academic collaboration and a shortage of high-tech professionals, such as molecular biologists have limited the growth of R&D. This is partially offset by an increase in the number of Indian scientists who have opted to return home from abroad.

The clinical trial business in India, running at about 45 billion rupees ($1 billion)[1] in revenue annually, benefits from the country's large, genetically diverse and medically naive population, which means trials can be conducted quickly and at low cost compared with trials in the West.

### Innovation capital

One of the biggest challenges for India's budding biotechnology sector continues to be lackluster R&D investment. Market leaders such as Ranbaxy and Dr. Reddy's Laboratories allocate only 5–10 percent of their revenues on R&D, compared with an average 15 percent spent by Western pharmaceutical companies.

A number of Indian pharmaceutical companies have spun off their R&D divisions into separate units in hopes of attracting investment capital and scaling up operations. However, the approach has not been as successful as hoped. Some companies now seek to reduce risk through R&D collaboration with other companies.

### Fiscal & political resources

Recognizing the importance of current and future states of the life sciences industry, the central and state governments have developed measures to support various aspects of the industry.

On the biotechnology front, the Indian central and state governments have put competitive tax concessions in place to encourage R&D and support the formulation and distribution aspects of the value chain. In addition, they created an "abbreviated new drug application" to reduce product approval delays.

A few of the tax concessions include:

- Tax holidays for industrial operations established in free trade zones or under-developed areas
- Deduction of profits earned from exports
- Liberal depreciation allowances
- Deduction of capital R&D expenditures
- Relief on all contributions to approved domestic research institutions
- For pharmaceutical manufacturing units, an additional weighted deduction of 200 percent for expenditures related to in-house R&D
- A new provision provides 125 percent weighted deduction for expenditures incurred towards outsourcing of R&D activities

The Biotechnology Industry Partnership Programme (BIPP) has been launched by the Department of Biotechnology (DBT) to support high-end biotechnology research capable of generating globally recognized intellectual property. Additionally, a proposal is in place to create the National Biotechnology Regulatory Authority (NBRA), expected to be an autonomous body formed specifically to regulate the biotechnology segment and reduce regulatory overlap.

# India

To support the distribution channels used by the producers of generic drugs and CMOs, the Union Ministry of Health and Welfare, in collaboration with the pharmaceutical industry and airport developers GVK and GMR, plan to set-up dedicated cargo zones to handle pharmaceutical imports and exports.

Price controls are carried out on certain drugs by virtue of the Drugs Price Control Order (DPCO), supervised by the National Pharmaceutical Pricing Authority (NPPA). The Indian Government's Department of Pharmaceuticals has also started medicine shops, called 'Jan Aushadhi,' in various locations. These shops sell generic medicines at lower prices than their corresponding branded medicines.

***Various forecasts indicate that India is on the brink of becoming a major pharmaceutical hub, and in particular a lucrative destination for clinical trials for global giants.***

## Outlook

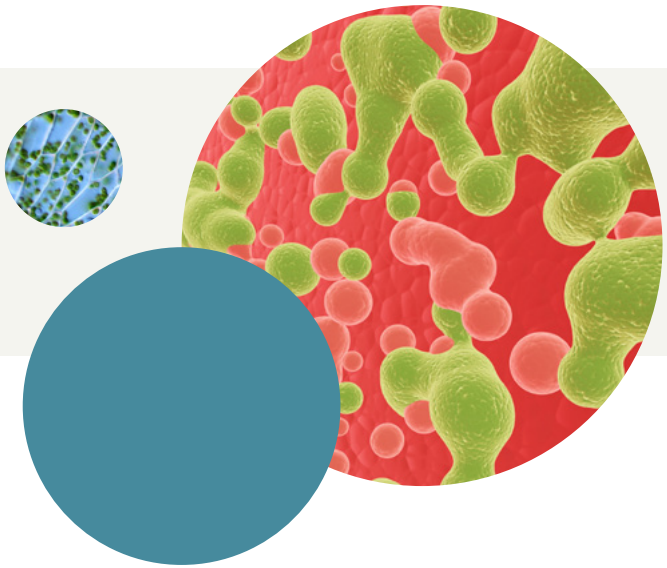
Various forecasts indicate that India is on the brink of becoming a major pharmaceutical hub, and in particular a lucrative destination for clinical trials for global giants, with several analysts valuing the country's pharmaceutical market at upwards of 2,288 billion rupees ($50 billion)[1] by 2020. Helping to propel this growth is strong local demand, fueled by the large population base and a growing middle class.

Beyond domestic demand, the area has created a positive reputation in areas essential to the future of the life sciences industry. India already has a strong CMO base and will continue to grow this area of the industry as global companies outsource to drive margins. In addition, with the large number of drugs coming off patent, the robust generic manufacturing market is poised to take advantage of new product areas. While the biotechnology market is still new, there is market share to be had in the realms of biosimilars and contract research. But advancements in high-tech infrastructure and human capital will be needed.

Legal infrastructure, in particular the regulation around ownership of public companies, is a big challenge to carry out business as it can slow down decision making. Another near-term challenge is the management of intellectual property. While the industry is supported by Intellectual Property Protection regime, licensing of most drugs and pharmaceutical products has ended. Manufacturers are now free to produce any drug duly approved by the Drug Control Authority, potentially hindering global players accustomed to more regulated environments.

1. Six-month average conversion rate of 45.7634 rupees per US dollar, as of October 2011.

# Indonesia



| 0.1% | 205 | 13.0% | 2.4% | 36 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2005) | Researchers in R&D (per million people, 2002) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

***Reflecting the rising disposable incomes of the population, Indonesia's pharmaceutical sector has seen double digit growth since 2009 and expects 14 percent growth for 2011. Change in legislation regarding investment will give the industry renewed growth.***

## *Overview*

The value of the market, estimated at Rp 34,508.8 billion ($4 billion)[1] in 2010 with 10 percent CAGR in the last five years, remains very small for a country of 240 million people. The sector is held back by a lack of local raw materials, increased competition in the generic drugs market, regulatory barriers against international investment, and a lack of innovation. However, economic prospects and changes in lifestyle added to the sheer size of the population make the Indonesian pharmaceutical market attractive.

Of the roughly 200 pharmaceutical manufacturers, the majority located in Java, the top 20 companies account for 80 percent of total production. The industry is largely domestic; four state-owned enterprises play an important role in generics and vaccine production through Kimia Pharma, Indofarma and Bio Farma. Seven out of the top ten companies are local, with the leader, Kalbe Pharma, holding a 14 percent share.

Indonesia imports more than 90 percent of the pharmaceutical raw materials it needs and exports of pharmaceutical products are very limited, with more than 75 percent of locally produced drugs consumed domestically. Exports might increase under terms of the ASEAN Free Trade Area (AFTA).

# *Indonesia*

About 35 companies are foreign owned. Pfizer, Bayer and GlaxoSmithKline collectively hold eight percent of the market, a very small share due to a series of entry barriers. Only the middle and upper income markets can afford pricey branded drugs. Ownership is limited to 75 percent for foreign investments and regulation 1010/2008 obliges foreign companies to set up local manufacturing.

## *Industry framework*

**Intellectual capacity**
One of the issues hampering the development of the pharmaceuticals sector in Indonesia is the lack of skilled labor and of trained staff, particularly at the Ph.D. level.

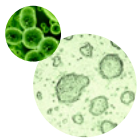
**Innovation capital**
Another issue is the lack of R&D in domestic companies. Product development overwhelmingly relies on foreign licenses or on expired patents. Despite this, several areas of opportunity exist:

- As incomes rise, consumers begin to demand more quality, thus encouraging local drug companies to innovate.
- The wide variety of tropical diseases could make Indonesia suitable for some R&D activities in this field.
- Herbal medicine ("jamu") is one area where Indonesia could create a competitive advantage, given the increased interest in and growing imports of 'alternative medicines' in Western countries. Raw material in this narrow area is abundant (30,000 of the 40,000 of available medicinal plant species are found in Indonesia) and the Ministry of Health ensures jamu is safe and backed by research.

**Fiscal & political resources**
Price cuts of branded generics, a new import tax imposed on raw materials for drug manufacturing and the lack of intellectual property rights (IPR) enforcement make Indonesia a challenging market to operate in. Also posing a challenge is the inclusion of Indonesia on the United States Trade Representative's Special 301 Priority Watch List in 2011, due to the prevalence of counterfeit pharmaceuticals (the total amount in circulation estimated at 15–20 percent of the total drugs on the market, says the International Pharmaceutical Manufacturers Group).

However, the Indonesian Health Ministry's focus on improving the country's business environment will encourage multinational drug makers to set up local manufacturing operations.

- A signatory to the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) has led to an improvement in patent protection — extending the term of protection from 14 to 20 years — and the introduction of the reversal of the burden of proof onto the defendant in intellectual infringement cases.
- The introduction of Good Manufacturing Practices as well as the ASEAN Common Technical Dossier and requirements will also encourage local companies to increase quality standards.



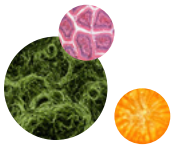
# Indonesia

## Outlook

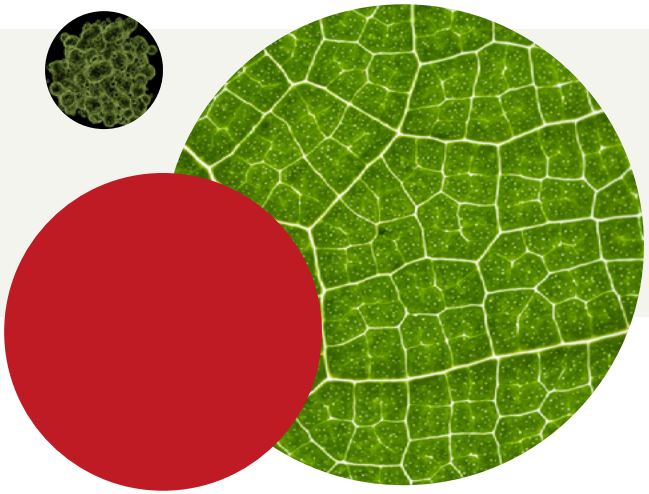
The main challenges to investment in Indonesia include intellectual property issues, low per-capita spending on pharmaceuticals and a small proportion of the elderly in the country. However, considering the size of the market, the sector is poised for considerable growth. Demand for drugs will rise due to an increased need for modern medicines, a growing and aging population, improving healthcare service as well as developing economic conditions.

Projected steady sales growth will provide substantial income to companies operating in the country and the government reform underway will encourage investment. The healthy number of mergers and acquisitions and the rationalization of operations that we are starting to see hint that a shift is about to take place in the sector as companies are well aware of the potential lying in the country.

1. Six-month average conversion rate of Rp 8627.19 per US dollar, as of October 2011.



# Singapore



| 2.3% | 6,088 | 49.0% | 3.9% | 8 |
|---|---|---|---|---|
| R&D expenditure (% of GDP, 2005) | Researchers in R&D (per million people, 2007) | High technology exports (% overall exports, 2009) | Total health expenditure (% of GDP, 2009) | World economic forum's innovation rank (out of 142) |

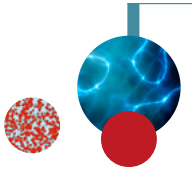
***Stable political structures, strong intellectual property protection, and favorable regulatory and tax policies make Singapore an attractive business location.***

## *Overview*

Despite the small size of the local market, the Republic of Singapore has the ambitious objective of staying one step ahead of its geographic neighbors and becoming the "Biopolis of Asia". The country has become a top destination for outsourcing of contract research, contract manufacturing and clinical research services by multi-national companies.

Leaders of Asia Pacific research and contract research companies continually identify Singapore as a destination of choice for regional headquarters. While India and China will flourish due to their immense markets, Singapore's mature business-environment makes the island-country a desirable launching pad into other regional markets. Singapore acts as a trading hub to connect Southeast Asia and the Western world and is a major re-exporter of pharmaceuticals. A large number of multi-national pharmaceutical corporations have established the base of their Asia Pacific operations in Singapore. Singapore is home to manufacturing facilities of eight of the top 10 pharmaceutical companies and all of the top 10 medical technology companies. In addition, several foreign pharmaceutical companies have R&D bases in Singapore, including Abbott Labs, Cell Research Corp, GlaxoSmithKline, MerLion, Novartis, Takeda and Inviragen.

# Singapore



*Singapore's mature business environment makes the island-country a desirable launching pad into other regional markets.*

Life sciences activity in Singapore largely occurs in several dedicated parks. The area's largest research park, Biopolis, is located in One North, Singapore's ongoing business park under development by JTC Corporation. One North is located at Buona Vista, proximate to Dover and Holland Village, the National University of Singapore and the National University Hospital. Phase one of Biopolis, a seven-building, 2-million-square-foot integrated biomedical research complex, was completed in 2003. Five of the seven buildings are designated for public institution use. The area is home to the Agency of Science, Technology, and Research (A*Star). Phase two, completed in 2006, added two buildings totaling roughly 430,000 square feet; work on a third phase is expected to deliver at year-end 2011 and includes two additional buildings, totaling roughly 450,000 square feet. In 2010, JTC announced the fourth and fifth phases of Biopolis. Improvements to lab design for clinical trial support are part of phase four, while phase five will cater to increased demand for biomedical research with two towers providing a gross floor area of just under 500,000 square feet.

The Tuas Biomedical Park (TBP) is a 916-acre biomedical manufacturing cluster developed in two phases by JTC Corporation. The park is located within the larger Tuas industrial zone in Singapore's western region. TBP offers "plug-and-play" opportunities, as well as build-to-suit opportunities for pharmaceutical manufacturers. Large companies such as Pfizer, GlaxoSmithKline, Novartis, Abbott and Roche all have operations at TBP.

## *Industry framework*

**Intellectual capacity**

Aware that R&D is dependent on the presence of talent, the Singaporean government has shaped the local education system to develop graduates with skills for work in life sciences. The government estimates 16,000 individuals are employed in the industry; it promotes life sciences studies and adapts curricula to fit the industry's needs.

**Innovation capital**

Two leading research universities are the source for a large share of innovation in Singapore. The National University of Singapore (NUS) has two centres of excellence relevant to the industry — Cancer Science Institute of Singapore and Mechanobiology Institute, Singapore. Nanyang Technological University (NTU) offers additional centres, including the Biomedical Engineering Research Centre, the Centre for Biotechnology, the Centre for Chiral and Pharmaceutical Engineering, the Computer-integrated Medical Intervention Laboratory and the Physiological Mechanics Laboratory in addition to several interdisciplinary centres focused on nanotechnology. Both schools have expanded their research and industry-related graduate programs in recent years.

Government support for universities is provided via the National Research Foundation (NRF) and the Education Ministry. The NRF of Singapore believes development of a critical mass of human capital is crucial to the advancement of its domestic research capabilities. It has funded research centres of excellence, including the two centres at NUS. The co-location of public institutions and private research companies in Singapore's largest research park, Biopolis, facilitates innovation support from the government.

# Singapore

**Fiscal & political resources**

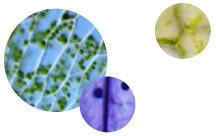
In October 2010, the government announced it would earmark S$3.7 billion ($3.0 billion)[1] for biomedical R&D over the next five years as part of its larger Research Innovation and Enterprise 2015 fund. It has also designated several boards and councils to support the growth of the industry:

- Singapore's Economic Development Board (EDB). Its Biomedical Sciences Group (BMSG) promotes private sector manufacturing and R&D activities while Bio*One Capital functions as the biomedical investment arm of EDB
- Singapore's Agency for Science, Technology and Research (A*Star). The Biomedical Research Council (BMRC) of A*Star funds and supports public research initiatives
- The Ministry of Health's (MOH). Its National Medical Research Council (NMRC) funds and supports public research initiatives, as well as awards medical research fellowships for the development of medical research manpower
- Singapore Biomedical Sciences Industry Partnership Office (BMS IPO)
- National Research Foundation (NRF)
- Many of the government councils work in close partnership. The BMRC works with the EDB's Biomedical Sciences Group and Bio*One Capital on the Singapore Biomedical Sciences (BMS) initiative. The BMS initiative seeks to develop the biomedical sciences sector into one of the country's economic pillars through a three-phase program running from 2000 through 2015.

## *Outlook*

Singapore is already active among contract research and manufacturing sectors of the industry and hopes to increase penetration into high-tech aspects of research and innovation. Strong intellectual property protection laws have already supported growth in the industry. The country is home to several research start-up companies and has attracted investment by Big Biotech and Big Pharma. Strong infrastructure, strong representation from the industry and government support will help Singapore expand manufacturing and research aspects of the value chain.

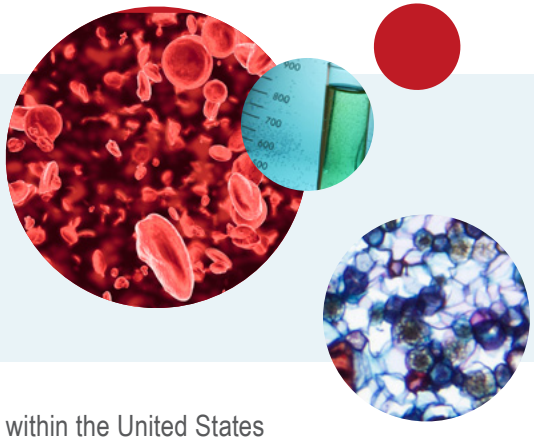
1. Six-month average conversion rate of S$1.23 per US dollar, as of October 2011.



***Strong intellectual property protection laws have already supported growth in the industry.***

# Closing thoughts

***Life sciences companies seek to balance operations among the three global regions as they strive for efficiency, revenue and margin opportunities.***



## *The drive for discovery and innovation is causing companies to rethink the way they make location decisions*

Increasingly, life sciences companies are evaluating the efficiency and effectiveness of R&D efforts. Companies are determining what aspects of the value chain are vital to discovery—those that are product lifelines and differentiators. As a result, the industry is bifurcating the drug discovery platform, keeping "core" discovery aspects in-house and in established clusters with rich talent pools, meanwhile leveraging the use of CROs and other outsourced resources for "non-core" aspects, like testing and viability assessment, and often times moving such functions to less expensive and often emerging clusters throughout the globe.

Investments focused on "core" R&D aspects of the value chain continue to fuel activity in established clusters in the United States and Europe. As companies evaluate the financial equation surround innovation, they often times are able to offset the higher real estate costs of established clusters with the advantages of deep intellectual capacity in such locations, and thus the enhanced odds of drug discovery. This suggests that established clusters and the knowledge workers who labor within those clusters can compete globally based on the quality of their innovation and discovery, not simply on hard costs of location. This has sometimes been described as the currency of the future, where ideas for innovation are the new currency in modern enterprises.

We conclude that established clusters within the United States and Europe will continue to report activity surrounding "core" functions in the form of small requirements from start-ups and the occasional right-sizing or re-locating of headquarter operations. Our analysis shows real estate activity is most prominent in cornerstone locales, such as the Bay Area, the New York/New Jersey corridor, San Diego, Boston, Seattle, Philadelphia, the United Kingdom, France, Switzerland and Germany, and we predict these clusters will remain leaders in "core" aspects of the value chain. It should be noted, however, that established clusters have reported a notable decline in speculative construction of laboratory facilities, demonstrating market awareness of constricted demand following the closing of many start-up operations during the recession.

Meanwhile, it is interesting to note the progress of emerging clusters among the global regions. Within the United States, several emerging clusters have been on the radar for some time, but have failed to reach a critical tipping point into becoming an established cluster. Some clusters, like Chicago and Houston, have very strong intellectual capacities and research institutions, but struggle to translate innovation from bench to marketplace due to lacking fiscal support or programming. While others, like Florida, Minneapolis and Indianapolis, have strong industry representation but remain challenged by fragmented framework, most notably lackluster funding from NIH and VC sources.

*(continued)*

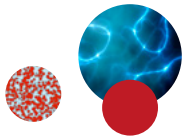
Emerging cluster governments in Asia and Latin America are making investments and improving political policies in order to become more competitive in high-tech aspects of the industry to be in contention for CRO opportunities. Efforts and funding by the Chinese, Singaporean, Indian and, to a lesser extent, Brazilian governments have been the most successful to date. Improvements to intellectual property laws, transparency, regulatory systems and the creation of full service research parks are a part of this effort. Although industry framework remains more fragmented when compared to emerging clusters in the United States, these clusters seem to be progressing at a rapid pace and garnering large amounts on interest from industry players. It will be interesting to witness in the coming years if emerging clusters in Asia and Latin America are able to create the environment necessary for robust, high-tech research communities.

***As we exit recessionary conditions and life sciences companies regain profitability, renewed investments in manufacturing facilities in emerging clusters is expected***

Investments towards non-R&D facilities experienced a pause during the recession. Constrained finances forced companies to create more efficient footprints, as evidenced through the many consolidations and contractions prevalent in the industry in recent years.

Coming out of the recession, companies will want to position themselves to gain market share in emerging markets. Factors such as growing economies, large populations, rising personal income levels and progressive political policies in emerging global clusters encourage growth and direct investment from industry leaders. Additionally, companies will leverage favorable conditions in emerging clusters as they bring on additional manufacturing capacity to take advantage of lower cost structures.

A large share of inward investment in the United States and established countries throughout Europe continues to be focused on manufacturing aspects of the industry. However, we feel that these locations will begin to see investments shift away from manufacturing as Brazil, China, India and other smaller clusters emerge as cost-advantageous sites that provide both revenue and margin opportunities.



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## *Global county statistics definitions & sources**

*1* Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development. Source: World Bank

*2* Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students engaged in R&D are included. Source: World Bank

*3* High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Source: World Bank

*4* Total health expenditure is the sum of public and private health expenditure. Source: World Bank

*5* Overall Innovation capabilities includes: capacity for innovation, quality of scientific research institutions, company spending on R&D, university-industry collaboration in R&D, government procurement of advances tech products, availability of scientists and engineers and utility patents granted per million people. Source: The World Economic Forum's Global Competitiveness Index 2011-2012

* For United States statistic sources, please refer to the United States methodology on page 16

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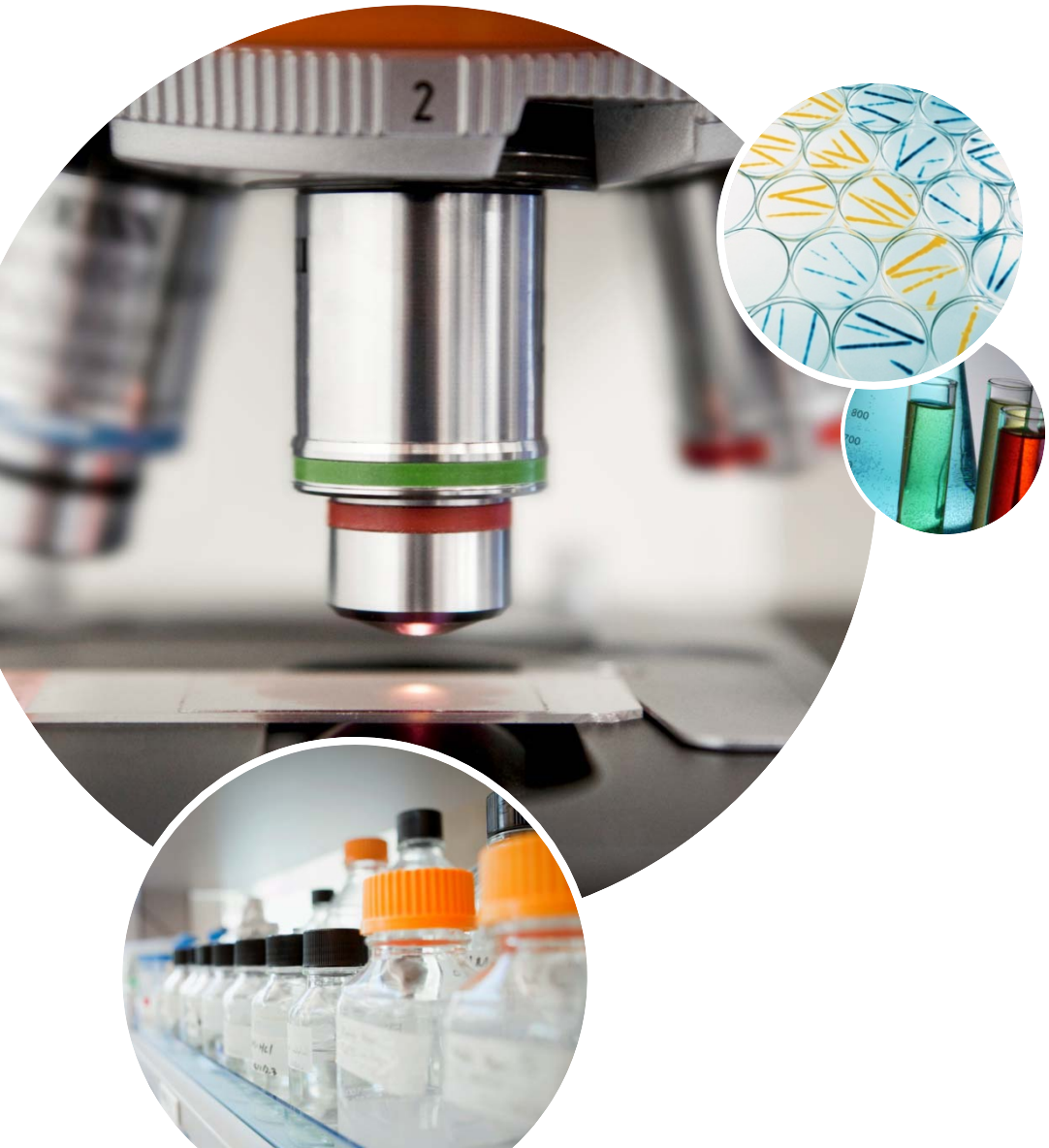
*Real value in a changing world*

# Life Sciences Cluster Report

Global . 2012



## Portfolio optimization and strategic site selection are crucial for success in the industry's new reality

In the new reality for life sciences companies – one where the product development formula of the past no longer applies, where extensive M&A activity is needed to fill pipelines and mitigate risk, and where an increasing amount of attention and opportunity lie in emerging markets – prudent measures and strategic solutions are critical to succeed.

More than ever, it is essential to achieve the ideal portfolio balance, with the proper size and type of facilities in the right locations.

# Global clusters

*A review of established and emerging clusters within the three global regions of the Americas, EMEA and Asia Pacific*

Americas | EMEA | Asia Pacific

# Global themes

***As the life sciences landscape continues to evolve, opportunities to optimize facility and real estate portfolios and site-select for enhanced innovation efficiencies emerge.***

In the new reality for life sciences companies – one where the product development formula of the past no longer applies, where extensive M&A activity is needed to fill pipelines and mitigate risk, and where an increasing amount of attention and opportunity lie in emerging markets – prudent measures and strategic solutions are critical to succeed. Yet with all this change and uncertainty comes an immeasurable amount of opportunity.

Beyond the costs to develop new drugs and treatments, facility and real estate costs are among the highest expenses for life sciences companies, and are therefore top of mind as the industry refocuses and reprioritizes. The industry is challenged by the conflicting need to right size in mature markets, where sales and demand are waning and where M&A activity oftentimes results in excess or duplicative facilities, while strategically growing in emerging clusters in order to capture market share and savings opportunities. More than ever, it is essential to achieve the ideal portfolio balance, with the proper size and type of facilities in the right locations. Given that the industry is contracting in mature markets, creatively positioning dispositions and knowing how and when to hit the market, can greatly impact the timeline, and thus expense, of divestiture. Additionally, knowing in which locations to maintain and expand operations has major bearing on the ability to capitalize on skilled labor force and fiscal resources, and thus, efficiently achieve new product breakthroughs.

## *Location strategy in mature market clusters hinges on deep resources for innovation excellence*

Established clusters in the United States, Europe and to some extent Japan realize that although the industry is increasingly looking to emerging markets for growth opportunities, much of the core R&D functions will remain domestic. It is also apparent that the industry is becoming more strategic with site selection, choosing locales with rich industry resources and capital and higher propensities for discovery and innovation. Although the mature clusters in the United States and Europe continue to be reliable choices, with deep and well-developed resources, emerging clusters within the United States and Canada are working feverishly to bolster their industry infrastructure.

Within the United States, the coastal cornerstone locales and certain mature clusters in EMEA continue to enjoy industry growth, oftentimes due to strong support from their world-class academic, healthcare and private sector institutions. Greater Boston, Philadelphia, New York City and Zurich all reported development activity and demand from partnerships with area universities and hospitals. And although other established global clusters like the San Francisco Bay Area, San Diego, New Jersey, Seattle, Paris and much of the United Kingdom all reported constrained demand due to rampant M&A activity, each remain confident that their supportive industry infrastructure will furnish the resources and environment for new start-ups to backfill vacated space.

Economic development groups and public–private partnerships in emerging United States and Canadian clusters are making efforts to position their markets for success. Clusters like Westchester / New Haven, Central & Southern Florida, Indianapolis and Montréal offer targeted incentive packages and newly constructed, state-of-the-art incubator centers and parks specialized for the industry. Beyond incentives, each of these clusters are bolstered by research institutions and enjoy the same government-instituted regulations and protections; however, real estate in these clusters can be attained at a lower cost.

## *Emerging global economies strengthen R&D capabilities and infrastructure*

Although emerging clusters in Asia Pacific and Latin America have been an industry choice for outsourced manufacturing for some time, the governments of emerging global economies are laser-focused on growing their high technology capabilities, due to increasing local demand and the positive impact they have on the economy and export revenue potential.

One of the biggest ways that emerging global clusters are increasing their competitiveness is through economic incentives and industry-dedicated funds. Clusters such as China, Brazil, India and Singapore all reported recent funding opportunities dedicated to the industry, and although many aim to ramp up the innovation potential of domestic start-ups, multinationals are able to capitalize on these offerings too, and have already done so in many cases. Additionally, nearly all the emerging global clusters cited have reported increased spending on overall public healthcare, widening the prospective patient pool and increasing consumer demand.

Beyond the fiscal resources directly available to industry companies, government and economic development group dollars have also supplied funds for prospective development projects that are

specialized to the needs of life sciences companies and start-ups. China, Singapore and Japan are home to some of the biggest government-funded life sciences parks and incubator centers.

The topic of globalization and movement into emerging economies always raises concerns over consistent and transparent regulations and intellectual property (IP) protection. In the past, emerging governments struggled to effectively outline and govern practices comparable to those in the United States and European Union. Knowing these issues are top of mind for multinational firms, emerging governments are reacting quickly to improve their competitiveness in the global marketplace. India, for instance, has improved its patent protection laws with a signatory to the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights, and introduced GMP and ASEAN Common Technical Dossier guidelines to increase quality standards. Colombia continues to expand its Free Trade Agreements with global partners, which has an impact on important trade sectors, such as pharmaceuticals.

## Global industry statistics

| Cluster | Researchers in science, per thousand total employment[1] | Graduate students in science, engineering, manufacturing & construction, as a % of total graduate students[5] | Gross expenditure on R&D, as % of GDP[7] | Total patent applications, residents only[8] |
|---|---|---|---|---|
| Brazil | 1.4 | 12.2% | 1.2% | 2,705 |
| Canada | 8.5 [2] | 21.1% [6] | 1.9% | 4,550 |
| China | 1.5 | N / A | 1.7% | 293,066 |
| Colombia | 0.4 | 24.2% | 0.2% | 133 |
| France | 8.9 | 26.2% [2] | 2.3% | 14,748 |
| Germany | 8.1 | 23.3% | 2.8% | 47,047 |
| India | 0.4 [3] | N / A | 0.8% [4] | 7,262 [9] |
| Indonesia | 0.2 | 21.7% | 0.1% | N / A |
| Japan | 10.5 | 21.9% | 3.4% | 290,081 |
| Mexico | 1.0 | 25.6% | 0.4% | 951 |
| Netherlands | 5.2 | 14.0% | 1.8% | 2,575 [9] |
| Singapore | 12.0 | N / A | 2.3% | 895 |
| Switzerland | 6.0 [2] | 21.6% | 3.0% [2] | 1,622 |
| United Kingdom | 8.8 | 21.7% | 1.9% | 15,490 |
| United States | 9.5 [4] | 15.3% | 2.9% | 241,977 |

Footnotes:

1. UNESCO, 2009
2. 2008 data
3. 2005 data
4. 2007 data
5. UNESCO, 2009
6. 2002 data
7. UNESCO, 2009
8. World Bank, 2010; includes total patents from all industries
9. 2009 data

# Americas

***Established clusters within the United States are undergoing varied effects from industry consolidation, while emerging clusters within the Unites States and the broader Americas region continue to enhance industry infrastructure and R&D capabilities.***

At a time of overall austerity in the life sciences industry, established clusters within the United States are trending along one of two paths. Several clusters in the Northeast are enjoying impressive growth, demand and resultant real estate development, due in large part to partnership support from academic, healthcare and private sector institutions. Conversely, a larger number of established clusters are experiencing consolidation and diminished demand, in line with the expected aftereffects of M&A activity and streamlining of operations. Emerging clusters within the United States have adopted an "if you build it, they will come" mentality. Be it via targeted incentive packages or the construction of incubator centers and parks, economic development groups and public–private partnerships from emerging clusters are all making strong efforts for a seat at the table.

Canadian markets continue to trend similarly to emerging clusters within the United States as they realize gaps in funding and are trying to create incentives and solutions to support life sciences companies. Clusters within Latin America are acting quickly to meet the demands of the industry and local populations. With increased wealth and access to healthcare, the demand for drugs and medical care is rapidly increasing. Although Latin American clusters are traditionally viewed as manufacturing destinations by multinational firms, particularly due to geographic proximity to the United States, local governments are ramping up domestic R&D capabilities to hopefully increase the amount of drugs and treatments created locally. Additionally, strong efforts are being made to protect IP and to combat smuggling and counterfeit drugs.

## United States

**Established**
- Greater Boston
- San Diego
- San Francisco Bay Area
- Raleigh-Durham
- Philadelphia
- Suburban Maryland / DC / Arlington
- New Jersey / New York City
- Los Angeles / Orange County
- Minneapolis-St. Paul
- Seattle

**Emerging**
- Westchester / New Haven
- Chicago
- Denver
- Cleveland / Columbus / Cincinnati
- Salt Lake City
- Dallas / Fort Worth
- Southern Wisconsin
- Central & Southern Florida
- Indianapolis
- Southern Michigan
- Atlanta

**Emerging**
- Canada
- Brazil
- Colombia
- Mexico

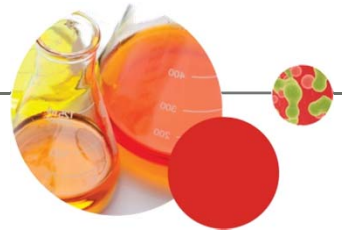
# *United States cluster methodology*

The determination of U.S. industry clusters was first based off of a weighted ranking of state-level data. Qualitative knowledge of industry activity was used to amalgamate metropolitan areas into clusters. Quantitative data was used to rank individual clusters on their existing industry infrastructure and propensity to best support the industry.

| | Life sciences employment[1] | | | Life sciences establishments[2] | | | Biotechnology & medical device venture capital funding[3] | | | National Institutes of Health funding[4] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30.0% | | | 20.0% | | | 25.0% | | | 25.0% | | | Weighting | |
| Cluster | % | Weighted score | Rank | % | Weighted score | Rank | $ (in millions) | Weighted score | Rank | $ (in millions) | Weighted score | Rank | Weighted score | Rank |
| Greater Boston | 3.1% | 22.4 | 2 | 1.4% | 15.9 | 2 | $1,392.7 | 19.5 | 2 | $2,274.9 | 25.0 | 1 | 82.9 | 1 |
| San Diego | 4.8% | 30.0 | 1 | 1.3% | 14.3 | 3 | $602.0 | 15.1 | 3 | $871.7 | 14.0 | 8 | 73.3 | 2 |
| San Francisco Bay Area | 2.3% | 18.7 | 5 | 0.8% | 8.3 | 13 | $2,371.8 | 25.0 | 1 | $1,366.4 | 17.9 | 3 | 69.8 | 3 |
| Raleigh-Durham | 2.8% | 21.0 | 4 | 1.8% | 20.0 | 1 | $154.8 | 12.6 | 10 | $916.7 | 14.3 | 6 | 67.9 | 4 |
| Philadelphia | 2.1% | 17.6 | 8 | 1.0% | 11.1 | 6 | $246.6 | 13.1 | 8 | $824.1 | 13.6 | 9 | 55.4 | 5 |
| Suburban Maryland / DC / Arlington | 1.7% | 15.9 | 9 | 1.0% | 11.0 | 7 | $317.8 | 13.5 | 7 | $965.6 | 14.7 | 5 | 55.1 | 6 |
| New Jersey / New York City | 1.3% | 12.3 | 14 | 0.7% | 3.4 | 20 | $482.2 | 14.4 | 5 | $1,649.6 | 20.1 | 2 | 50.2 | 7 |
| Los Angeles / Orange County | 2.3% | 18.4 | 7 | 0.5% | 0.0 | 21 | $514.7 | 14.6 | 4 | $1,045.2 | 15.4 | 4 | 48.3 | 8 |
| Minneapolis-St. Paul | 2.9% | 21.2 | 3 | 0.9% | 10.0 | 11 | $209.3 | 12.9 | 9 | $290.1 | 3.7 | 18 | 47.8 | 9 |
| Seattle | 1.4% | 12.7 | 13 | 0.8% | 8.0 | 15 | $101.7 | 8.2 | 12 | $885.3 | 14.1 | 7 | 43.0 | 10 |
| Westchester / New Haven | 2.3% | 18.7 | 5 | 0.9% | 10.0 | 11 | $62.3 | 4.0 | 15 | $443.5 | 7.2 | 14 | 39.8 | 11 |
| Chicago | 1.2% | 9.8 | 15 | 0.7% | 4.3 | 18 | $141.6 | 12.5 | 11 | $682.0 | 12.5 | 11 | 39.1 | 12 |
| Denver | 1.7% | 15.8 | 10 | 1.1% | 12.8 | 5 | $79.8 | 5.9 | 14 | $318.7 | 4.4 | 17 | 38.8 | 13 |
| Cleveland / Columbus / Cincinnati | 1.1% | 8.2 | 17 | 0.9% | 10.1 | 10 | $92.4 | 7.2 | 13 | $687.3 | 12.5 | 10 | 38.0 | 14 |
| Salt Lake City | 1.5% | 14.5 | 12 | 1.3% | 14.1 | 4 | $25.2 | 0.0 | 20 | $162.1 | 0.9 | 20 | 29.5 | 15 |
| Dallas / Fort Worth | 0.9% | 5.6 | 19 | 0.7% | 6.0 | 17 | $331.6 | 13.6 | 6 | $224.4 | 2.3 | 19 | 27.4 | 16 |
| Southern Wisconsin | 1.1% | 8.9 | 16 | 1.0% | 11.0 | 7 | $36.2 | 1.2 | 17 | $399.1 | 6.2 | 15 | 27.2 | 17 |
| Central & Southern Florida | 1.0% | 6.8 | 18 | 0.8% | 7.1 | 16 | $47.1 | 2.4 | 16 | $465.5 | 7.7 | 13 | 24.0 | 18 |
| Indianapolis | 1.5% | 15.0 | 11 | 0.8% | 8.3 | 13 | $25.2 | 0.0 | 20 | $123.8 | 0.0 | 21 | 23.3 | 19 |
| Southern Michigan | 0.5% | 0.0 | 21 | 0.9% | 10.2 | 9 | $27.9 | 0.3 | 19 | $655.5 | 11.9 | 12 | 22.4 | 20 |
| Atlanta | 0.7% | 3.3 | 20 | 0.7% | 3.7 | 19 | $36.2 | 1.2 | 17 | $373.0 | 5.6 | 16 | 13.8 | 21 |

Footnotes:

1. Bureau of Labor Statistics, 2011
2. Bureau of Labor Statistics, 2011
3. PricewaterhouseCoopers / MoneyTree Report, 2011
4. National Institute of Health / Awards by Location, FY 2011



# 1

## *Greater Boston ranks No. 1 among U.S. life sciences clusters, bolstered by its efficiency, collaboration and intellectual prowess.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

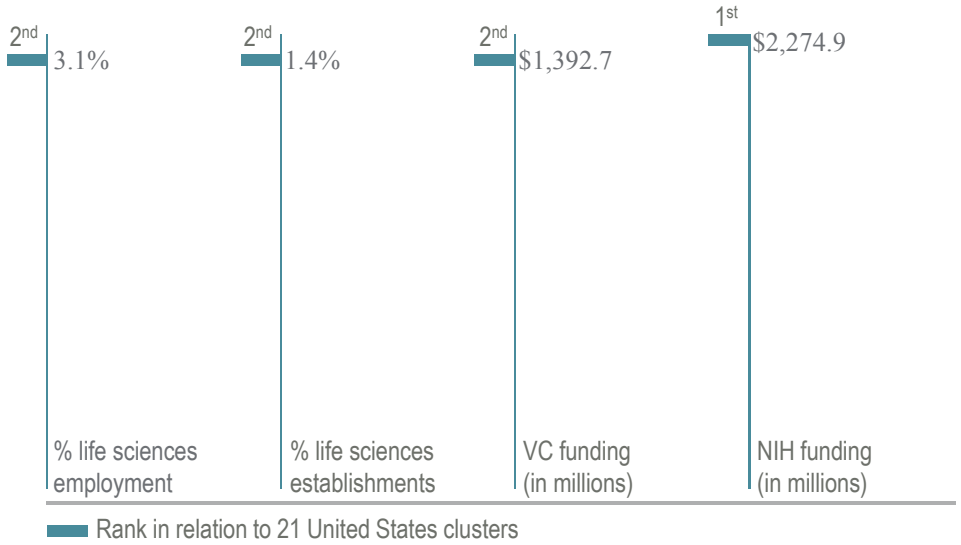
### Greater Boston market overview

With the drive for discovery and innovation causing a rebalancing of operations, the Boston market continues to benefit from global realignment. The discovery process demands efficiency, collaboration and intellectual prowess. Boston is the elite provider creating that element of connectivity and is fueled by top-notch universities, innovation centers, research hospitals, venture capital firms and, most importantly, a strong labor force.

The Boston MSA features more than 74,000 employees within the pharmaceutical, biotechnology and medical device subsectors of the industry, trailing only San Diego on a percent of total workforce basis. Additionally, the area is the leading recipient of National Institute of Health (NIH) funding. Massachusetts is home to five of the top eight NIH-funded hospitals in the United States, which act as global leaders in biotechnology research. The top five NIH-funded universities (Harvard, University of Massachusetts, Boston University, MIT, and Tufts) anchor this cluster and offer advanced degrees in biosciences, fuel employment in the industry and add great depth to the development of innovative products.

The Greater Boston life sciences industry includes geographic markets that are both established and emerging. Cambridge is the state's core life sciences cluster. Here, large biopharma companies intermingle with start-ups, who begin here and grow until they are acquired or relocate as they outgrow space options. While Cambridge is a mature market, there are multiple emerging markets outside of the city attracting attention. These emerging clusters include the Greater Boston Suburbs, the Seaport District and the Longwood Medical and Academic Area (LMA).

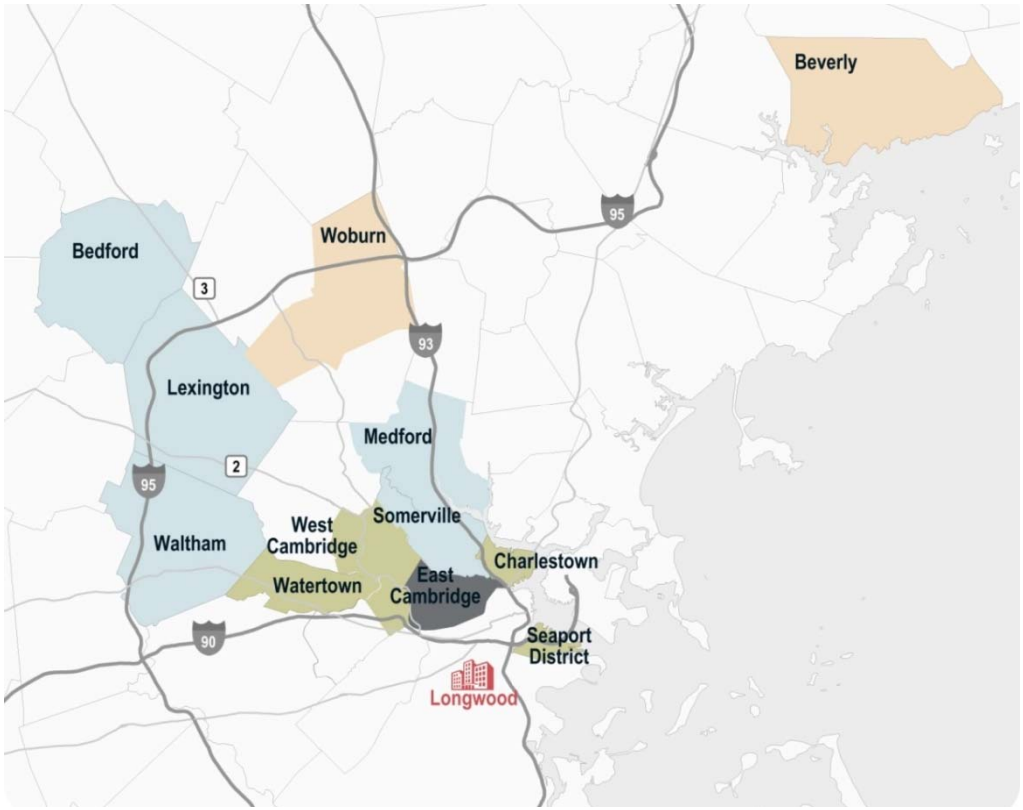
### Greater Boston life sciences scorecard

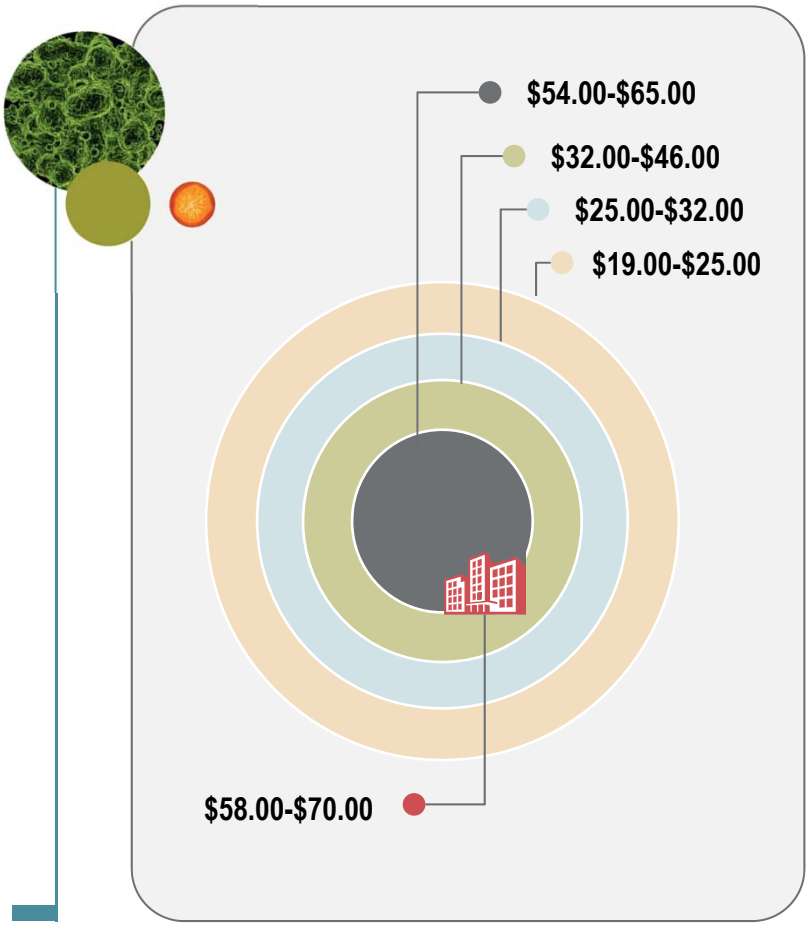



*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# The *ripple* effect of East Cambridge

## The Jones Lang LaSalle life sciences **rent ring**



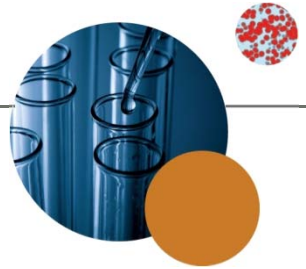




### Rent ring

The concept of the rent ring is built on the understanding that the Greater Boston life sciences industry stems from East Cambridge. This market has become incredibly dense, with just over 7 million square feet of lab space in less than a 1.5-mile radius from the Kendall Square MBTA Station. As a result, this market is extremely competitive, with few growth options and asking rents reaching as much as $65.00 per square foot NNN for trophy spaces. East Cambridge represents the bull's-eye, the center of the ring, where rents are highest. Consequently, demand begins to spill outward.

Asking rents are lowered as tenants begin to look right outside of East Cambridge, in West Cambridge and Watertown to the west and Charlestown and the Seaport District to the east. These markets are far less dense and act as emerging clusters. Here, asking rents vary from $32.00 to $46.00 per square foot NNN, still high, but considerably lower than East Cambridge rates. The next step outward are suburban towns of Bedford, Lexington, Waltham, Medford and Somerville. Again the landscape changes dramatically, where lab space is considerably less clustered, but with lower rents ranging from $25.00 to $32.00 per square foot NNN. Farther out sit Woburn and Beverly, where asking rents range from $19.00 to $25.00 per square foot NNN. The Longwood Medical and Academic Area remains a unique outlier in the rent ring, where rents are often higher than those of East Cambridge ($58.00 to $70.00 per square foot NNN) due to its downtown location and proximity to healthcare institutions. However, the size of the leasable lab market in LMA is significantly smaller than East Cambridge, and does not have the same effect on the overall Greater Boston life sciences market.

The next sections present a deeper dive into each of these clusters, and how each falls into the life sciences rent ring.



# Cambridge

## Overview

At the heart of the Greater Boston life sciences market is Cambridge, holding nearly 7.5 million square feet lab space. The city acts as a global anchor for the industry, making it one of the most competitive and resilient markets in the nation. Cambridge maintains a true advantage as it is home to major academic institutions and centers of excellence, all within minutes of each other. Harvard University and the Massachusetts Institute of Technology fuel a strong labor force. Large private institutions like the Whitehead Institute and the Broad Institute nurture innovation and promote collaboration. Venture capital firms support industry growth and continue to locate in Kendall Square. And intertwined throughout all these entities are the life sciences companies, from start-ups to mature corporations, who continue to benefit from co-locating.

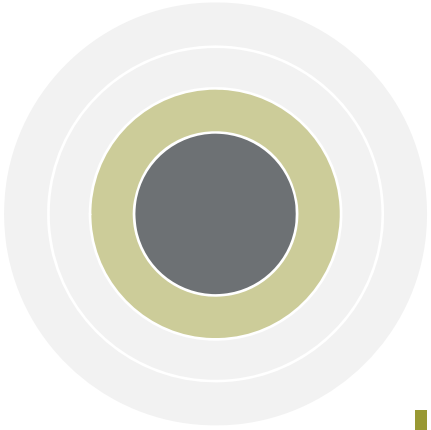
Real estate costs are higher in Cambridge but the proximity to outstanding intellectual capacity and the higher probability of discovering the next profitable drug outweigh the premium. Average asking rents in the Cambridge lab market have now reached levels of the last market peak at $55.00 per square foot NNN. Cambridge lab rents are one of the first in Greater Boston to fully recover, and have proved resilient during the real estate bust, only dipping approximately 16.0 percent off peak.

Cambridge currently holds nearly 2.0 million square feet under construction, all dedicated to the life sciences industry. Although the majority of developments are build-to-suits, the city is home to the only speculative lab development in the country. Skanska is constructing 123,000 square feet of lab space at 150 Second Street. This spec development speaks to the confidence in the market. The remaining 1.7 million square feet, sponsored by large life sciences conglomerates, big pharma and local research institutes, is 95.0 percent preleased. *[Please refer to development map on next page for more details]*. Historically, Cambridge has had minimal options for start-up or niche pharmaceutical companies seeking lab space. More and more developers are looking to meet this demand through the "rent-to-bench" model, where companies requiring very little space can rent turnkey, short-term lab space as their needs require.

All this activity is consolidated to East Cambridge, which already accounts for the vast majority of inventory. Across town, West Cambridge acts as an extension of the East Cambridge life sciences sector and continues to develop its own identity. The area boasts more of a suburban, campus-like feel, compared to the urban East Cambridge. West Cambridge provides a unique opportunity for large or growing tenants who are looking to experience cost savings and still maintain access to the renowned resources in Cambridge. Here, flexible zoning policies have been implemented to facilitate the development of lab space. As West Cambridge continues to form a cohesive identity, the submarket will see greater tenant demand and stronger market fundamentals.

## Cambridge rent ring

- Average asking rents across the Cambridge lab market have now reached levels of the last market peak at $54.61 p.s.f. NNN
- Trophy lab rents in East Cambridge can reach up to $65.00 p.s.f. NNN
- West Cambridge asking rates are substantially lower at $34.00 to $46.00 p.s.f. NNN



**IRONWOOD**
Ironwood Pharmaceuticals signed an amendment to its lease at 301 Binney Street. Due to this lease extension and phased expansion for 93,000 s.f., Ironwood will now occupy a total of 303,000 s.f.

**2M SF UNDERWAY**
East Cambridge boasts nearly 2M s.f. under construction, including the country's only speculative lab development. The remaining 1.7M s.f. is 95.0 percent preleased.

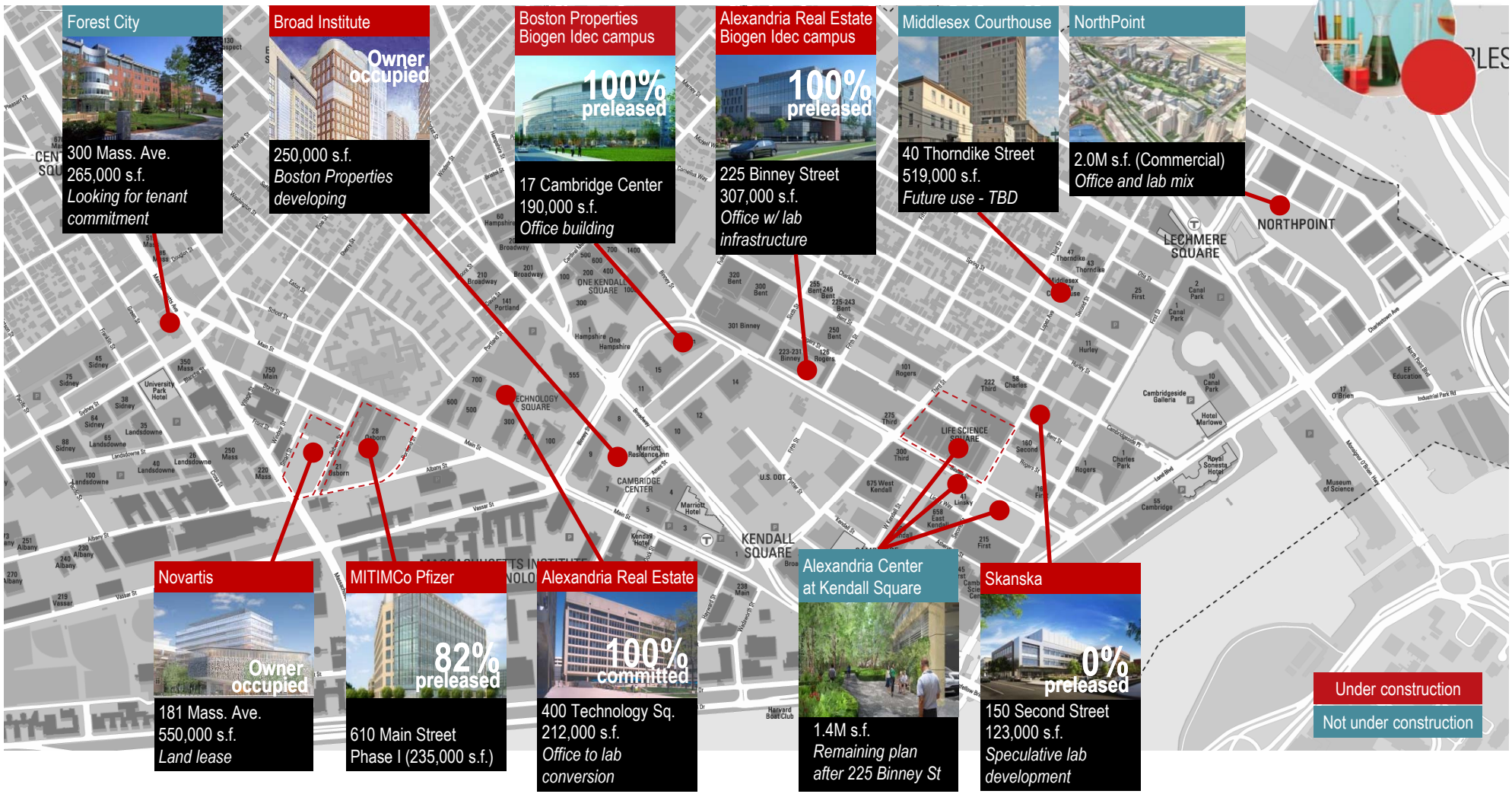
**FRESH POND RESEARCH PARK**
The Davis Co. bought the mixed-use 207,000 s.f. portfolio from Spaulding & Slye Investments. It sold for $38.4M ($185 p.s.f.); it represents a development opportunity for lab space in West Cambridge.

**BOSTON BIOMEDICAL**
signed a 63,000 s.f. lease at recently delivered 640 Memorial Drive. The lab building is now 79.0 percent preleased.

***Cambridge acts as a global anchor for the industry, making it one of the most competitive and resilient markets in the nation.***

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space

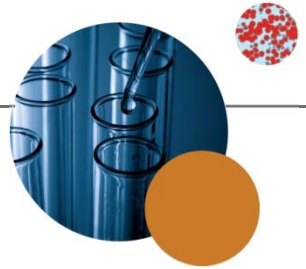
# Cambridge development




## Outlook

Cambridge will remain a stronghold for the life sciences community, and thus will remain extremely competitive. Although average asking rents are quite strong in the Cambridge lab market, the vacancy rate still remains relatively high (13.0 percent) compared to the Cambridge office market (7.3 percent). There are seven blocks of available space over 100,000 square feet if one includes 150 Second Street which is slated to deliver at the end of this year.

However, it is expected that lab demand will continue to grow and help to fill these spaces. Users seeing 200 to 300 percent growth projections are poised to expand into these larger blocks of space, where start-up and mid-tier organizations will continue to absorb the remaining space within this world class R&D hub.



# Suburbs

## Overview

Developers and tenants alike have recognized that the suburbs provide an important option for tenants finding space and pricing constraints in Boston and Cambridge biotech markets. As Cambridge presents an inefficient and undesirable supply of second and third generation laboratories, the suburbs provide a sound alternative where developers are delivering office-to-lab conversions as well as ground-up construction. Although less concentrated than the East Cambridge hotbed, there is a definite life sciences identity evolving along Route 128. Historically, the suburbs have served to support growing manufacturing and back-office functions. Today, more and more life sciences tenants are choosing the suburbs as their core location. The following highlights suburban cities that are benefitting from Cambridge spill-over demand.

Watertown acts as an extension of West Cambridge, with Alexandria Real Estate Equities owning the majority of the lab market share. Although technically a suburb, Watertown's existing infrastructure and strong accessibility has allowed a lab market to develop in the Arsenal area. The latest notable transaction was from Forma Therapeutics, who relocated to 45,000 square feet at 500 Arsenal Street.

Farther west sits Waltham, home to both mid-tier and global organizations. Noteworthy companies located in Waltham include AstraZeneca, Genzyme and Alkermes. With an established office market fostered by the high-tech industry, these firms are attracted to the existing amenities provided by the Route 128 corridor.

The Lexington / Bedford area is arguably the most active life sciences market in the suburbs. A number of tenants have recently relocated from Cambridge, taking advantage of the direct connection Route 2 provides to the area from the city. Major companies include Joule Biotechnologies, BioScale, Quanterix, Abpro and T2 Biosystems. Alternatively, Dyax signed a 45,000-square-foot lease at 55 Network Drive in Burlington, which should help connect this city to the Lexington / Bedford life sciences market.

Demand is spilling out of Lexington and Bedford into Woburn and Beverly, where Cummings Properties has developed a critical mass of lab supply. Tenants of all sizes, from start-ups to large companies, can find suitable space to meet their business goals. Farther south, Medford and Somerville are largely driven by start-up activity, where small companies are seeking economic relief in reduction of operating spending.

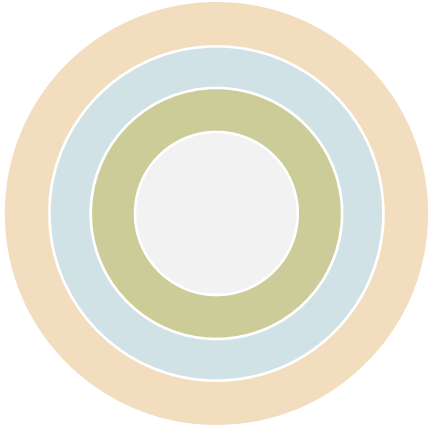
## Outlook

Across the suburban market, redevelopment of flex-type properties into Class B laboratory facilities is popular, offering space at an attractive price point. Tenants looking for desired Class A lab space will consider build-to-suit options with landlords providing opportunities for asset conversion. With tenant demand driving this repositioning, non-core life sciences landlords typically require tenant commitments to ensure they receive their return on investment.

## Suburban rent ring

Average asking rents for lab space varies across the suburban landscape

- Watertown rents mimic those of West Cambridge at $32.00 to $46.00 p.s.f. NNN
- Lexington / Bedford rates range from $26.00 to $32.00 p.s.f. NNN, Waltham has similar asking rates at $25.00 to $27.00 p.s.f. NNN
- Somerville / Medford incubator rents range from $25.00 to $32.00 p.s.f. NNN
- Woburn and Beverly rates are slightly lower at $19.00 to $25.00 p.s.f. NNN



**1366 TECHNOLOGIES**
The manufacturing solutions company signed a 41,000 s.f. lease at 6-8 Preston Court in Bedford. The tenant is relocating and expanding from 45 Hartwell Avenue in Lexington.

**64 GROVE STREET**
A 59,925 s.f. research facility (70.0% lab) in Watertown. Currently owned and occupied by Boston Biomedical Research Institute, which is looking to sell the property as a potential leaseback.

**9 CROSBY DRIVE**
Entegris purchased the 80,000 s.f. Bedford building from Duffy Properties for $7.1M, or $89 p.s.f. The company plans to convert the flex property to lab space.

**DYNASIL**
This Watertown tenant is seeking approximately 50,000 s.f., half of which will be devoted to R&D and products manufacturing and the other half to office.

*The Greater Boston Suburbs provide a variety of lab growth options for space users at an attractive price point.*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space

# Seaport District

## Overview

The Seaport ("Innovation") District has attracted a variety of users due to its proximity to downtown Boston and the rental savings to be found in contrast to surrounding hubs such as Cambridge. The most notable relocation is Vertex Pharmaceutical's decision to leave Cambridge and construct its new 1.1 million-square-foot office/lab headquarters by the end 2013. This colossal move fueled immense interest in the Seaport District for many life science tenants, both large and small. Due to rising popularity of this neighborhood, the landscape has changed with market rents rising and space options becoming few and far between. As a result, the Seaport District has quickly transformed into a very tight market where, over the past two years alone, over 14.5 percent of Seaport supply has been absorbed. Minimal space options remain for small and large tenants alike and thus recent lab activity has begun to slow.

## Outlook

Given the current state of the Seaport District, and a forecast for only a tightening market, sizeable life sciences tenants will have to consider build-to-suit options here. As the existing landscape and infrastructure of the area continues to transform, build-to-suit options may become more and more attractive for established life sciences tenants.

**ACETYLON**
signed for approximately 10,000 s.f. at Seaport Center.

**VERTEX**
1.1M s.f. office/lab headquarters to deliver by end of 2013.

**VERTEX**
signed additional lease at One Harbor Street for 98,000 s.f., where space will be retrofitted to lab.

**FUTURE DEVELOPMENTS**
Life sciences activity in the Seaport District hinges on build-to-suit developments from established tenants.

*Growing life sciences companies are opting to head off to try the new frontier of the "Innovation District," where tenants can locate close to downtown and see some possible cost savings.*

# Longwood

## Overview

The Longwood Medical and Academic Area (LMA) is one of the world's premier medical, research and academic communities. This 213-acre site is comprised of 18.1 million square feet, where all buildings are institutionally owned with the exception of only two properties: BioMed Realty Trust's Center for Life Sciences at 3 Blackfan Circle (703,000 square feet) and Merck's Longwood Research Facility (466,000 square feet). Since Merck owns and occupies this building, it is truly only the Center for Life Sciences that constitutes the commercial leasable market. To meet the growing demand for leasable lab space, National Development and Alexandria Real Estate Equities are constructing a 413,000-square-foot research and development building at Longwood Center. Dana Farber signed on as the anchor tenant, agreeing to lease 154,000 square feet (37.3 percent).

## Outlook

Others are also looking to expand their LMA lab footprint. Brigham and Women's (BWH) is building 358,000 square feet on the former Mass Mental Health Center site. They recently completed a long-term ground lease in order to construct 360,000 square feet of office and lab space from Emmanuel College. Children's Hospital announced plans for a new 445,000-square-foot clinical building in the heart of its campus and also has long-term plans to develop a 440,000-square-foot office and lab building a block from its campus. Adjacent to Longwood Center, the Winsor School plans for a third-party development of over 300,000 square feet on their "endowment" portion of its campus.

**DANA FARBER**
signed on as anchor tenant (154,000 s.f.) at Longwood Center (413,000 s.f.) with National Development and ARE.

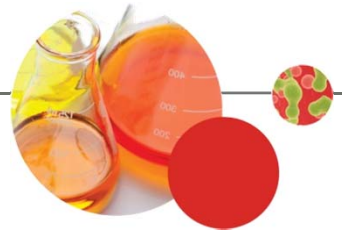
**BWH**
will build 360,000 s.f. lab building on Emmanuel College campus and a new clinical & research facility on former Mass Mental Health site.

**CHILDREN'S**
The hospital is planning to construct a 445,000 s.f. clinical building on-campus and a 440,000 s.f. office and lab building adjacent to campus.

**WINSOR SCHOOL**
is planning third-party development of over 300,000 s.f. on "endowment" portion of campus.

*The LMA is the second largest employment district in the state, surpassed only by downtown Boston. It is home to four of the top five independent hospital recipients of NIH funding.*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space



***San Diego ranks No. 2 among U.S. life sciences clusters, supported by its collaboration, cohesiveness and academic prowess.***

## Global trends

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Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

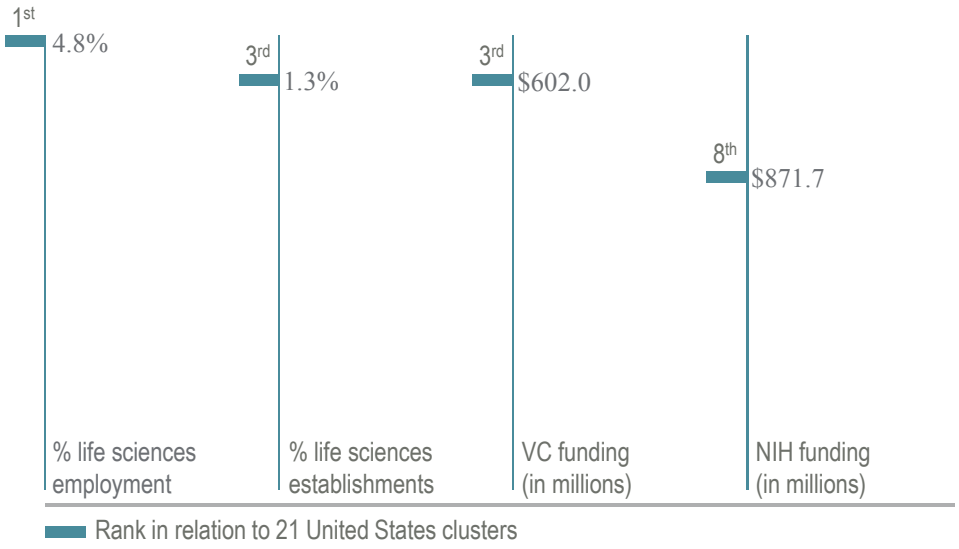
## San Diego market overview

M&A activity continues to create a buzz in the San Diego life sciences sector. During the past 12 months, the local market has recorded a staggering $13.8 billion in M&A activity among eight deals. Blockbuster deals completed in the most recent quarter included AstraZeneca's acquisition of Ardea Biosciences for $1.3 billion, Hologic's purchase of Gen-Probe for $3.7 billion, and Bristol-Myers Squibb's offer to purchase Amylin Pharmaceuticals for $7.0 billion. Not to be forgotten was Illumina fending off Roche's $6.7 billion takeover, which died after Roche let its offer expire in late April.

But how will this swell in M&A activity affect the local real estate market? Will San Diego be left with a surplus of available space, much like what happened in the previous decade when a number of Big Pharma firms pulled out of town? It appears that AstraZeneca will keep Ardea in its San Diego facility while the company completes Phase III testing of its lead drug candidate. Amylin, who leases over 400,000 square feet in UTC, has yet to receive direction from Bristol-Myers Squibb on what will happen with its real estate.

With a number of questions still pending on the Amylin and Ardea facilities, the life sciences real estate market had exceptionally slow leasing activity. Some positive news came with Shire Pharmaceuticals (who acquired Advanced Biohealing in 2011) finalized negotiations with BioMed Realty for a build-to-suit campus in Sorrento Mesa. The company's initial plan is to construct a 170,000-square-foot facility to house manufacturing, warehouse and other related uses, with the site providing planned growth of up to 800,000 square feet. Shire will continue to operate its 85,000-square-foot Torrey Pines facility in addition to the build-to-suit, and the company is currently in negotiations to expand into an adjacent Torrey Pines project to accommodate immediate growth. Additional leasing activity included Takeda expanding into 43,000 square feet of office space in Torrey Pines and ACON labs renewing in its 17,000-square-foot Sorrento Mesa facility.

## San Diego life sciences scorecard



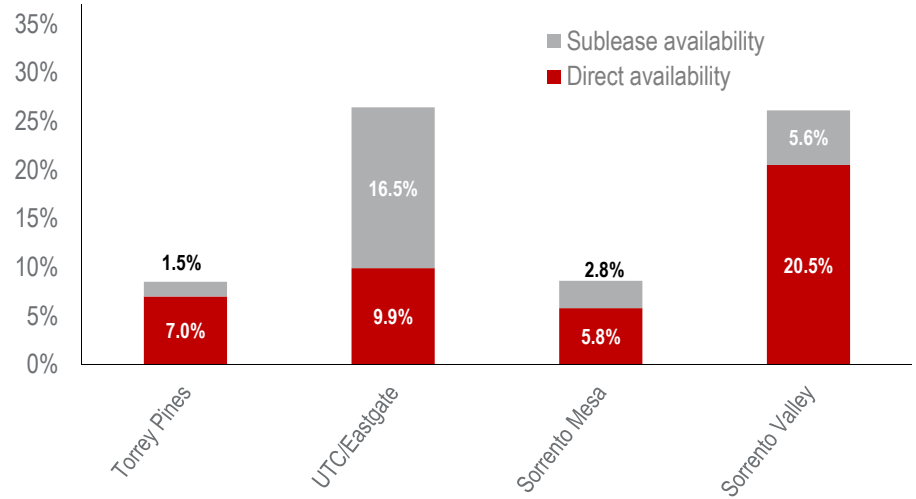

*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Life sciences market analysis

**Trailing M&A activity**

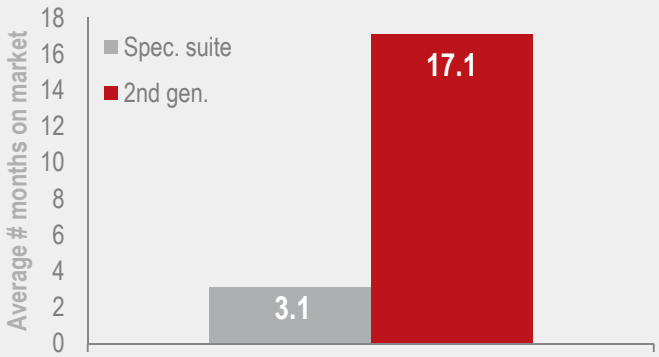
| Date | Transaction Parties | Price |
|---|---|---|
| June 2011 | Advanced Biohealing sale to Shire | $750M |
| July 2011 | Amira sale to Bristol-Myers Squibb | $325M |
| October 2011 | Anadys sale to Roche | $230M |
| November 2011 | eBioscience sale to Affymetrix | $330M |
| December 2011 | Intellikine sale to Takeda | $190M |
| April 2012 | Gen-Probe sale to Hologic | $3.7B |
| April 2012 | Ardea sale to AstraZeneca | $1.3B |
| August 2012 | Amylin sale to Bristol-Myers Squibb | $7.0B |

**Submarket availability**




## Submarket Outlook

**Time on market analysis: spec. vs. 2nd gen. suites**

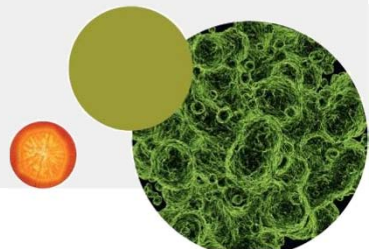



**Submarket summary / market outlook**

The second quarter's availability rate for San Diego's life sciences market (Torrey Pines, UTC, Sorrento Mesa, Sorrento Valley) was 13.4 percent, rising 70 basis points from the first quarter.

The increase in total availability was primarily due to a sharp rise in sublease space. Back in May, Sapphire Energy listed its 79,000-square-foot building for sublease and Amylin formally listed 71,500 square feet of specialty lab space to the market. Direct availability on the other hand recorded a small drop during the quarter, spurred on by some leasing activity in Torrey Pines and UTC / Eastgate.

Rental rates continued to rise across all submarkets. Sorrento Valley, which has historically been the "low rent" submarket, is seeing rental rates in the $2.25-$2.50 per square foot per month NNN range. Landlords continue to modernize antiquated space and have realized a sharp increase in rates as well as transaction volume when compared to second generation space that is left untouched, as highlighted in the graph to the left.



# Torrey Pines

## Overview

Torrey Pines is home to San Diego's largest concentration of lab space with over 5.0 million square feet. The submarket is adjacent to the UC San Diego campus and acts as the epicenter of San Diego's life sciences market. It boasts occupancy by a number of acclaimed research institutes, some of the world's largest pharmaceutical companies and a number of successful biotech companies that range from start-ups to mature corporations.

Torrey Pines has experienced relatively light leasing activity among its lab product. The first half of 2012 only recorded 75,684 square feet of transaction activity, down from the 2011 first half total of 169,000 square feet. On the other hand, the submarket's small supply of available space has been very active during the second quarter, highlighted by Takeda Pharmaceuticals expanding into 43,200 square feet of additional space as it relocated its San Francisco workforce to San Diego.

## Outlook

After a relatively quiet first half of 2012, activity in Torrey Pines is anticipated to increase during the second half of the year, both on a positive and discouraging front. The month of July has already seen Vertex Pharmaceuticals complete a six and a half year renewal in its 81,000-square-foot facility. Additionally, Shire Pharmaceuticals and Sequenom have requirements to fulfill immediate expansion needs. Perhaps the most significant news is Pfizer's recent sale of three campus buildings, which together total 307,000 square feet. The sale closed during the third week of August and will bring a flood of new supply to the submarket and cause the total availability rate to surge by some 480 basis points to13.3 percent.

| Key market indicators | | |
|---|---|---|
| Inventory | ▲ | 5,339,591 s.f. |
| Total availability | ▼ | 8.5% |
| Direct availability | ▼ | 7.0% |
| Sublease availability | ▲ | 1.5% |
| Asking rents | ▲ | $2.95-$3.75 NNN/s.f./mo. |

*Change quarter-over-quarter*

**LEASING ACTIVITY**
**Takeda Pharmaceuticals** 43,159 s.f. (100% office)
**Shire Pharmaceuticals** 40,864 s.f. (100% office)
**Zenobia Therapeutics** 1,340 s.f.

**4 BTS DEVELOPMENTS**
**Spectrum** 160,000 s.f.
**Sunrise** 155,000 s.f.
**10265 Science Center Drive** 65,756 s.f.
**10285 Science Center Drive** 39,335 s.f.

***This quarter's biggest news: Pfizer's sale of three campus buildings, that together total 307,000 square feet.***

**PFIZER CAMPUS**
Legacy Partners was the buyer of CB5, CB6 and CB7, totaling 307,000 s.f. All three buildings were sold vacant. The space had been on the market for 12 months and closed on August 14.

**5 BIOTECH REQUIREMENTS**
Sequenom is in the market for 25,000 s.f., Wellspring Biosciences is out with a 12,000 s.f. requirement, Anaphore and Dermtech are both out for 7,000 s.f. and BioEdge for 3,500 s.f.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# UTC / Eastgate

## Overview

The UTC / Eastgate submarket, like Torrey Pines, is comprised of mature, publicly traded companies with advanced product development. This submarket, which offers the most direct competition to Torrey Pines, has 2.3 million square feet of lab space and is located in San Diego's "Golden Triangle," which offers numerous amenities to tenants. Eli Lilly, Illumina, Bristol-Myers Squibb (Amylin Pharmaceuticals) and Celgene are the submarket's largest users, together leasing 1.4 million square feet of space or 61 percent of the submarket's total life sciences inventory.

Transaction activity in the UTC / Eastgate market has been slow, with only four transactions completed year-to-date, totaling 43,000 square feet. This trend is consistent with the previous four years as the submarket has suffered from weak transaction volume. Where it has stood out is its robust activity among large users, seeing some of San Diego's largest lease transactions, most recently Celgene who signed a 172,000-square-foot, 10-year transaction late last year.

## Outlook

UTC currently has 330,000 square feet of space under construction with another 784,000 square feet of potential build-to-suit and redevelopment opportunities, with both BioMed Realty and Alexandria working on future plans. Bristol-Myers Squibb finalized its purchase of Amylin Pharmaceuticals in August and has yet to announce plans for the 406,000 square feet that Amylin currently utilizes. Additionally, Illumina continues to market its 193,000-square-foot campus for sublease. Look for UTC / Eastgate to continue modest amounts of leasing activity through the balance of 2012, with no large transaction on the horizon.

| Key market indicators | | |
|---|---|---|
| Inventory | ▶ | 2,273,936 s.f. |
| Total availability | ▲ | 26.5% |
| Direct availability | ▶ | 9.9% |
| Sublease availability | ▲ | 16.6% |
| Asking rents | ▲ | $2.65-$3.75 NNN/s.f./mo. |

*Change quarter-over-quarter*

**LEASING ACTIVITY**
**Samumed** 12,125 s.f.

**2 BTS DEVELOPMENTS**
**Innovation Center**
275,000 s.f.
**Cushman Land** 190,000 s.f.

**ESPLANDE**
A 67,050 s.f. building redevelopment project.

**SOLSTICE**
The biotech firm is in the market for 5,000 s.f.

***UTC currently has 330,000 square feet of space under construction with another 784,000 square feet of potential build-to-suit and redevelopment opportunities.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Sorrento Mesa

## Overview

Sorrento Mesa is comprised of 4.0 million square feet of lab space and caters to all tiers of San Diego life sciences companies. Some of the largest companies there include BP Biofuels, AstraZeneca (Ardea), Hologic (Gen-Probe), Vical, Arena Pharmaceuticals, Nuvasive and Genomatica. Over the years, Sorrento Mesa was formed as developers saw opportunities for greater returns through the conversion of industrial and flex buildings into R&D wet lab facilities.

Sorrento Mesa recorded 253,000 square feet of leasing activity during the first half of 2012, more than any other submarket; this was highlighted when Shire Pharmaceuticals selected the vacant land site on Camino Santa Fe (adjacent to the existing Alere campus) for its regenerative medicine campus. Shire's initial plan is to construct a 170,000-square-foot facility to house manufacturing, warehouse, and other uses, with the site able to provide growth of up to 800,000 square feet.

## Outlook

Sorrento Mesa boasts a number of emerging companies that continue to expand within the submarket. Organovo, a breakthrough regenerative medicine company, has continued to grow over the past five years and recently moved into a 15,000-square-foot, state-of-the art facility on Nancy Ridge Drive. Genomatica, voted number one in *Biofuels Digest* "30 Hottest Companies," continues to gain momentum and market share. The company recently raised a $41.5 million, Series D round of financing and is in negotiations to expand its 29,000 square foot premises within the Wateridge Summit campus. Since inception, the company has secured a total of $125.0 million in financing.

| Key market indicators | | |
|---|---|---|
| Inventory | → | 4,009,844 s.f. |
| Total availability | ↑ | 8.6% |
| Direct availability | ↑ | 5.8% |
| Sublease availability | → | 2.8% |
| Asking rents | ↑ | $2.25-$2.85 NNN/s.f./mo. |

*Change quarter-over-quarter*

**LEASING ACTIVITY**
**Shire Pharmaceuticals** 170,600 s.f. (build-to-suit)
**ACON Labs** 16,784 s.f.
**SG Biofuels** 11,417 s.f.

**PACIFIC CORPORATE CENTER**
A 83,000 s.f. build-to-suit.

**WESTRIDGE**
A 45,000 s.f., two building flex / lab campus on Nancy Ridge Drive sold for $4.4 million ($96 p.s.f.).

**4 BIOTECH REQUIREMENTS**
Intrexon is out for 35,000 s.f., Tear Lab has a 14,000 s.f. requirement, Valor Medical is out for 10,000 s.f. and SKS Ocular 4,000 s.f.

***Shire's plan is to construct a 170,000-square-foot facility to house manufacturing, warehouse and other related uses, with the site providing planned growth of up to 800,000 square feet.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Sorrento Valley

## Overview

Sorrento Valley was developed as an ancillary market to Torrey Pines and today continues to be home to many of San Diego's start-up life sciences companies. With a base of older industrial and flex buildings that have been converted to lab space, this submarket provides an economical alternative for early stage companies. Some of the submarket's prominent companies include Halozyme Therapeutics, Tandem Diabetes and Althea Technologies.

First half leasing activity within the Sorrento Valley submarket produced four lease transactions totaling 77,000 square feet of total leasing activity, with no deals completed during the second quarter. Despite the limited activity, however, the submarket has recorded a steady increase in rental rates, trending toward the mid-$2.00 per square foot per month NNN range. Although some of this increase is due to the overall health of the life sciences market, the repositioning of antiquated space is also strengthening rents.

## Outlook

BioMed Realty, which led the submarket's redevelopment trend at its newly renovated Coast9 campus, has seen considerable leasing activity. The newly renovated campus has already signed four new companies totaling 38,000 square feet, with another two companies currently in negotiations. Further repositioning of Sorrento Valley's older product is anticipated by Parallel Capital Partners who recently purchased 310,000 square feet of lab, office and R&D buildings from Collins Development. Leasing activity among smaller tenants is expected to remain strong during the second half of 2012, which will further reduce lab space availability under 10,000 square feet.

| Key market indicators | | |
|---|---|---|
| Inventory | ➤ | 1,260,661 s.f. |
| Total availability | ▲ | 26.1% |
| Direct availability | ➤ | 20.5% |
| Sublease availability | ▲ | 5.6% |
| Asking rents | ▲ | $1.95-$2.50 NNN/s.f./mo. |

*Change quarter-over-quarter*

**LEASING ACTIVITY**
**Althea Technologies** 2,633 s.f. (100 percent office)

**2 REDEVELOPMENT PROJECTS**
**Coast9**163,000 s.f.
**4215 Sorrento Valley Boulevard** 55,000 s.f.

**COLLINS PORTFOLIO**
Collins Development, a long time owner of lab, flex and office space in Sorrento Valley, is under contract to sell its 310,000 s.f. portfolio to Parallel Capital Partners. The purchase price is estimated at $130 p.s.f.

**4 BIOTECH REQUIREMENTS**
Inovio Pharmaceuticals has a 20,000 s.f. requirement, Pathway Genomics 12,000 s.f., NexBio is out for 15,000 s.f. and Cosmo Biosciences 5,000 s.f.

***Sorrento Valley has recorded a steady increase in rental rates, trending toward the mid-$2.00 per square foot per month NNN range.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

3

***The Bay Area ranks No. 3 among U.S. life sciences clusters, bolstered by its proximity to institutions of higher education and venture capital funding, as well as its talented workforce.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

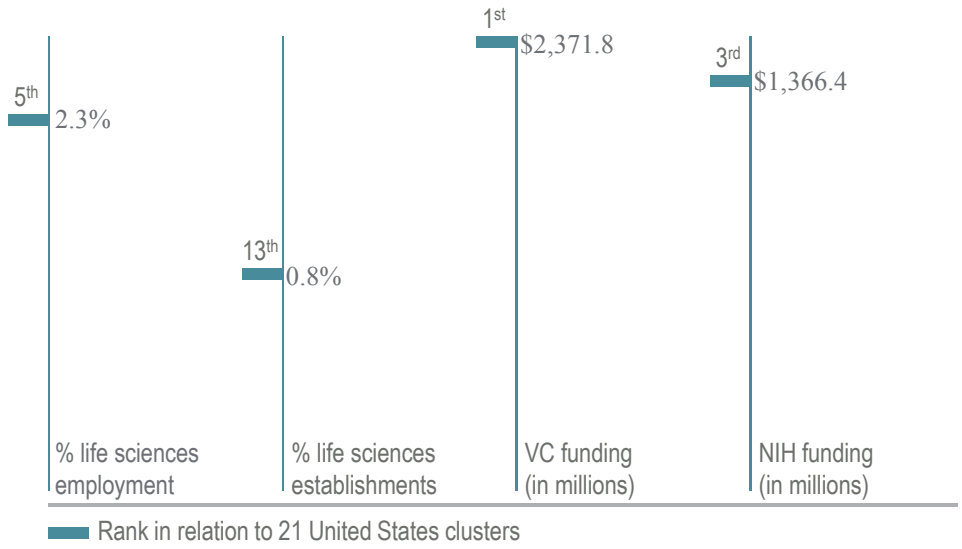
## San Francisco Bay Area market overview

Long considered one of the greatest cities in the world, San Francisco boasts a location, business center and tourist destination unmatched by many. These qualities continually attract students to its local universities as well as job seekers desiring the San Francisco lifestyle. As a result, the city's talent pool consists of some of the brightest and most innovative in their field.

Down the coast, Mid-Peninsula and Silicon Valley have long been at the forefront of innovation and advancement in technology, attracting talent from all around the world. Major corporations such as Genentech continually support academic programs at local universities through grants, scholarships and internship programs. Specific areas within Palo Alto are dedicated solely to research and development firms and heavily recruit recent graduates from nearby Stanford to adopt next generation innovation.

The East Bay shares this talent pool, and UC Berkeley attracts students from around the world to its renowned biology and chemistry programs. For more than 30 years the University of California at San Francisco, Stanford University and the University of California at Berkeley have actively partnered with experts in the industries of healthcare, biotechnology and pharmaceuticals to develop some of the most cutting-edge advances in the field of medicine.

## San Francisco Bay Area life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Mid-Peninsula

## Overview

The San Francisco Mid-Peninsula is home to a multitude of top life sciences, biotechnology and pharmaceutical firms in the United States. Its central location between Silicon Valley, San Francisco and the East Bay gives companies greater access to talent and innovation throughout the greater Bay Area. The majority of life sciences companies have collected near and around the South San Francisco submarket where Genentech has established a significant presence. Other well-known firms in the area include Novartis, Life Technologies, Stemcentrx, Genomic Health, Exelixis, Rigel Pharmaceuticals, Amgen, Onyx Pharmaceuticals, Elan, Janssen Pharmaceuticals, Crecendo Bioscience, Sutro Bio Pharma, Theravance, Pain Therapeutics, Heartflow Cardio, Threshhold Pharmaceuticals, Gilead Science and Facet Bio.

## Outlook

Recent acquisitions by larger companies coupled with other external pressures in the global life sciences industry have begun to impact local real estate decisions in the Mid-Peninsula. Recent acquisitions of smaller biopharmaceutical companies have resulted in the consolidation and reduction of space. Although this has created a sense of uneasiness among landlords and life science developers, it has provided more opportunities for newer-generation biotech companies by freeing up space with existing R&D and lab improvements. South San Francisco has seen a majority of the industry's leasing activity given its location, access to local talent and its strong foundation as being a major biotech and life science hub for the Bay Area.

With most deals signing within the 10,000- to 25,000-square-foot range, leasing activity has been moderate when compared to its heated office counterpart. For this reason, although there are many plans for new construction, life science developers are currently in a holding pattern and will not break ground unless their project has genuine interest from a major tenant.

**STEMCENTRX**
expanded into an additional 22,191 s.f. of space at 450 East Jamie Court in South San Francisco, expanding its current footprint in the building to 46,581 s.f.

**259 E GRAND AVENUE**
Onyx Pharmaceuticals will start construction on its 170,618 s.f. building at 259 E Grand Avenue in South San Francisco.

***The Mid-Peninsula has long been a hub for the nation's top life sciences and biotechnology firms.***

**120-150 INDUSTRIAL ROAD, SAN CARLOS**
Vice Capital LLC acquired the 229,640 s.f. R&D building from Nguyen Family Trust for $46.2M, or $201 p.s.f. The property is currently occupied by Novartis.

**AFFYMAX**
The drug discovery and development company is currently in the market for 125,000 to 150,000 s.f. of space with lab infrastructure.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Mission Bay

## Overview

During the last decade, San Francisco's Mission Bay submarket has undergone a significant transformation as one of the city's highest priority redevelopment areas. With the University of California at San Francisco anchoring the area with a world-renowned research facility and planned hospital, the area quickly generated demand among biotech and pharmaceutical companies. Today the submarket contains 4.4 million square feet of office, life science and biotechnology space and houses such firms such as Nektar Therapeutics, Bayer Pharmaceuticals and Fibrogen. Alexandria Real Estate Equities became a major developer in the area in recent years and has been one of the few companies to deliver new construction to the San Francisco market since the recession essentially froze all other construction activity in the market.

## Outlook

Leasing activity among biotech and life sciences companies in Mission Bay has slowed in recent years. In 2010, Alexandria Real Estate Equities sold eight of its nine development parcels to Salesforce.com for its new headquarters. By early 2012, however, Salesforce.com abandoned development plans in favor of a more central location, re-opening the opportunity for biotech and life sciences companies to plant new roots in this burgeoning area. Although Salesforce.com's intentions for the use of this land remain unknown, several organizations in the area are excited for what may develop in the future.

**SANOFI**
This company signed a new lease at 185 Berry Street for 2,145 s.f. after securing a partnership with UCSF for diabetes research.

**499 ILLINOIS**
Alexandria Real Estate Equities purchased the 453,256 s.f. building for $646 p.s.f. in April 2011.

**1600 OWENS**
Construction is pending on this 246,000 s.f. life sciences building, being developed by Alexandria Real Estate Equities.

**MEDIVATION**
is in the market for 28,000 s.f. of expansion space.

*Mission Bay, although small compared to many rival life sciences markets, is anchored by UC San Francisco's renowned research department and unrivaled local amenities.*

# Oakland-East Bay

## Overview

Life sciences hubs in the East Bay include Oakland, Emeryville, Berkeley, Richmond, Fremont and Newark, anchored by research institutions including the University of California, Berkeley, the Children's Hospital Oakland Research Institute, Lawrence Berkeley National Laboratory and California State University East Bay. Major companies include Amgen, Novartis, Bayer HealthCare and WaferGen Biosystems. Many companies are involved in research and development activities as well as the manufacture of their products.

The creation of the Oakland Enterprise Zone by the California State Legislature in 1993 was intended to stimulate business growth in the East Bay. Businesses located within the zone, which includes Berkeley and Emeryville, are entitled to a variety of tax incentives to promote hiring. Bayer is one of the largest biotech firms located within this zone, and was a major force in expanding the zone in 2009, a move that ensured the retention of thousands of biotech jobs in the region.

## Outlook

With some of the lowest real estate costs in the Bay Area, the East Bay is an affordable location for companies looking to innovate and set up small-scale manufacturing facilities. Proximity to notable institutions in San Francisco and the South Bay, as well as a highly educated workforce, cements the East Bay as a life sciences growth market.

**NOVABAY PHARM-ACEUTICALS**
The firm renewed 14,544 s.f. for an 8-year term at 5980 Horton Street in Emeryville.

**WATERFRONT AT HARBOR BAY**
Six-building, 380,000 s.f. portfolio acquired by AmStar in July for $46M, or $121 p.s.f.

**EVERYVILLE**
Wareham Development completed EmeryStation Greenway totaling 99,000 s.f.

**LAWRENCE LIVERMORE LAB**
is in the market for 20 to 40,000 s.f. of dry lab/office space, and 105,000 s.f. of R&D/ classroom space.

*The East Bay's central location between the South Bay and San Francisco neatly rounds out the entire Bay Area as a strong life sciences cluster.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# 4

***Home to one of the largest research parks, the Raleigh-Durham market has deep and mature innovation capabilities.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

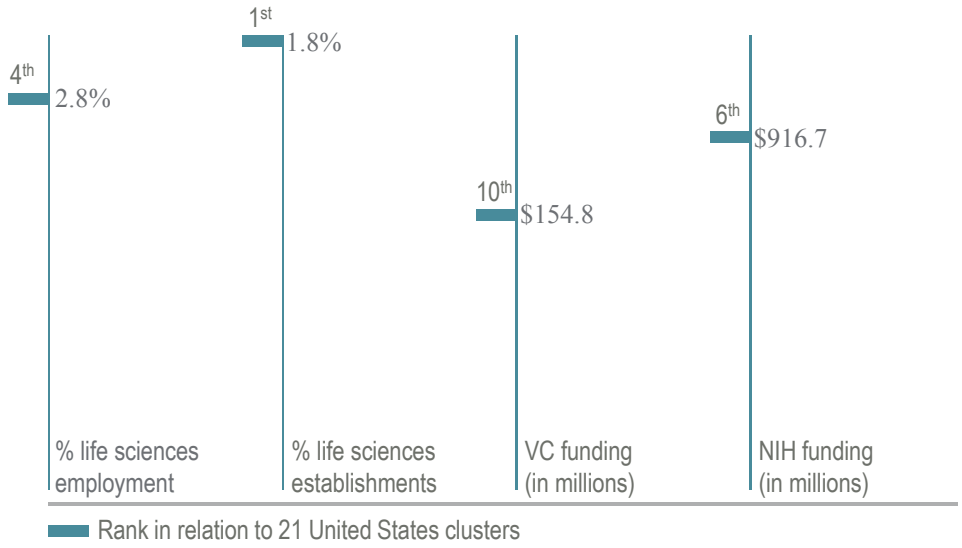
Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

## Raleigh-Durham market overview

The Raleigh-Durham life sciences cluster is familiarly called the Research Triangle Region due to the geographic nexus of the area's three leading research institutions: Duke University, North Carolina State University and the University of North Carolina at Chapel Hill. Squarely in the center of the region is the Research Triangle Park (RTP), a 7,000-acre center of research created by the state to help coalesce R&D talent to the region.

Small start-ups and incubator groups tend to make up the majority of life sciences occupiers in the Raleigh-Durham cluster. Many are spin-offs out of the university system that migrate into RTP with hopes of gaining funding support to continue their research work. As a result, most requirements and availabilities tend to be smaller in nature, rather than large needle movers. Currently, very few lab spaces are available for lease, particularly in the range where most users fall, 5,000 to 15,000 square feet. Similarly, only two large R&D facilities remain on the market, consisting of Gilead Science's 100,000-square-foot availability and Wyeth's 81,000-square-foot facility that was vacated in 2010. There is little demand for a contiguous space of that size.

## Raleigh-Durham life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Research Triangle Region

## Overview

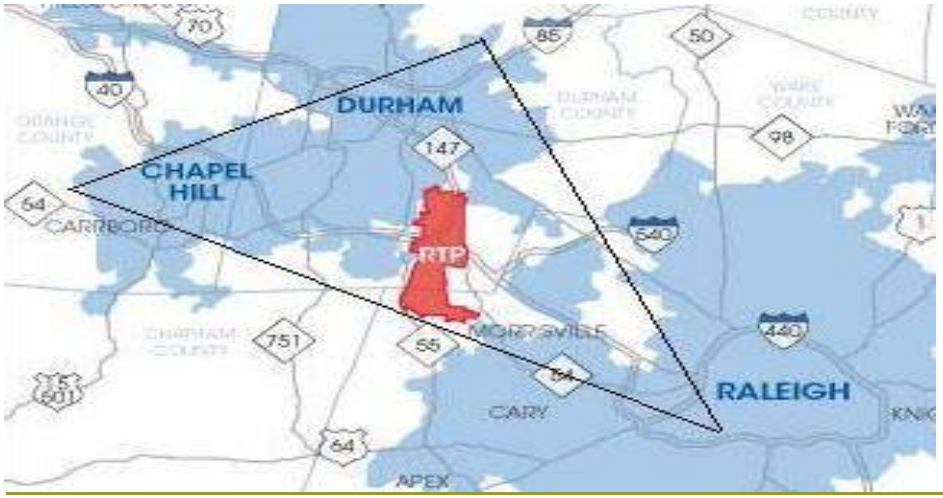
At the heart of the Raleigh-Durham life sciences market is the Research Triangle Region. This hotbed of life science companies acts as an anchor for the industry, taking advantage of the R&D talent in the region as well as the nation's largest concentration of contract research organizations. Large private institutions, like the North Carolina Biotechnology Center, provide links among academic, business and civic leaders, and funding programs to support the commercialization of innovations. Public entities on the other hand, like North Carolina Biosciences Organization, represent the interest of more than 150 companies in state and federal legislation and regulatory affairs.

Some of the industry's largest players are situated in the Research Triangle Region and have fueled much of the activity in the marketplace. Much of the current large-scale growth is fueled by ag-tech companies such as Syngenta, BASF, Monsanto and Bayer CropScience. Syngenta is adding to its current footprint by developing a 147,000-square-foot, $71.0 million R&D facility within RTP and over the summer Bayer CropScience celebrated the opening of its newest $20.0 million research facility, a three-story, 60,000-square-foot greenhouse. Alexandria Real Estate received approval to build its $13.5 million, 50,000-square-foot ag-tech center in Durham. The campus will feature 18,000 square feet of greenhouse space and is expected to serve as a catalyst for the growing crop science sector.

Among pharmaceutical players, United Therapeutics is close to completing a 180,000-square-foot addition to its approximately 200,000-square-foot facility. Construction began in May of 2011 and the total cost has been estimated at $74.0 million. Additionally Salix Pharmaceuticals, who completed a 120,000-square-foot office headquarter merger in early 2011, is still exhibiting modest expansion potential.

## Outlook

Overall, the Research Triangle Region is expected to remain fairly stable during the coming quarters with fluctuations of expansions and contractions among the area's many tenants. Major swings in vacancy, in either direction, are not expected and the market should continue to have a stable presence of life sciences players in the year to come.




**METABALON, INC.**
leased 27,105 s.f. at 617 Davis Drive in the Keystone Technology Park.

**UNC HEALTHCARE**
Leased 15,000 s.f. at Quadrangle I.

**UNITED THERAPEUTICS**
is underway on a 180,000 s.f. expansion.

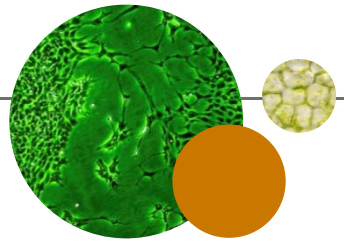
**SYNGENTA**
The ag-tech company is developing a 147,000 s.f. R&D facility.

**MERCK**
purchased the 113,000 s.f., 25-acre Diosynth Plant at 6501 George Watts Drive. The property will serve as a cGMP production facility.

**BASF**
is in the market with a 40,000 s.f. requirement

*Squarely in the center of the region is the Research Triangle Park (RTP), a 7,000-acre center of research created by the state to help coalesce R&D talent to the region.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



***Philadelphia's continually evolving "Eds and Meds" infrastructure is facilitating growth of its deep life sciences employment and corporation base.***

## Global trends

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Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

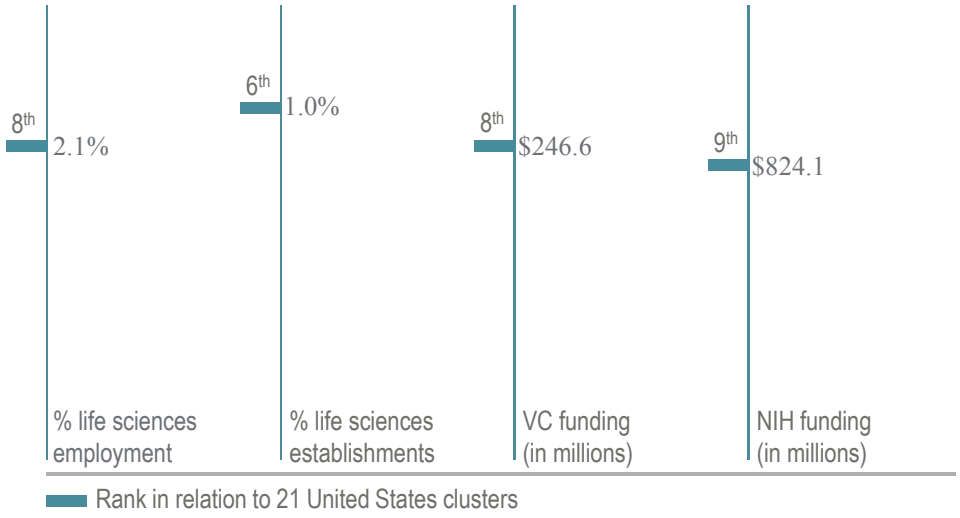
## Philadelphia market overview

Philadelphia's large concentration of leading academic institutions and pharmaceutical companies has created a central life sciences hub in the Mid-Atlantic region. With close proximity to New York's financial markets and Washington, DC's regulatory center, the Philadelphia Metropolitan Area is home to more than 1,200 companies, ranging from the industry's largest multinational companies, including AmerisourceBergen, GlaxoSmithKline and Shire Pharmaceuticals, to the sector's fastest growing firms, such as NuPathe, Tengion and PhaseBio.

The region's vast array of leading universities and research institutes fosters a collaborative environment, having drawn nearly $4.0 billion of venture capital funding to the region over the past 10 years. This constituted 61.6 percent of all venture capital funding in that period. As a result, Philadelphia's innovation hubs, such as Ben Franklin Technology Partners, have harbored the development of leading biotechnology companies from the start up to growth stages. Two of the countries' largest biotechnology IPOs in 2010, NuPathe and Tengion, were founded and grown using these resources. Most recently, Audubon-based Globus Medical raised $100.0 million in its August IPO this year, marking the first successful public debut for the region's life sciences industry since 2010.

The enhancement of the cluster's existing sector infrastructure has been strengthened through the investments of the area's leading research institutions and world-renowned teaching hospitals. With 100 colleges and universities and 25 medical schools, Philadelphia's institutions have fed the region's 432,000 jobs and $20.2 billion in earnings within the biotechnology and healthcare sectors, accounting for nearly 15.0 percent of Philadelphia's economic activity. These factors collectively have created a bioscience innovation hub with a deep talent pool and the resources to facilitate continued growth.

## Philadelphia life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# University City

## Overview

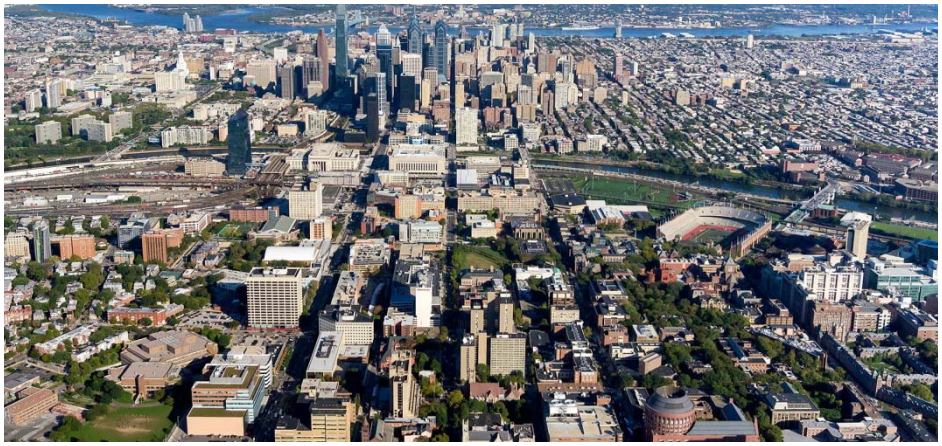
Located due west of the Schuylkill River in the Philadelphia Central Business District, University City plays host to the University City Science Center, one of the oldest and largest urban research parks in the United States. The Science Center is strategically located proximate to several major universities and research institutions including the Children's Hospital of Philadelphia, Drexel University, the University of Pennsylvania, University of the Sciences in Philadelphia and the Wistar Institute. Serving as an incubator for many of the region's growing companies and research efforts, University City's Science Center has led to more than 40,000 jobs in the region and $64.5 million for the city and state in tax revenue.

As a result of high demand for space in the Science Center's incubators and the proven success of its graduate companies, the Science Center's state-of-the-art laboratory facilities have transformed the growing submarket into the tightest, most expensive submarket in the CBD. In August 2012, the University of Pennsylvania announced a global research and licensing agreement with pharmaceutical corporation Novartis. As part of the deal, Novartis is committing $20.0 million to build the Center for Advanced Cellular Therapies, which will house the cancer research studies. The facility will be in close proximity to Penn's campus.

In light of record-low vacancy and more than 2.0 million square feet of proposed developments in University City, developers continue to market properties to anchor tenants. Most recently, spurred by a lease with Penn Presbyterian Medical Center, the Science Center broke ground on 3737 Market Street as part of a joint venture with Wexford Equities. The 272,700-square-foot asset will contain 88,000 square feet of new office and lab space for the market's start-up tenants. Although most of the region's development activity has consisted of build-to-suit projects for pharmaceutical tenants, University City contains both of the market's only ground-up office projects with vacancy. With prospects for continued development, University City owners will continue to target life sciences and "Eds & Meds" tenants for remaining development sites.

## Outlook

Growing life sciences tenants and developing research initiatives are broadening the pharmaceutical tenant base in the tight submarket. Whereas University City's incubator-born, VC-bred firms such as Avid Radiopharmaceuticals, Centocor, Morphotek and BioRexis have brought leading pharmaceutical companies to the Philadelphia CBD via acquisitions, Penn's recent partnership with Novartis is reflective of institution-led innovation via translational research. With the University of Pennsylvania and the Children's Hospital of Philadelphia both experiencing continued growth and expanding research capabilities, the region's leading research institutions will continue to drive real estate activity and investor interest in the market's leading research hub.



View from University City to Center City Philadelphia

**PENN PRESBYTERIAN MEDICAL CENTER**
signed a 155,700 s.f. lease at the Science Center's new ground up development at 3737 Market Street. The lease, paired with a 25,950 s.f. lease with Good Shephard Penn Partners, drove the project's September groundbreaking.

**AVID RADIO-PHARMACEUTICALS**
expanded from 16,000 to 24,500 s.f. The Lilly subsidiary has continued to expand since graduating from one of the Science Center incubators.

**3737 MARKET STREET**
Spurred by a large lease with Penn Presbyterian Medical Center, the 272,700 s.f. property broke ground in September 2012. The $80.0 million project will bring 88,000 s.f. of new lab and office space to University City.

**WISTAR INSTITUTE**
Scheduled for Spring 2014 completion, the Wistar Institute is under construction on its new $100.0 million, 89,700 s.f. Cancer Research Tower. The expansion will enable Wistar to expand its research operations, scientific faculty and collaborative research.

***The epicenter of Philadelphia's higher education and healthcare sectors, University City, serves as the regional hub for research, talent and innovation.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Route 202 Corridor

## Overview

While lab presence is spread throughout the Pennsylvania suburban markets, the largest concentration resides along the Route 202 Corridor that extends from King of Prussia / Wayne to the Malvern / Exton submarket. The area is home to several of the region's largest pharmaceutical firms, including AmerisourceBergen, Auxilium Pharmaceuticals, Endo Health Solutions, Shire Pharmaceuticals and West Pharmaceuticals as well as many life science companies which have opted to co-locate for synergistic and logistical purposes.

The Route 202 Corridor has become a hotbed of construction activity between new office construction and major roadway infrastructure repairs and improvements. At the end of 2011, two major life science tenants, Endo Health Solutions and West Pharmaceuticals, announced build-to-suit headquarters projects in Malvern and Exton respectively. Both projects are expected to be completed by the start of 2013, delivering 471,000 square feet of LEED-certified office / lab space along the 202 Corridor, marking the first new office completion in Malvern / Exton since 2008. Looking past the obvious economic impact, these deals reveal the growing trend of large pharmaceutical companies announcing plans to build LEED-certified headquarters projects.

Starting in 2011, the Pennsylvania Turnpike Commission began two major infrastructure improvements to strengthen the corridor's accessibility, making it more desirable for life science companies. In March of 2011, the Turnpike Commission began building the Route 29 All-Electronic Interchange ("AEI"), or slip ramp, along the Pennsylvania Turnpike in an effort to shorten travel times of the more than 50,000 commuters who use Route 202, Route 29 and the Turnpike daily. Simultaneously, the Turnpike Commission started a road widening project to expand a highly traveled 6.5-mile stretch of the Route 202 highway between Swedesford Road and the Exton Bypass, which is expected to be completed by summer 2014.

## Outlook

The advent of these infrastructure improvements were instrumental in Endo Health Solutions' decision to move forward with its new build-to-suit headquarters project off the Turnpike Interchange exit in Malvern. The infrastructure improvements are garnering the interest of most large tenants in the market, greater than 100,000 square feet, with several build-to-suit opportunities in close proximity to Endo's new facility at growing corporate parks such as Atwater Corporate Campus and Great Valley Corporate Center. The Corridor's largest current requirement, Shire Pharmaceuticals, is searching for 300,000 to 500,000 square feet of specialized office / lab space. Rather than renewing or relocating to second generation lab space, the company has narrowed its search to sites near the Interchange. With more than 900,000 square feet of large tenants in the market, expect more big deal activity and construction announcements along the Route 202 Corridor through 2013.

A recent view of the Route 202 widening project from the Route 29 overpass in Malvern

**AUXILIUM PHARMACEUTICALS** signed a new lease to relocate from Malvern into 74,516 s.f. at 640 Lee Boulevard in Wayne.

**BUILD-TO-SUIT HEADQUARTERS TO DELIVER EARLY 2013** Endo Health Solutions' 300,000 s.f. facility at the Atwater Corporate Center in Malvern, and West Pharmaceuticals' 171,000 s.f. property in Exton are completing construction.

**BPG PROPERTIES** acquired a two-property portfolio totaling 170,866 s.f. of lab and office space for $19.8 million, or $116 p.s.f. The properties were located in West Chester and Exton and were 100% leased.

**SHIRE PHARMACEUTICALS** Looking to build a 300,000 to 500,000 s.f. headquarters facility along the Route 202 Corridor.

***The Route 202 Corridor is home to the largest life sciences companies in the Philadelphia Suburbs. Tenants located in the market include Auxilium, Endo, Shire and West Pharmaceuticals.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Suburban Maryland / DC / Arlington



## *Life Sciences activity in the Suburban Maryland / DC / Arlington cluster largely occurs in suburban Montgomery County.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

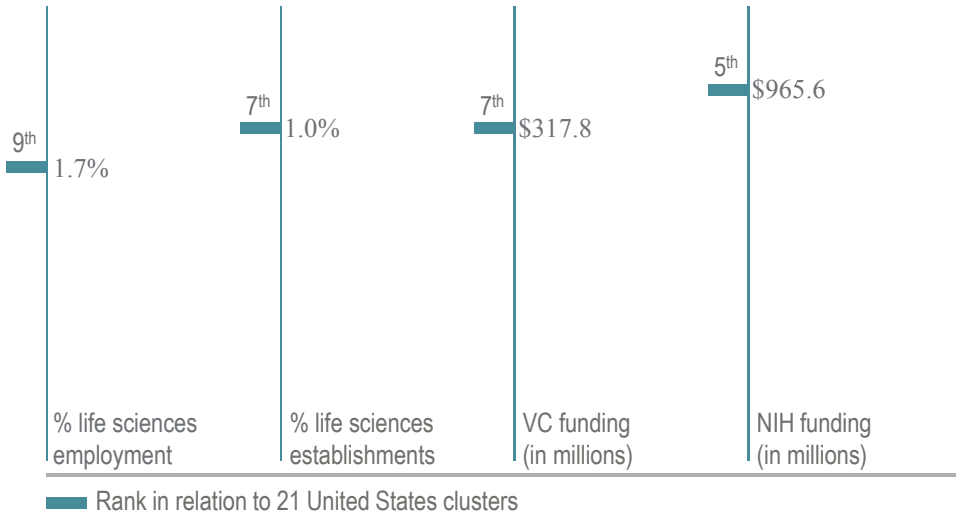
### Suburban MD / DC / Arlington market overview

The Suburban Maryland / DC / Arlington life sciences cluster has benefited tremendously from the area's large federal government presence. Government agencies such as the National Institutes of Health (NIH) and the U.S. Food and Drug Administration (FDA) have provided contracts for private sector companies as well as a critical mass of scientists who have gone on to start or staff many of the region's private biolife companies.

Aside from its federal backbone, the market boasts a significant inventory of existing lab space which originated primarily from a decision by Alexandria Real Estate to invest in speculative space. The growth that rewarded Alexandria came largely from research into the human genome. The companies that led the region's development into a cluster included Human Genome Sciences, MedImmune and Qiagen, all with strong ties to the federal government and an affinity for public-private research partnerships.

The life sciences are largely clustered among suburban Montgomery County, particularly along the I-270 corridor. The J. Craig Venter Institute and Johns Hopkins (satellite campus) are both located there. Federal government facilities are found to the south in the Twinbrook, White Flint and North Bethesda submarkets. Washington DC and Arlington, VA act as supporting clusters to life sciences activity in Maryland. Their proximate locations keep talent and funding flowing across the region.

### Suburban MD / DC / Arlington life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# I-270 Corridor

## Overview

The life sciences are largely clustered among suburban Montgomery County, particularly along the I-270 corridor, known locally as "DNA alley." Within the I-270 corridor, a heavy concentration of biolife companies is found in the Shady Grove micromarket encompassing Rockville and Gaithersburg.

The disposal of large blocks of space and federal budget cuts earlier this year swelled vacancy in the area and diminished rental rates from the peak achieved in 2010. A prime example is J. Craig Venter Institute's current sublease of its entire building at 9704 Medical Center Drive (124,000 square feet). Conversely, the NIH signed a 15-year lease for 75,056 square feet at 9800 Medical Center Drive in Rockville for its infectious disease research lab. It is one of the largest leases for the industry in 2012. Novavax signed a large deal in 2011 and is slated to move into 20 and 21 Firstfield Road in Gaithersburg. The company will be vacating approximately 25,600 square feet at the end of 2012 and the other half of the building in the middle of 2013. Now that the company has a future home it is trying to sublease its current space at 9920 Belward Campus Drive.

Qiagen plans to build a 244,000-square-foot facility and will initially only occupy half the space, allowing the balance to be ready for anticipated future company expansion. Emergent BioSolutions reportedly moved into an additional 8,000 square feet to total more than 40,000 square feet at 2273 Research Boulevard. The company sells the only approved anthrax vaccine to the federal government and recently won a grant worth up to $200.0 million dollars to launch a new biodefense development and manufacturing facility in the state of Maryland. Intrexon decided to stay and renew at 20358 Seneca Meadows Parkway in Germantown. Based in Blacksburg, Virginia, Intrexon signed a 55,000-square-foot lease of both laboratory and office space. The company designs and produces novel and enhanced biological products and processes throughout multiple industry segments.

Human Genome Sciences (HGS) was acquired by GlaxoSmithKline (GSK) in 2012 for $14.25 per share. GSK revealed that the transaction will improve their earnings beginning in 2013 and will result in a $200.0 million cost saving by 2015. These companies have reportedly worked together for years, including a lupus treatment which was granted marketing approval last year. HGS occupies 9910 and 9911 Belward Campus Drive and 14200 Shady Grove Road. GSK placed 14200 Shady Grove Road on the market for sublease in 2012. The three building complex totals 657,414 square feet and is located close to the I-270 corridor.

In the area of new development, the National Cancer Institute (NCI) has a build-to-suit under construction. The building will be approximately 575,000 square feet and is slated to deliver in 2012 / 2013. Great Seneca Science Corridor is under construction with multifamily projects; however, the existing and proposed development plans include 17.5 million square feet of commercial space, 9,000 dwelling units and 52,500 jobs.

## Outlook

Given historically modest growth in election years, a decrease in the federal budget and an apprehensive posture toward new investment among most businesses across the country, tenant demand in the I-270 Corridor's life sciences sector has stagnated. State and local government incentives, venture capital investments in the life sciences space and technological innovations, however, could produce significant long-term gains for the industry in the years ahead but does not have enough influence to be an immediate effect. In light of these conditions, real estate participants would be well advised to continue monitoring the life sciences industry to ensure that supply / demand trends are optimized in their favor.

**NIH**
The institute signed a 15-year lease for 75,056 s.f. at 9800 Medical Center Drive.

**GREAT SENECA SCIENCE CORRIDOR**
is under construction with multifamily projects; however, the existing and proposed development plans for 17.5M s.f. of commercial space.

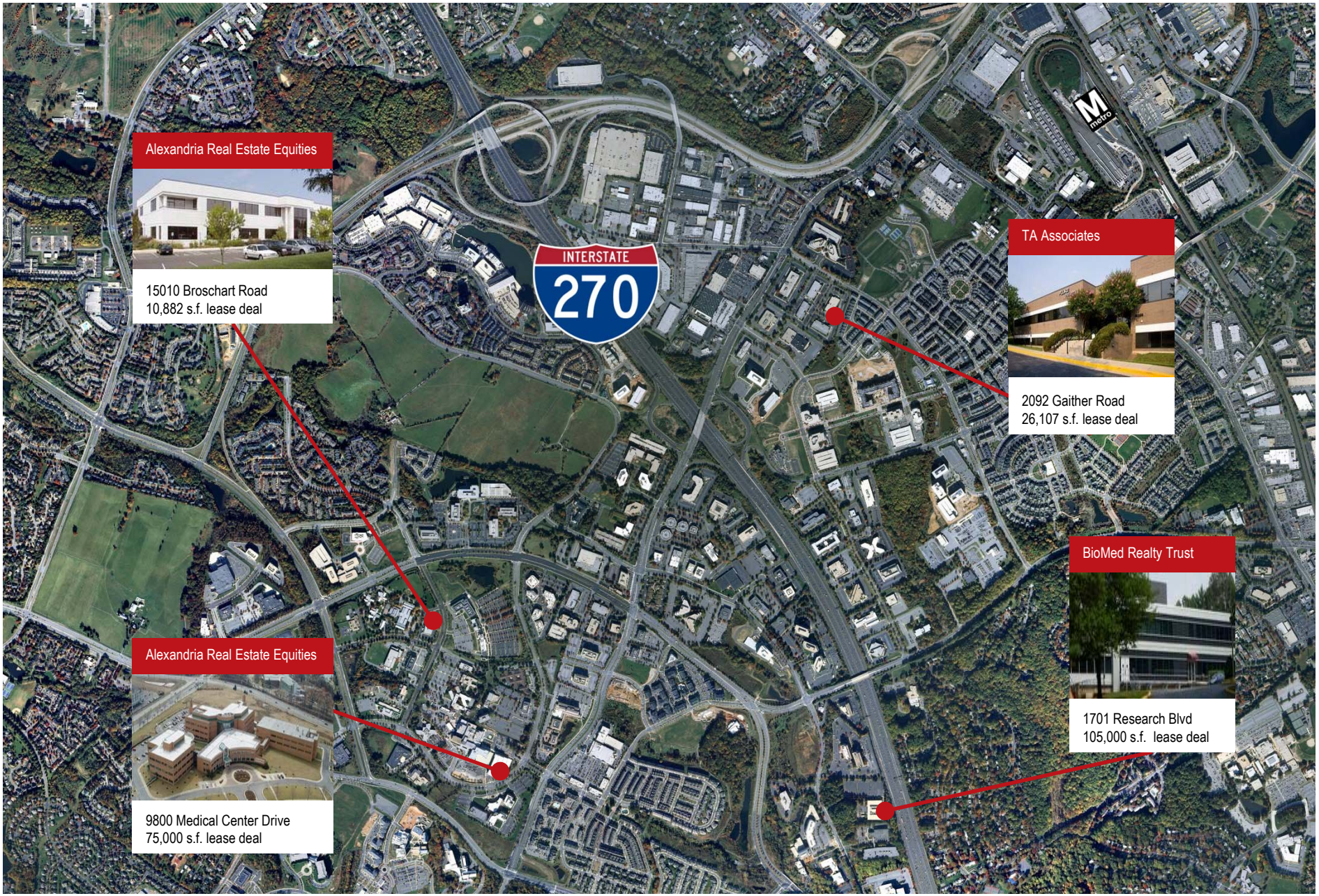
**BIOMED REALTY TRUST**
purchased Belwood I and II in 2012 for a reported $26.2 million ($245.80 p.s.f.). The two properties totaled 106,469 s.f.

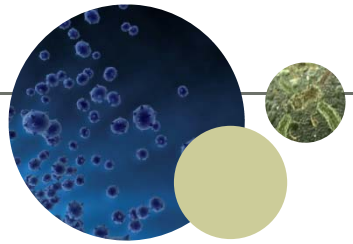
**J. CRAIG VENTER**
The institute is subleasing their entire building at 9704 Medical Center Drive, consisting of 124,000 s.f.

***State and local government incentives could produce significant long-term gains for the industry in the years ahead but does not have enough influence to be an immediate effect.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# I-270 Corridor lease activity





# Frederick

## Overview

Many price-conscious tenants are drawn to the Frederick market due to its proximately to I-270 and the Shady Grove micromarket. In general, as space in the Rockville-Gaithersburg area, including Shady Grove, is absorbed this could cause tenants to venture farther north on I-270 into Frederick. A handful of tenants have decided to be in both the I-270 Corridor and Frederick markets. MedImmune has their headquarters in Gaithersburg but also has a branch in Frederick and Qiagen and Charles River Laboratories have also made Frederick their home. Qiagen moved in an additional 10,000 square feet in early 2011 to occupy the entire building at 6951 Executive Way. Charles River Laboratories is staying in Frederick, renewing their lease of 35,003 square feet early in 2012.

## Outlook

Strong ties to the Shady Grove micromarket should bode well for the emerging market. After experiencing a slight increase in vacancy in 2011, it has tempered off in 2012 and will likely remain stagnant over the coming quarters.

**CHARLES RIVER LABORATORIES** renewed 35,003 s.f. for five years at 15 Wormans Mill Court.

**EMERGENT BIOSOLUTIONS** sold Wedgewood IV, buildings 1 and 3 (292,000 s.f.) to Matan Realty for $12.2M, both 100 percent vacant.

**U.S. ARMY MEDICAL RESEARCH INSTITUTE OF INFECTIOUS DISEASE** is under construction on a six-story research facility at Fort Detrick, due to deliver in 2014.

**MRIGLOBAL** has a reported lease expiration in 2013. R&D is presumed to be the function at its current Frederick location.

***Charles River Laboratories is staying in Frederick, renewing their lease of 35,003 square feet.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# New Jersey / New York City



7

***New Jersey / New York City ranks No. 7 among U.S. life sciences clusters, supported by a large labor force and life sciences-business community.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

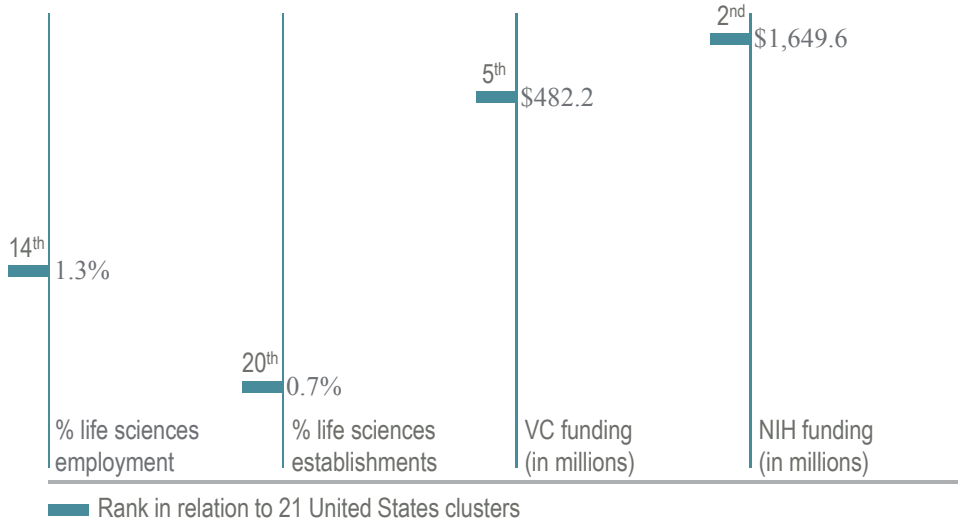
## New Jersey / New York City market overview

The New Jersey / New York City area remains one of the most desirable locations for life sciences firms in the country with the highest concentration of college graduates in the nation. The cluster directly employs over 106,000 people in the life sciences industry, the second highest amount in the nation behind only Los Angeles, and boasts over 3,700 life sciences establishments, the most in the United States. Although these raw statistics are impressive and demonstrate the deep resource pool available, they lose their impact when viewed as a percentage of total employment and establishments, given the large concentration of workforce and businesses in the New Jersey / New York City metro area.

The New Jersey / New York City life sciences market consists of the five boroughs of New York City and Northern and Central New Jersey. Although proximity to major research universities helped build the established life sciences clusters in Boston and Raleigh-Durham, access to major transportation and distribution systems coupled with the aforementioned concentration of educated employees and academic institutions has driven the life sciences industry locally. Nearly all the world's major pharmaceutical companies have operations in the metro area, including Pfizer, Merck, Johnson & Johnson, Celgene, Bayer and Novo Nordisk.

Although some of the large life sciences and pharmaceutical firms have continued to consolidate their operations through the area, demand has remained strong, especially within New Jersey as small and mid-level firms have increased in both numbers and size in the last few years.

## New Jersey / New York City life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# New Jersey

## Overview

A large concentration of pharmaceutical, biotech and medical device firms is one of the primary attributes that has helped position New Jersey as a global leader in the life sciences industry. Bayer HealthCare, Bristol-Myers Squibb, Celgene, Johnson & Johnson, Novartis Pharmaceuticals, Novo Nordisk, Merck and Pfizer are among the companies with a large presence in New Jersey. Furthermore, the technical demands of many life sciences' occupations require a highly skilled workforce, which is continually replenished by a pipeline of graduates from the state's colleges and universities. Almost two-thirds of the life sciences' New Jersey workforce holds at least a bachelor's degree. Geographic proximity to Manhattan and a mature transportation infrastructure that includes access to Newark Liberty International Airport have helped Garden State companies to reach the global marketplace.

Northern and Central New Jersey are known as the "Medicine Chest" of the world. The three primary geographic markets within Northern and Central New Jersey that contain the largest concentration of life sciences industry companies are The Route 1 Corridor from Middlesex County south to the Princeton area, Somerset/Morris counties (the Golden Triangle region) and parts of Bergen County. These areas currently boast much of the state's 5.9 million square feet of available R&D/Lab space for lease.

The sluggish economic conditions combined with mergers and acquisitions among the large pharmaceutical companies continue to shuffle players in the state. After operating in Northern New Jersey for 80 years, Roche recently announced that it will be closing its Nutley research center by 2013 and will shed 1,000 jobs. The 119-acre site along Route 3 is likely to be redeveloped for retail use. The Swiss pharmaceutical company plans on opening a smaller clinical research center to be located in New York, while continuing to employ 400 people at its diagnostics facility in Branchburg. In Monmouth Junction, Pfizer sold its 378,000-square-foot research facility, which is now being marketed for multitenant use. The building was originally utilized by Wyeth Research, which was acquired by Pfizer, and deemed as surplus property. In addition, Dendreon will close its manufacturing facility in Hanover Township as part of a restructuring effort, but recently leased nearly 40,000 square feet of office space in Bridgewater for its headquarters which will relocate from Seattle, Washington.

Countering these consolidations and the shedding of excess space has been demand-generated by mid-level pharmaceutical and biotech firms. In 2011, more than 2.0 million square feet of office leases were signed by companies in the life sciences sector, with approximately one-quarter of this activity involving lease extensions. Among the firms driving this wave of activity were Celgene, Evonik Degussa, Lifecell and Novo Nordisk. However, demand downshifted during the first half of 2012, with just over 600,000 square feet leased. Allergan, Dendreon and Savient have been among the firms recently absorbing significant space in the Bridgewater area.

The New Jersey Center of Excellence in Bridgewater

**ALLERGAN**
relocated from California and leased 93,000 s.f. at 200 Somerset Corporate Boulevard in Bridgewater. By third quarter 2012, Bridgewater witnessed more than 200,000 s.f. of life sciences activity.

**NOVO NORDISK**
is vacating over 240,000 s.f. of space on College Road West in Princeton and relocating its U.S. headquarters into 770,000 s.f. at 800 Scudders Mill Road in Plainsboro.

***The N.J. Center of Excellence in Bridgewater encompasses 1.2M square feet of lab, office, GMP production & warehouse facilities.***

**BAYER CORPORATION**
purchased 67 Whippany Road (550,000 s.f.) in Whippany for future occupancy. Bayer plans to consolidate its employees throughout the state.

**TEVA & PFIZER**
are both in the market for significant amounts of space within the state.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

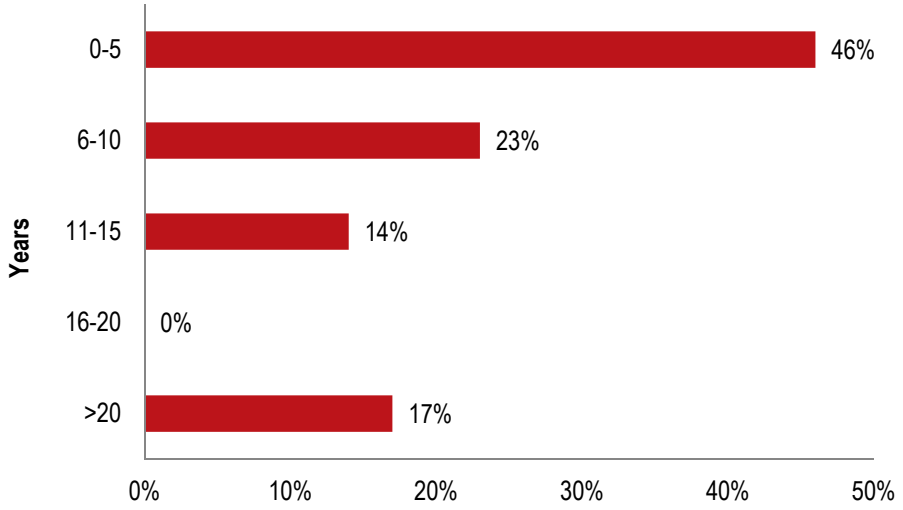
# New Jersey

## Outlook

Consolidations among larger pharmaceutical companies will likely continue to generate headlines in the year ahead, as firms pursue aggressive strategies to cut operating expenses. These companies are prompted to consider consolidation options due to the heighted drug development costs, now estimated over $1.3 billion, and the considerable number of products up for patent expiration during the next few years.

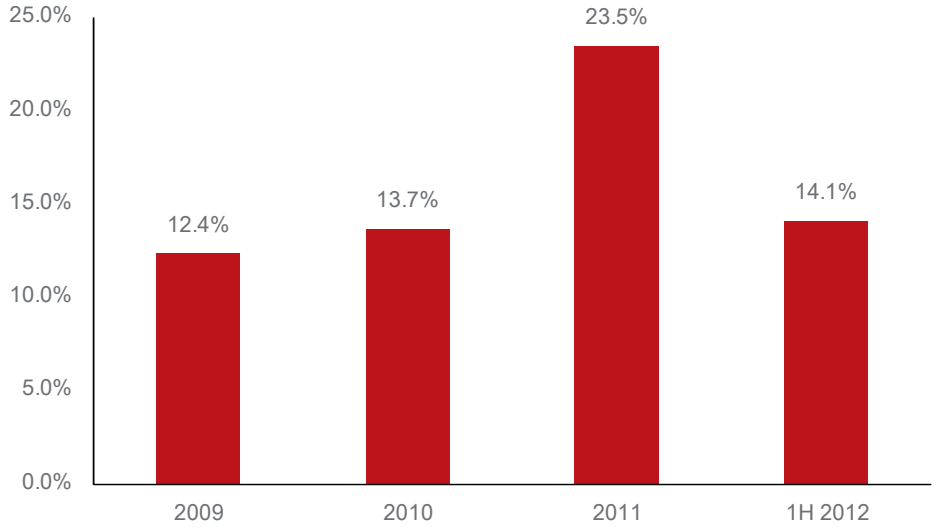
Despite the ominous shadows cast by consolidations and mergers, New Jersey's biotech industry continues to expand, according to a recently released industry survey from BioNJ and Ernst & Young. The survey reported an increase in biotech employment in the Garden State by almost 1,500 jobs since 2010. This figure does not include the thousands of indirect jobs generated by the presence of biotech firms. In addition, the number of biotech companies in New Jersey increased from 300 in 2010 to 340 in mid-2012. More than 60.0 percent of the respondents in the survey have been operating in New Jersey for either less than five years or more than 20 years. This mix of start-up and established companies are healthy ingredients for future stability and growth of the industry.

### Biotech companies by number of years in business in New Jersey



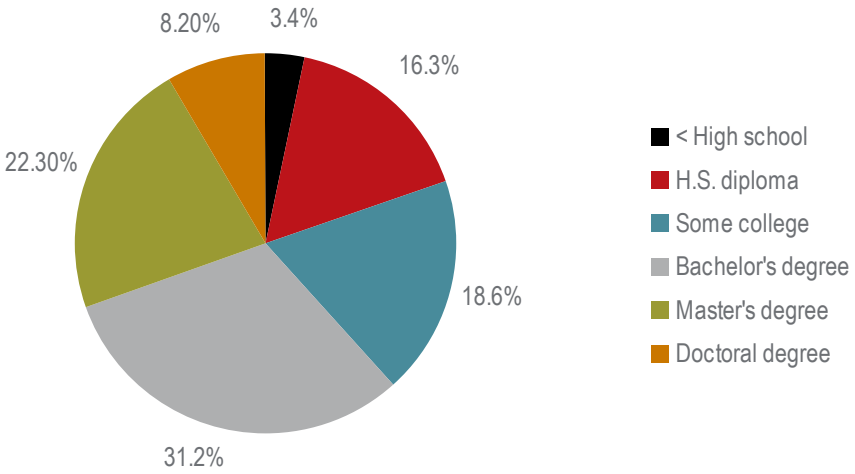

*Source: BioNJ and Ernst & Young*

### Life sciences as % of total office leasing activity




*Source: Jones Lang LaSalle Research*

### New Jersey life sciences employee educational breakdown




*Source: New Jersey Department of Labor Workforce Development*

# New York City

## Overview

Spurred by the desire to become less reliant on Wall Street and establish New York City as an innovation hub, the New York City Economic Development Corp has embarked on a drive to grow research and education in the technology and life sciences industries. Completed in 2010, the Alexandria Center for Life Science was the first of its kind in New York City. An office park focused primarily on life sciences firms, the development has attracted big name companies such as ImClone, Abbott Laboratories and Novartis. Although historically located near hospitals or in non-central locations like the Alexandria Center for Life Science on the far east side, life sciences companies have now begun to follow the technology industry in moving to the city's fastest growing submarket, Midtown South.

Most recently, New York Genome Center signed a lease for 171,000 square feet at 101 Avenue of the Americas in Midtown South. The space will serve as the center's headquarters and will become the city's largest genetic sequencing facility, growing to about 500 employees in the first five years. Construction of the space is expected to be completed by the end of 2013 and include sequencing, bio informatics, a research lab and innovation center. The decision of the New York Genome Center to move to this location was seen as a catalyst for the life sciences industry in New York City and is expected to attract other research firms to the area. InVentiv Health, a life sciences consulting company, also signed a large lease in Midtown South for 75,000 square feet at 450 West 15th Street at the beginning of this year.

Earlier this year, Mayor Bloomberg announced a partnership between Cornell University and Technion-Israel Institute of Technology as the winner of an intense international competition to build an applied science school on Roosevelt Island. This $2.0 billion campus is expected to house about 2,500 graduate students by 2043 and further establish New York City as a science and technology hub. The city has also provided funding this year to two other applied science schools to open campuses in the city: Columbia University in Washington Heights and New York University in Brooklyn.

## Outlook

With the city's continued efforts and plans for innovation growth, we anticipate more bioscience and technology research centers will open in the city in the near future. Although asking rents are on the rise in Midtown South, we predict this will be a growing area for these industries as they strive to attract employees and be close to their peers. The development of applied science schools will further grow the employee talent base in the city and spur new company development in the coming years.

(left to right): the Alexandria Center for Life Science and the New York Genome Center

**NEW YORK GENOME CENTER**
signed a lease for 171,000 s.f. at 101 Avenue of the Americas. The center plans to build a state-of-the-art research center and plans to grow from 100 to 500 employees over five years.

**ALEXANDRIA CENTER FOR LIFE SCIENCE**
completed the first stage of construction in 2010, which included the first three buildings planned. The lower east side site plans to have 1.0M s.f. of commercial lab space on the city-owned land.

**ALCON**
The eye care division of Novartis is out with 20,000 s.f.

**ELAN**
is out with 15,000 s.f.

*"Our city really is a global leader in the commercial life sciences, with some 110,000 employees this sector is already larger here than in any other metropolitan area in the U.S." -Mayor Bloomberg*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Los Angeles / Orange County

***The Los Angeles / Orange County market ranks No. 8 among U.S. life sciences clusters, specializing in medical research and medical device manufacturing.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

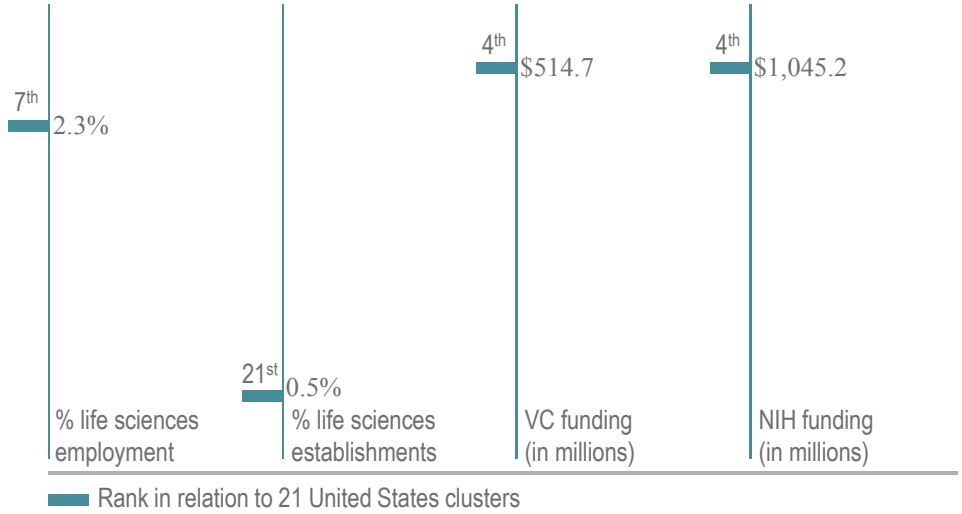
## Los Angeles / Orange County market overview

Although Los Angeles and Orange County are very different markets in terms of economic drivers, the life sciences sector in both markets share resources with proximity to world-class learning and research institutions. Two of the five University of California campuses with medical schools are located in the Los Angeles / Orange County market: UC Los Angeles (UCLA) and UC Irvine. In addition, the region is home to major research universities such as UC Santa Barbara, Cal Tech and the University of Southern California (USC).

From a sheer numbers standpoint, the Los Angeles / Orange County cluster has the largest life sciences-related employment pool in the country, with over 118,000 individuals actively working in the industry. When you consider the large population in the area, however, industry-related employment only makes up 2.3 percent of total workforce.

The Los Angeles / Orange County life sciences market is comprised of 5.6 million square feet. Approximately 40.0 percent of the space is located in Los Angeles County, nearly 10.0 percent of the inventory is concentrated in Thousand Oaks alone and the remaining 50.0 percent is in Orange County, primarily in the Airport Area and South County submarkets. Currently, the region leads in medical device manufacturing, but is more an emerging sector with regard to pharmaceutical and biotechnology development and manufacturing.

## Los Angeles / Orange County life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Los Angeles

## Overview

The Los Angeles market is well positioned for future life sciences growth. The region is home to leading research universities and maintains a highly diverse and educated work force. Given the size of the Los Angeles market, life sciences clusters are spread throughout the region and can be grouped together as West Los Angeles, South Bay, Los Angeles North, San Gabriel Valley, and the Santa Clarita Valley. Major private research institutions are also located in the Los Angeles basin: Cedar Sinai Medical Center, the City of Hope National Medical Center, Huntington Medical Research Institute, the Children's Hospital of Los Angeles and Kaiser Foundation Hospital.

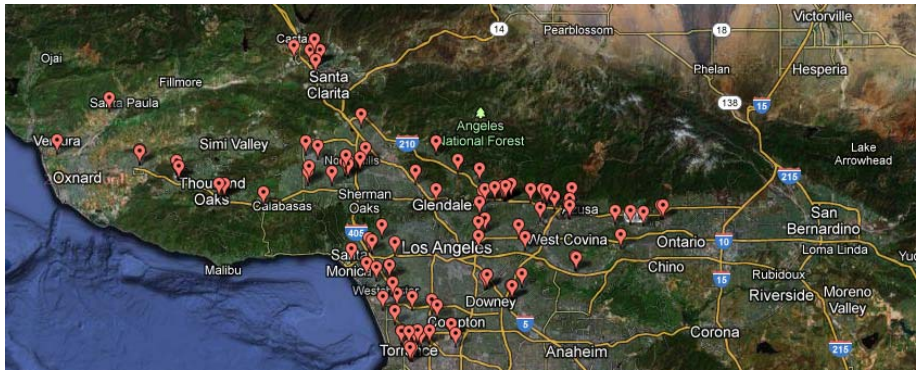
The Los Angeles life sciences industry has a general emphasis on medical device firms. Although there are not a large number of pharmaceutical firms, Amgen, the world's largest biotechnology company, is headquartered in the area. There is also significant presence by firms such as Allergan, Abbott Laboratories and Baxter.

The Los Angeles life sciences market covers 2.2 million square feet of laboratory space.[1] Every submarket is unique, based on the presence of major universities, large research institutes, and companies anchored in that market. Life sciences companies in Los Angeles typically focus on business parks with inexpensive space that can be adapted to fit these companies' unique needs.

## Outlook

Strong year-to-date earnings by Amgen and Baxter International, both of whom have facilities in Los Angeles, point to robust industry growth ahead. Furthermore, given the strong market fundamentals, the outlook for the life sciences market is very optimistic for the Los Angeles Basin. Local universities will continue to incubate and spin out new early stage life sciences companies who will need to lease space and who will prefer to be near those universities or other biomedical firms. Current construction of lab space in minimal, suggesting that the supply of wet lab space should remain thin in Los Angeles.

[1] Excludes Amgen's 2.2 million square foot campus.




Life sciences facilities clustered throughout the Los Angeles area total 2.2M s.f.

**PRECISION DYNAMICS CORPORATION (PDC)**
Company specializes in clinical identification solutions. PDC signed a 7-year, 44,000 s.f. lease at 27770 N Entertainment Drive in Santa Clarita during the first quarter.

**INNOVATION VILLAGE NEAR CITY POLY POMONA**
Phase I was 50 acres and now they are expanding it by 100 acres.

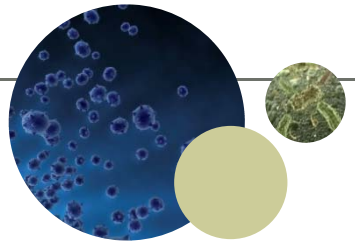
**XENCOR, INC.**
The bio-therapeutics company leased 25,000 s.f. at 111 West Lemon Avenue, Monrovia during the first quarter.

**ABAXIS BIOSCIENCES**
Abraxis BioScience was acquired by Celgene in 2010. Prior to being acquired, the company bought 35 acres in Culver City and developed a biotech campus.

*Rather than having one main cluster where life science firms are located, Los Angeles is a series of smaller clusters that congregate near universities, large biotech firms or research institutes.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Orange County



## Overview

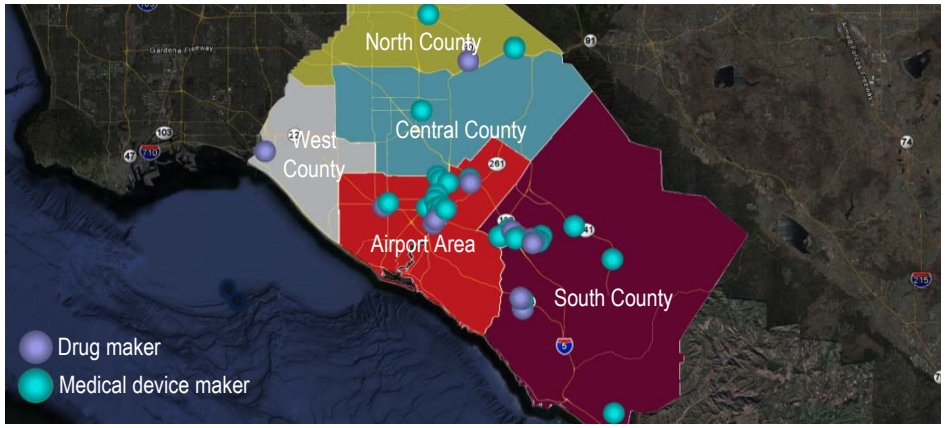
Orange County is a vibrant environment for life sciences companies. Neighboring Los Angeles and San Diego, the county is the third most populous in the state and sixth largest in the country with over 3.0 million residents. In the past, the market has been known for its heavy presence of mortgage-related companies; however, the collapse of the housing bubble and the resulting recession in 2007 led to an economic diversification that has ultimately altered the makeup of the commercial real estate sector. Throughout the market's post-recession recovery, firms from the technology and life sciences industries have been some of the most active in adding jobs to the local economy and backfilling vacancies.

From the founding of Allergan, Beckman Coulter and Edwards Life Sciences in the 1950s, Orange County's life sciences sector has grown to be a dominant industry with over 1,100 companies. Although these companies are scattered in all corners of the county, a majority of the firms are clustered around the Airport Area and South County submarkets, both of which have consistently been the most active commercial office, industrial and flex areas in the market since 2008. Life sciences firms are attracted to the Airport Area for its high profile location and access to appealing workforce demographics, whereas South County provides an abundance of newer lab / flex property and is less than an hour drive to San Diego which offers a deep talent pool and the potential for demand spillover.

There are currently few vacant true biotech space options in Orange County. As the industry has increased its need for specialized space, landlords are becoming more accommodative to the expense associated with the specialization of space. To the extent that each user has specific needs, there are no averages for the price of leased space.

## Outlook

With increasing earnings, the life sciences industry in Orange County is projected to remain a major contributor to the economy's job growth and a driver for the commercial property sector. Tenants from other industries have slowly been building confidence in the economy's recovery, which has translated into the amount of large office options dwindling, particularly in the Class A assets around the Airport Area. Although Orange County remains a tenant's market, leasing activity is expected to increase by companies outside of the vibrant technology and life sciences tenants, which should spur more competition for desirable space. Options in South County's flex inventory remain plentiful, but true biotech space is in short supply across the entire Orange County market. With overall vacancy still high in the office and flex inventory, there is no new development in the pipeline aside from two large, build-to-suit projects for companies outside of the industry. Life science users looking for space will continue to be drawn to the large campus-style options that are concentrated near the existing clusters of life sciences firms.




Clusters of Orange County's largest life sciences firms

**ALCON RESEARCH**
The ophthalmic company signed two of the market's largest leases in the past year with 210,000 s.f. at 15800 Alton Parkway in Irvine and 184,000 s.f. at Serrano Creek Center in Lake Forest.

**9401 & 9501 JERONIMO**
The two-building, 166,413 s.f. complex was purchased by Chapman University to expand its Crean School of Health and Life Sciences. Chapman plans to spend an additional $24.0 million to provide labs, classrooms and office space for the school's graduate students.

**MASIMO MEDICAL**
The medical technology company is in the market for 200,000 s.f. somewhere between the Airport Area and South County's Irvine Spectrum Area.

**LABCORP**
The medical laboratory testing and services company is in the market for 100,000 s.f. around the Airport Area, particularly interested in single-story product.

*Orange County's life sciences firms are clustered in the Airport Area and South County submarkets.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Minneapolis



***Industry leading companies, a highly skilled workforce and world-class research capabilities make Minneapolis-St. Paul the Midwest leader in medical device manufacturing.***

## Global trends

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Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

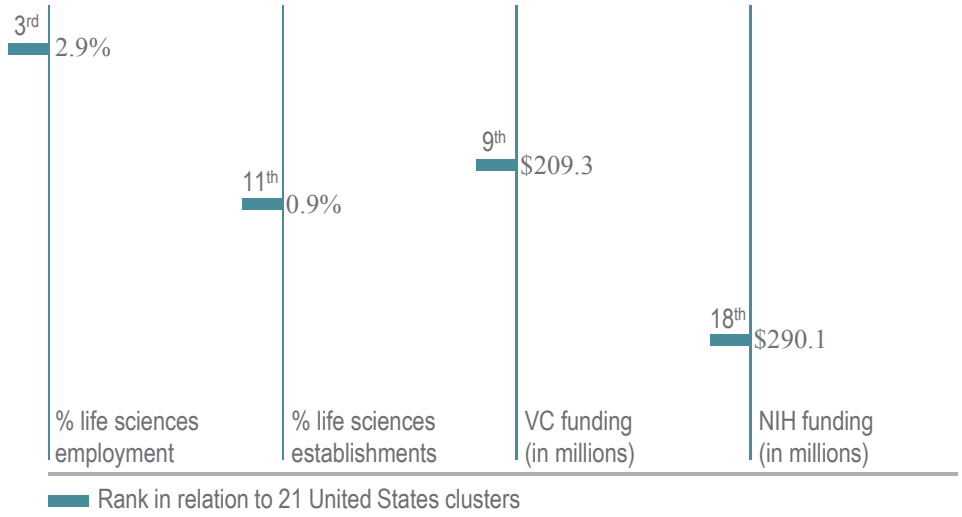
## Minneapolis-St. Paul market overview

Minneapolis-St. Paul is particularly strong in medical device manufacturing, ranking second in the nation with slightly more than 38,000 employed in this subsector. A number of major medical device manufacturers such as Medtronic, St. Jude Medical, Smiths Medical and Boston Scientific are either headquarter or have major operations in the Twin Cities.

Locally, the University of Minnesota is a key driver of the life sciences industry. This is true not only because it consistently develops a large pool of skilled workers from which local life sciences companies can draw from, but also because of its R&D capabilities. The Academic Health Center at the University of Minnesota receives more than $321.0 million annually in sponsored research, and the University of Minnesota has averaged slightly more than $230.0 million annually in National Institutes of Health (NIH) funding since 2002. Overall, the state of Minnesota ranked 13th in NIH funding in 2011, and number one in the Midwest on a per capita basis. With federal funding not likely to increase in the near future there is a push to attract more funding from the private sector.

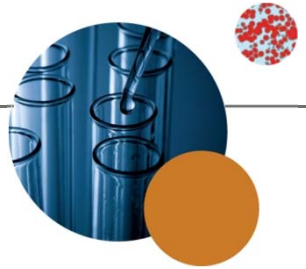
In an effort to improve the business climate and help attract investment, multiple steps have been taken locally. In addition to the expansion of its R&D tax credit, Minnesota adopted an Angel Investor Fund in July 2010. The initiative was championed by the BioBusiness Alliance of Minnesota, a subsidiary of LifeScience Alley, which recognized the capital needs of many emerging start-ups. The program is already fully subscribed for 2012 and funding is set at $12.0 million annually through 2014. Many are advocating an annual increase in the tax credit as a result of the program's subscription rate. Additionally, both the Minnesota Science and Technology Authority Strategic Plan and the Minnesota Innovation Partnership were created to help turn innovative ideas into businesses and commercial successes. However, generating funding for the Minnesota Science and Technology Fund has been a challenge as the legislature has yet to be convinced to do so.

## Minneapolis-St. Paul life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Minneapolis-St. Paul

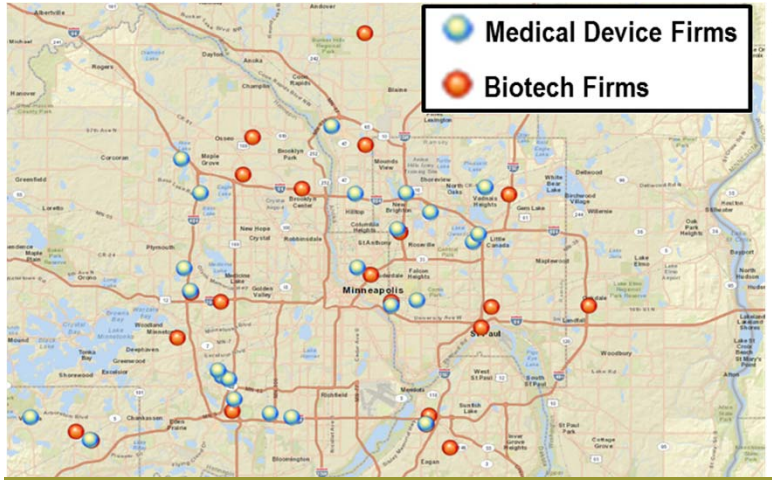


No singular life sciences corridor exists within the Minneapolis -St. Paul MSA, rather a majority of companies occupy space throughout the suburban submarkets. Many are located along the I-694 corridor in the Northeast and Northwest submarkets including medical device manufacturers Medtronic, St. Jude Medical, Boston Scientific and Smiths Medical. The I-494 corridor in the West and Southwest submarkets is also home to a significant number of medical device manufacturers and biotech companies. Not surprisingly, these areas have seen the most activity from both start-up companies and spin-offs from the larger players, mostly due to their proximity to a large pool of skilled workers.

Consolidation of space has been common among some of the larger medical device firms in the last year. Medtronic vacated 100,000 square feet of office and lab space in the Northeast submarket in late 2011 and Boston Scientific is consolidating its space in the Twin Cities after its acquisition of Atritech in early 2011. Currently Boston Scientific has a combined 125,000 square feet of space for lease in two buildings: 25,000 square feet in the Northwest submarket and 100,000 square feet in the Northeast submarket. Cheaper manufacturing options overseas, uncertainty in the current U.S. Food and Drug Administration (FDA) approval process and the potential for a new medical device tax are significant factors contributing to the current landscape.

Despite some of these challenges and uncertainties, there are a number of life sciences companies either actively in the market for space or planning expansions of existing space. Synovis Life Technologies, purchased by Baxter International in February of this year, is currently in the market for 80,000 square feet of office, lab and warehouse space. Ottobock, a manufacturer of prosthetics, is looking for 120,000 square feet of office and warehouse space in the West submarket. Pharmaceutical company Upsher-Smith Laboratories has announced plans for an approximate 130,000-square-foot expansion of their existing headquarters in Maple Grove. The National Bone Marrow Institute is in the market for 325,000 square feet of office space and considering either moving its headquarters to the Minneapolis CBD or remaining in the Northeast submarket. Additionally, some significant leasing deals have already occurred in 2012; Tornier, Starkey Hearing Technologies, and TRIA Orthopedic each signed leases in the Southwest submarket.

Another highlight in the local life sciences industry is the scheduled completion of The Cancer and Cardiovascular Research Building in the spring of 2013. The building will act as the gateway to the University of Minnesota's Biomedical Discovery District, a $292 million research project resulting from a funding program approved by the state of Minnesota in 2008. The long-term vision for the district includes additional university facilities as well as private sector partners. In future years this initiative has the potential of attracting private sector companies to cluster in or around the Biomedical Discovery District, located within the Minneapolis city limits.




Twin Cities Top Life Sciences Companies

**3 SIGNIFICANT DEALS**
Tornier signed 56,000 s.f. at 10801 Nesbitt Avenue S in Bloomington; Starkey Hearing Technology signed 42,278 s.f. at Prairie Oaks Corporate Center; TRIA Orthopedic signed 32,400 s.f. at Northland Plaza

**UPSHER-SMITH LABORATORIES**
is planning a 130,000 s.f. expansion of their HQ in Maple Grove

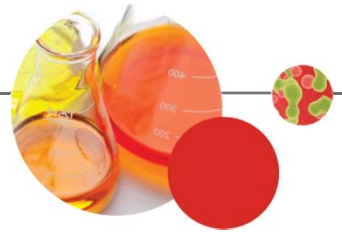
**AORTECH**
moved into its custom built 13,000 s.f. manufacturing facility in Rogers in late 2011

**LARGE AVAILABILITIES**
101,000 s,f, building at 8299 Central Ave NE with high-tech lab and clean room space; 79,000 s.f. of lab and clean room space for lease at 1185 Willow Lake Blvd; 25,000 s.f. of clean room sublease space at 3750 Annapolis Lane N

**3 REQUIREMENTS**
The National Bone Marrow Institute is in the market for 325,000 s.f. of office HQ space; Ottobock is in the market for 120,000 s.f. of office and warehouse space; Baxter is in the market for 80,000 s.f. of office, lab and warehouse

*There is long-term potential for private sector companies to cluster in or around the University of Minnesota's Biomedical Discovery District.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



# 10

## *Seattle's life sciences community remains lively with expanding cancer and drug research companies.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

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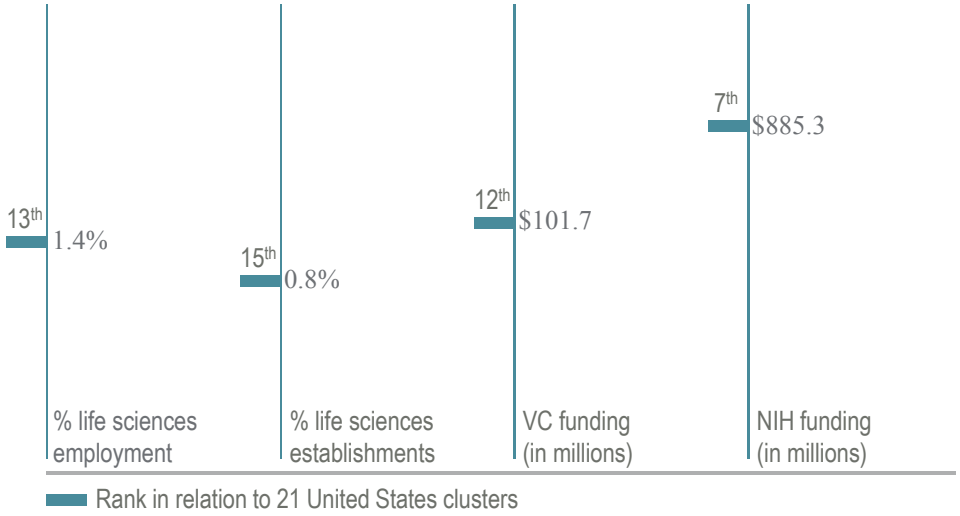
Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

### Seattle market overview

Seattle has one of the fastest growing life sciences markets in the nation and has become one of the core cancer research markets in the nation. Puget Sound's life sciences is comprised of nearly 1,000 firms employing more than 22,000 directly in the industry, with an additional 191,000 people employed in the hospitals and the medical field. One of the distinguishing features of the Seattle-area life sciences market is that very little manufacturing is done in the region. Nearly all Puget Sound-area life sciences industry activities are based on research and development. Unlike areas with a strong concentration of life sciences manufacturing jobs, when a growing Puget Sound company is purchased by a larger company, the frequent trend has been the employees and the companies to remain intact and local to Seattle. This is the case with many companies like Zymogenetics, which was acquired by Bristol-Myers Squibb in 2010; Blue Heron, which was acquired by OriGene Technologies in 2010; and Sonosite, which is being acquired by Fujifilm.

At 4.6 million square feet the Seattle life sciences market is a smaller market with a high density of companies situated in its two core markets of South Lake Union and Bothell. Seattle has a dynamic mix of life sciences companies both private and public who serve a vast array of activities from cancer research to drug research. The University of Washington Medicine, Fred Hutchinson Cancer Research, Seattle Cancer Care Alliance, Seattle Genetics, Amgen and Bristol-Myers Squibb all are staples of excellence in the market and have seen significant growth over the last decade. A major contributor to Seattle's life sciences growth can be attributed to industry leading research coupled with generous funding by some of the world's largest philanthropic organizations, like the Bill & Melinda Gates Foundation.

### Seattle life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# South Lake Union

## Overview

The South Lake Union area is Seattle's life sciences epicenter – with nearly 2.8 million square feet of life sciences space, it makes up nearly half of Seattle's overall life sciences market. South Lake Union is situated just north of Seattle's CBD and offers a more urban campus feel to its buildings than its traditional CBD brethren to the South. This market is dominated by life sciences and tech companies who thrive on an amenity-rich environment to maintain and increase employment retention and company growth. South Lake Union has seen a continual downward trend in vacancy over the last two years and currently is nearing 1 percent vacancy which has raised concern that new life sciences development has not kicked off yet. Nevertheless, the downward pressure on vacancy has escalated lab rents to the highest levels it has ever seen, with some spaces as high as $55.00 per square foot NNN. Rental rates should continue to rise as space demand remains constrained.

## Outlook

The South Lake Union market is already a robust and stable market with high occupancy and rising rents. However, demand is also on the rise and there is no new construction underway to meet it. With limited availability tenants may look to traditional office space for life sciences conversion which other tenants like Dendreon have done at Russell Investments Center.

**PRESAGE BIOSCIENCES**
leased 9,756 s.f. at Fairview Research Center I in South Lake Union.

**NOVO NORDISK**
leased 12,764 s.f. at South Lake Union's Fairview Research Center I. The lease brought the property to 100 percent occupancy.

**FAIRVIEW RESEARCH CENTER II PROPOSED**
140,000 s.f. life sciences building.

**THE OMEROS BUILDING**
The 151,225 s.f. research facility has 43,068 s.f. of contiguous space available.

*The South Lake Union market has quickly become the hottest market in the Seattle area, attracting major tech companies and life sciences companies to its rich amenity base and walkability.*

# Bothell

## Overview

Bothell is the second largest life sciences market in the Seattle area at roughly 800,000 square feet spread between its two core areas of Canyon Park and North Creek. Bothell is a tertiary suburban market east of Seattle and north of Bellevue and is set up in two distinct business park layouts. With a suburban campus feel, higher parking ratios and larger floor plates, it offers life science tenants the ability to maximize efficiency by not splitting up researchers onto multiple floors and also taking advantage of significantly more discounted rates than South Lake Union, currently averaging around $27.00 per square foot NNN. Major firms such as Seattle Genetics, Amgen, HaloSource, SonoSite and Alder Biopharmaceuticals occupy this market which has become a viable second option for Seattle-area life science users.

## Outlook

Bothell's life sciences market has a bright future ahead of it as it continues to grow and add more tenants to its roster. With limited availability in the South Lake Union area, Bothell should see significant spillover demand in the coming quarters as expansion space is readily available here. Bothell's multitude of life sciences companies offers a cohesive symbiotic tenancy among life sciences users who all benefit from cheaper rates, state-of-the-art product, efficient floor plates and well-designed infrastructure.

**CEPHIAD**
leased 39,600 s.f. at Canyon Park Business Center in Bothell.

**VERATHON**
renewed 97,216 s.f. at North Creek.

**CHILDREN'S RESEARCH INSTITUTE**
is in the market for 20,000 s.f. and focused on the Seattle office market.

**217th PLACE RESEARCH CENTER**
The 67,799 s.f. research facility is fully vacant and available.

*Bothell is the primary suburban life sciences market, attracting companies who need large floor plates, high parking ratios and a less costly alternatives for lab space.*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space

# Westchester / New Haven



***Westchester / New Haven ranks No. 11 among U.S. life sciences clusters; new incubator developments are driving activity.***

## Global trends

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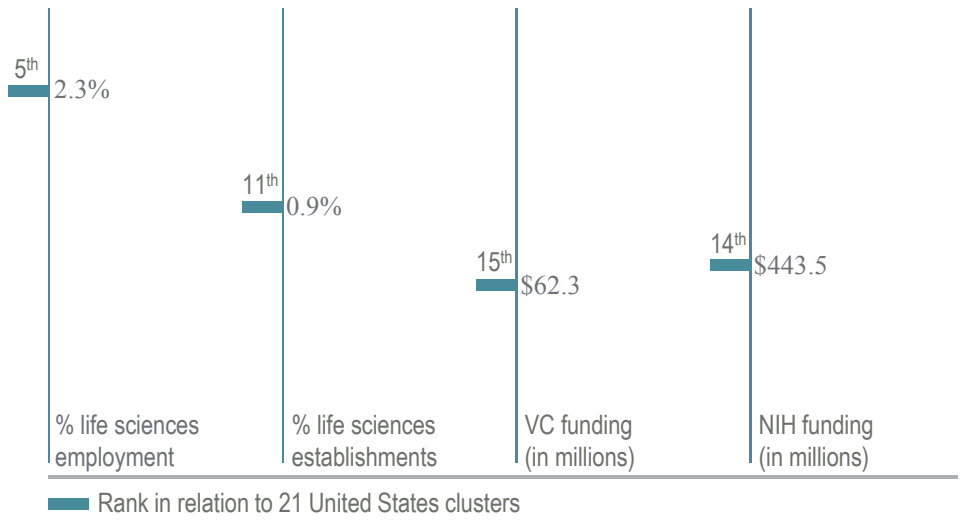
## Westchester / New Haven market overview

Although the Westchester / New Haven market is struggling to regain momentum and find footing in the current economic climate, the life sciences are a bright spot. The region benefits from unparalleled access to talent and innovation. The existence of a strong and educated workforce alongside a plethora of higher educational institutions and research hospitals position Westchester / New Haven strongly for growth in the life sciences arena, priming the region for emergence as a competitive industry cluster.

The Westchester / New Haven region, which currently ranks 11th among U.S. life sciences clusters, employs more than 17,000 workers in life science industry, which represents 2.3 percent of the region's total employment. The New Haven, CT MSA accounts for about 56.0 percent of this life science employment whereas Westchester County, NY accounts for 44.0 percent. Since the close of 2011, employment in life science sectors has increased 0.6 percent. Although the growth has been somewhat muted, it is outpacing employment growth in many other areas more typically associated with regional economic growth.

There are currently more than 500 life sciences establishments in the region and, in the past few years, Westchester and New Haven have become target locations for life science and biomedical companies. State and local government entities in both Connecticut and New York have increased efforts to encourage investment in life sciences and the development of incubators through incentive engagement and facilitating funding. Venture capital funding in the region totaled $62.3 million for 2011 while NIH funding funneled $443.5 million into life science-related investment. The consistent funding and support in a region with an existing infrastructure favorable to the life sciences is allowing this corridor between well-known life science hubs Boston and New Jersey to emerge on its own as a formidable contender for life science development.

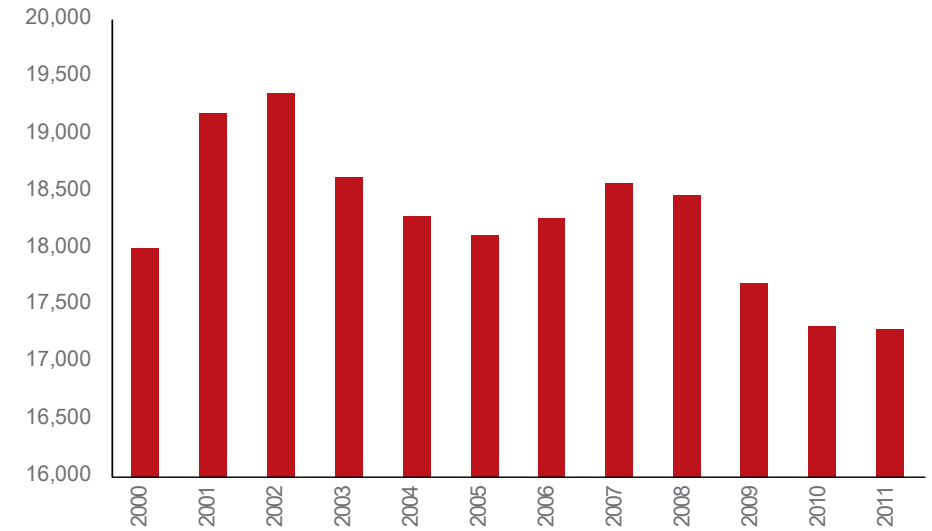
## Westchester / New Haven life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

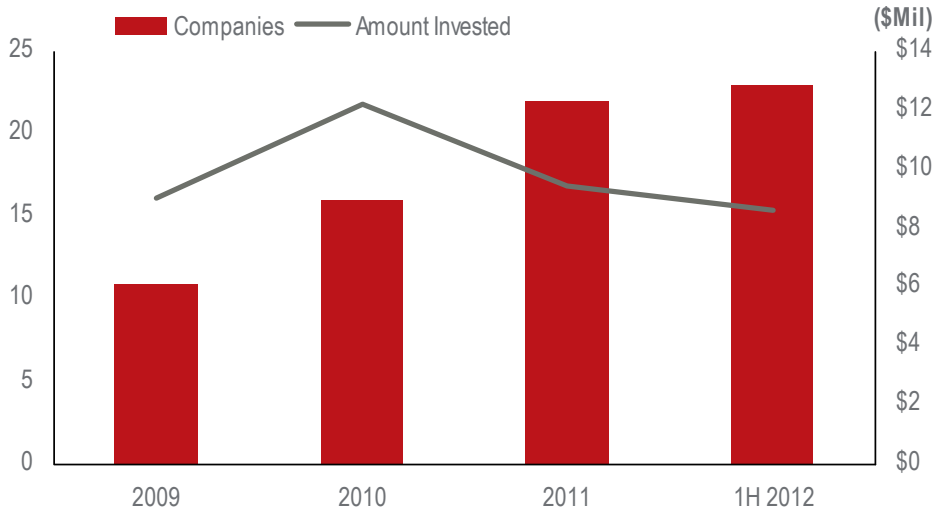
# Life sciences market analysis

## Life science related employment




Source: Bureau of Labor Statistics

## Connecticut grants and funding (bioscience and related clean-tech and advanced materials)




Source: Connecticut Innovations

*Ardsley Park, Ardsley, NY*

*Downtown Crossing, New Haven, CT*

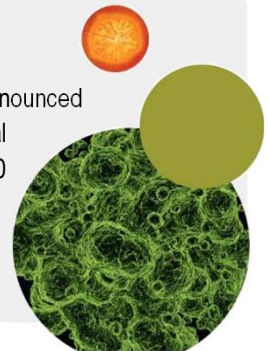
## *Market movers*

### Acorda Therapeutics at Ardsley Park – Westchester, NY

- Acorda Therapeutics moved into its new corporate headquarters at the Ardsley Park life sciences campus in Westchester, NY in July. The four-building campus is managed and leased by BioMed Realty Trust and has 258,040 square feet of office and laboratory space. Acorda occupies 138,000 square feet in two buildings. Another 500,000 square feet is earmarked for future development, and existing buildings on the campus are undergoing a renovation program during the next 12 months.

### Alexion Pharmaceuticals at Downtown Crossing – New Haven, CT

- After departing New Haven seven years ago, Alexion Pharmaceuticals announced in June it would be the anchor tenant for the new life sciences / biomedical Downtown Crossing in New Haven, CT. The company will occupy 325,000 square feet in the 426,000-square-foot office and laboratory building intended to facilitate New Haven's role as a life sciences / biotech hub. Construction is slated to commence in 2014 with a 2016 completion.



# Westchester, NY

## Overview

Since 2010, Westchester County has put out an aggressive effort to establish the market as a life sciences hub. Two major campaigns characterize this effort: "NY BioHud Valley" and "Westchester County: New York's Intellectual Capital," which both emphasize Westchester's role as a knowledge center. The campaigns have made local funding available for companies that promise job creation, and there are several major life sciences users that have utilized incentives to expand their footprint. Acorda Therapeutics is one example, having received up to $5.2 million in tax credits to remain in Westchester. Histogenics also recently purchased two former office buildings that they will adapt into research and development space. Likewise, healthcare providers such as WestMed and Memorial Sloan Kettering are also expanding and converting buildings into healthcare facilities.

## Outlook

Life sciences momentum is fueling various projects in Westchester County. There are two major construction projects in early planning stages. New York Medical College is building a $12.6 million biotechnology incubator, which could create as many as 215 jobs. The project received a $4.0 million boost in funding at the end of 2011. Adjacent to this incubator, Fareri Associates also has plans to build a $500.0 million, 2.0 million-square-foot park for biotech and medical tenants, creating as many as 5,000 permanent jobs.

**EPICEPT**
Epicept renewed 9,805 s.f. of office and laboratory space at 777 Old Saw Mill River Road in the second quarter 2012.

**104 CORPORATE PARK DRIVE**
HistoGenetics purchased 104 Corporate Park Drive (118,000 s.f.) for $12.0M, or $102 p.s.f.

**CONTRAFECT**
ContraFect is investing $3.5M in a 15,000 s.f. office and laboratory build-out at iPark (28 Wells Avenue) in Yonkers.

**767 OLD SAW MILL RIVER ROAD**
76,000 s.f. of space is available at this building at BioMed Realty's Landmark at Eastview campus.

*Westchester County offers access: Access to world-class research institutions and programs, access to capital and access to competitively priced real estate.*

# New Haven, CT

## Overview

New Haven is home to more than 40 life sciences related companies, with direct accessibility to related research programs at Yale University and Yale / New Haven Hospital. Incentives and legislation have been funneled through Connecticut since prior to the recession, helping the life sciences industry to remain a driver despite unfavorable economic conditions. That said, payrolls have struggled. Life sciences employment in the metro is down 1.9 percent year-over-year. Life sciences companies still view New Haven as an attractive hub with low lease rates compared to those of other regional hubs like Boston and New Jersey / New York City. Recently, Durata Therapeutics, based in New Jersey, announced an 18,000-square-foot lease in Branford, CT for research and development use. In addition, Greenleaf Biofuel's New Haven 8,000-square-foot plant is nearly complete, scheduled for full operation in Fall 2012.

## Outlook

Governor Malloy's 2011 "BioScience Connecticut" initiative aims to spur life sciences development, creating 16,400 jobs by 2037. With statewide efforts like this in place, New Haven will benefit from its strong life sciences infrastructure and continue to grow. For example, Alexion Pharmaceuticals became another beneficiary of the "First Five" initiative and will receive $51.0 million in incentives to become the anchor tenant at Downtown Crossing, a new biomedical facility in New Haven.

**LOGISTICARE**
Logisticare leased 8,900 s.f. of space at 127 Washington Avenue in the second quarter 2012.

**688 E. MAIN ST**
Massey Properties, LLC purchased the R&D facility Orchard Business Park (32,693 s.f.), for $765,000, or $23 p.s.f.

**ALEXION PHARMACEUTICALS**
Alexion committed to 325,000 s.f. to anchor the proposed biomedical facility, Downtown Crossing.

**DOWNTOWN CROSSING**
101,000 s.f. remains vacant at 100 College Street, the 10-story biomedical building in planning.

*"By becoming a leader in bioscience, Connecticut can again be at the forefront of an economic renaissance."*
*-Governor Malloy*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space

# 12

***The Chicago area has developed a reputation as a hub for research and innovation.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

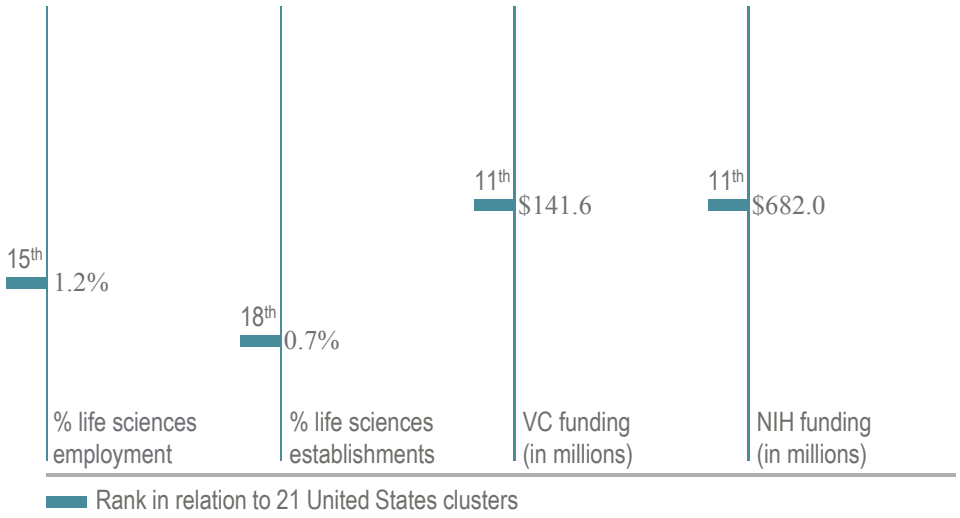
## Chicago market overview

Since the opening in 1946 of Argonne National Laboratory, the first national science and engineering research laboratory, the Chicago area has developed a reputation as a hub for research and innovation. Headquartered in the Chicago area are large life sciences companies including Abbott Laboratories, Astellas, Baxter, Hospira, Takeda and Walgreens. These companies, and many smaller life sciences firms, are located in the north suburban submarket. The area benefits from large life sciences-related employment of nearly 45,000 individuals employed in pharmaceutical, biotech and medical device disciplines.

The metropolitan area is home to several leading universities and institutions. These include Northwestern University, the University of Chicago, the Illinois Institute of Technology (IIT) and the University of Illinois at Chicago (UIC). The area also attracts graduates from other schools in the state, such as the University of Illinois at Urbana-Champaign and Southern Illinois University School of Medicine. The area's universities are among the factors that identify Chicago as a life sciences cluster.

Research is a heavy point of emphasis at area centers like the International Institute of Nanotechnology at Northwestern, the Center for Pharmaceutical Biotechnology at the University of Chicago and the Medical Imaging Research Center at IIT. The Illinois Medical District was created in 1941. Since then the area has become rich with hospitals, medical centers and research facilities including the biotech incubator, Chicago Technology Park. The 56-acre park features a 56,000-square-foot research center for emerging ventures and roughly 118,000 square feet of graduate and other facilities to accommodate more established companies.

## Chicago life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# North / Northwest

## Overview

A concentration of life sciences companies are found in the North suburban submarket. Until recently, the long-standing presence of some of the largest pharmaceutical companies in the world has attracted related companies specifically to this area. In the last several years, both Astellas and Takeda Pharmaceuticals have made long-term commitments to the area by each building new North American headquarters of 445,000 square feet and 630,000 square feet, respectively. More recently, medical device maker Carefusion relocated to 150,000 square feet in Vernon Hills

Although life sciences activity had previously been limited the North suburban submarket, the July 2012 acquisition of Catalyst Rx by SXC Health Solutions to form Catamaran has expanded the industry into the Northwest submarket. As a result of this merger, the two companies will consolidate headquarters to occupy 250,000 square feet in Schaumburg with the potential to expand by an additional 50,000 square feet during the first years of term.

In 2011 construction began on The Illinois Science + Technology Park in Skokie. The result of a collaboration between Illinois Science and Technology Coalition, iBio and China's Shanghai Bio Pharmaceuticals Association, the 23-acre campus will provide laboratory, office and conference space for life science-focused companies. Once fully complete, the site will offer a total of 2 million square feet of advanced facilities.

## Outlook

Activity in the coming months will be fueled by AbbVie, Abbott Laboratories' most recent spin-off, as well as the newly merged Catamaran venture. Although it is not yet known what AbbVie's impact will be on the market, if this spin-off goes down a similar path as Hospira, when it spun-off from Abbott, it could require its own space.

Additionally, as corporations continue to take a hard look at their financial health, announcements surrounding employment levels (and subsequent space needs) will be monitored closely. Many global corporations, looking to streamline operations after a merger or in general, have been cutting jobs in recent years. Takeda, for example, announced global layoffs earlier this year that would impact operations in the United States. Other pharmas, meanwhile, are in expansion mode and have been beating market expectations quarter after quarter. As M&A activity continues to heat up, it will not be shocking to find widely varying space needs in the near- to mid-term.

Takeda campus at the intersection of I-294 and Lake Cook Road in Deerfield

**CATAMARAN**
In August of 2012 a newly formed venture between SXC Health Solutions and Catalyst Rx signed a new lease in Schaumburg for 250,000 s.f.

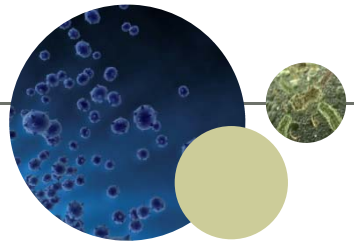
**CAREFUSION**
Medical device producer Carefusion signed a new lease in May 2012 in Vernon Hills for 150,000 s.f.

**ASTELLAS**
In June 2012, Astellas Pharma US completed construction on its new 445,000 s.f. North American headquarters in Northbrook.

**WALGREENS**
Walgreens is in the market for approximately 50,000 s.f. This comes on the heels of signing a lease for 56,000 s.f. at 1000 Lakeside in Bannockburn earlier in the year.

***Headquartered in the Chicago area are large life sciences companies including Abbott Laboratories, Astellas, Baxter, Hospira and Takeda, as well as druggist Walgreens.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



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*After several years of stagnation, Denver area bioscience companies are benefiting from renewed interest from investors and partners.*

## Global trends

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Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

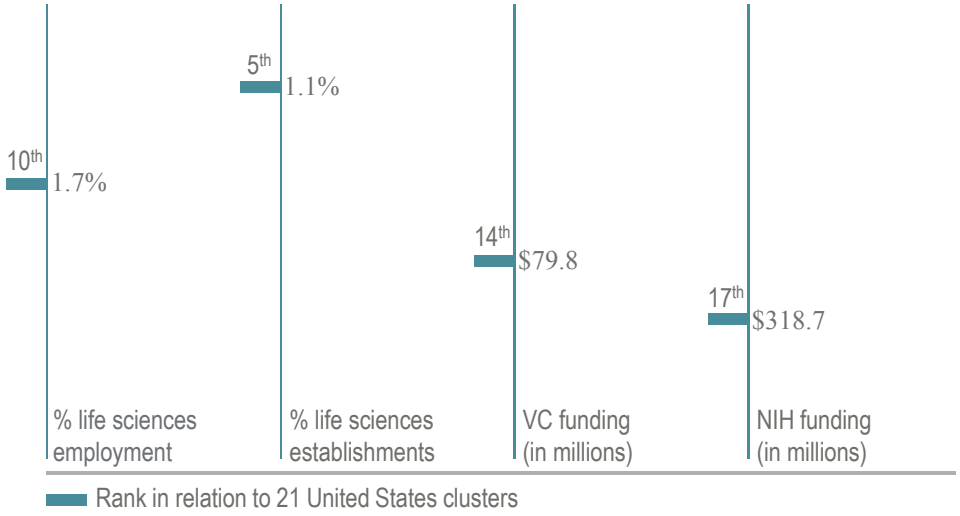
## Denver market overview

Metrowide, nearly 25,000 people are employed in life sciences-related occupations in the Denver area. Ten higher education institutions operate life sciences programs and research resources. Among them are Colorado State University, the University of Colorado at Boulder and the Colorado School of Mines. The largest research facility in Colorado is the Fitzsimons Life Science District, located in Aurora. With swift growth in the industry over the past few years, Fitzsimons has created a central hub for research dedicated to life sciences, healthcare and education. The state is home to over 1,200 companies in the bio-related fields of medical devices, pharmaceuticals, agricultural and traditional biotechnology including Allos Therapeutics, Amgen, Array Biopharma, Sandoz, Somalogic and OPXBIO.

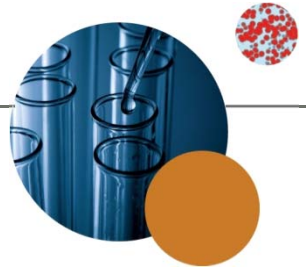
The Colorado BioScience Association works to further Metro Denver and Colorado's life sciences community. Aiding this effort are Colorado programs such as grants, sales tax exemptions and support for start-up companies. The state has five venture firms predominantly or solely focused on funding local life sciences companies.

Denver's life sciences industry is trending positively. Budding start-ups have the intellectual and innovation resources needed to develop into successful and solid companies, while established companies enjoy access to resources with the presence of the Fitzsimons Life Science District and the Anschutz Medical Campus. A new 37,000-square-foot accelerator building was constructed at Fitzsimons and has 9,715 square feet remaining for lease. However, it is evident that the market requires investors and landlords who specialize in the development of research facilities in order to meet future demand.

## Denver life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*



# Northwest / Boulder

## Overview

Although industry activity is spread throughout the entire Denver metro area, the Northwest and Boulder submarkets, encompassing the cities of Broomfield, Boulder, Lafayette, Louisville, Westminster and Longmont, are the most prominent. The University of Colorado at Boulder anchors these submarkets as one of the leading research universities in the country. In addition to offering undergraduate students the chance to make money while gaining research experience (Bioscience Undergraduate Research Skills and Training), the state of Colorado along with the University of Colorado fund the State Bioscience Discovery Evaluation Grant program. This program focuses on development-oriented research in order to accelerate commercialization by reducing inventions to operational practice and validating their ability to address significant market applications.

The Northwest and Boulder submarkets are home to over 250 life sciences companies. Companies in the cluster are typically smaller in nature, some examples include Sophono, Bolder Biotechnology, BiO2 Medical, Inc., Ventria Bio Science, UrgentRx and Solix Biosystems These and other companies in the Northwest and Boulder markets employ over 12,000 people, just shy of half of the state's life sciences employment.

## Outlook

Northwest Denver (including Boulder) is a growing region for the life sciences industry and has made remarkable progress over the past decade. It is now considered the main bioscience cluster in Colorado, despite the majority of life science companies in this submarket being small in size (5,000 to 15,000 square feet). With the expanding research labs at the University of Colorado, start-ups and more mature companies alike will continue to benefit from their presence.

Overall activity in the Northwest area has been fairly static with only a handful of companies expanding such as Biodesix and Agilent Technologies. This lack of new leasing activity is viewed as temporary and transactions should increase in 2013 following the election. One continuing challenge for earlier stage companies is finding existing second generation lab space in the 2,000- to 10,000-square-foot range. When such space becomes available, it is typically absorbed very quickly. It is the predominate opinion of those active in the industry that the concentration of bioscience companies in the area will continue to grow due to the current industry presence and desirable location which assists with recruiting and retention of skilled employees.

In line with macro industry trends, several companies have consolidated or formed partnerships. Cortex Pharmaceuticals and Pier Pharmaceuticals of Louisville merged and Pier has become a Wholly owned subsidiary of Cortex. Spectrum Pharmaceuticals acquired Allos Therapeutics of Westminster and Allos has become a wholly owned subsidiary of Spectrum. Accera of Broomfield announced a partnership with Nestle Health Science, and Array BioPharma of Boulder has formed a strategic alliance with Genentech, a member of the Roche Group. It is expected that additional companies will follow suit and form similar partnerships and mergers.

**2 RECENT DEALS**

Allos Therapeutics / Spectrum Pharmaceuticals renewed its lease for 31,248 s.f. at 11080 Circle Point Road in Westminster.

BiOptix renewed its lease for 13,965 s.f. at 1775 38th Street in Boulder.

**3 LARGE BLOCKS**

2860 Wilderness Place
60,000 s.f. office/lab

1795 Dogwood Street
50,000 s.f. office/lab

2950 Wilderness Place
30,000 s.f. office/lab

***The Northwest and Boulder submarkets are the most prominent and home to over 250 life sciences Companies.***

**2 RECENT SALES**

Mountainview Corporate Center in Broomfield sold for $92M, or $199 p.s.f. Hines was the seller, Westfield was the buyer.

Diagonal Tech Center in Longmont sold for $6.9M, or $55 p.s.f. Bank of America was the seller, Goff was the buyer.

**4 ACTIVE TENANTS**

Solix Biosystems out for 12,000 s.f.

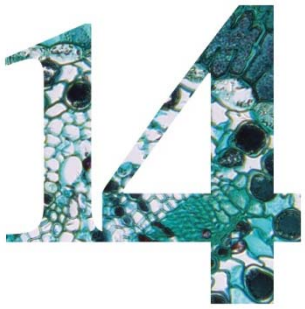
Sophono out for 11,000 s.f.

mBio Diagnostics out for 10,000 s.f.

Isogenis out for 7,000 s.f.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Cleveland / Columbus / Cincinnati



***The life sciences industry is a bright spot among Ohio's local economy due to steady job growth and company expansions across the state.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

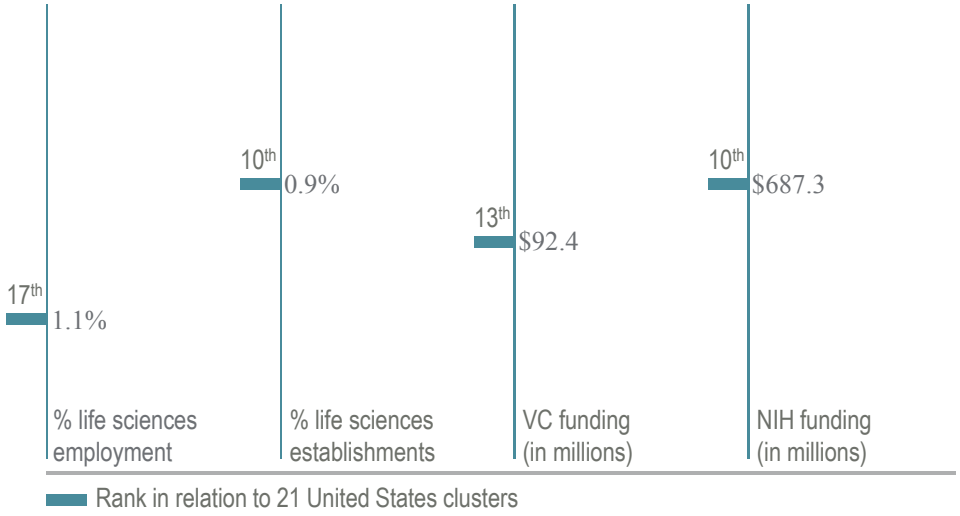
## Cleveland / Columbus / Cincinnati market overview

Although life sciences activity is scattered throughout the state of Ohio, a majority of industry representation and output comes out of the northeastern, central and southwestern regions of the state, with activity clustering around the major cities of Cleveland, Columbus and Cincinnati, respectively. In addition to general business resources associated with these metropolitan areas, research and academic institutions proximate to these cities provide industry-specific resources including funding opportunities and research manpower. These three clusters account for just under 30,000 individuals employed in the life sciences, at roughly 1,300 company locations.

In 2011 institutions and companies in Cleveland, Columbus and Cincinnati collectively attracted $687.3 million in NIH grants. Five of Ohio's institutions – Case Western University, Ohio State University, University of Cincinnati, Cincinnati Children's Hospital and the Cleveland Clinic – consistently rank among the top NIH funding recipients. These, and other research institutions, have formed several collaborative efforts in order to facilitate research efforts, among them the Global Cardiovascular Innovation Center, the Center for Stem Cell and Regenerative Medicine and the Biomedical Structural, Functional and Molecular Imaging Enterprise. In August 2012, universities from each of the three metros – Case Western, University of Cincinnati and Ohio State University – announced a statewide collaboration to streamline processes around clinical trials.

Several large life sciences players have facilities outside the aforementioned three major clusters. Abbott Laboratories announced plans in early 2012 to invest $270.0 million into its nutrition plant in Tipp City and Mound Laser & Photonics Center announced it would invest $400,000 into its facility in Kettering. Other major life sciences occupiers throughout the state include Charles River Laboratories, Amylin, Alkermes and Eurand.

## Cleveland / Columbus / Cincinnati life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Cleveland / Columbus / Cincinnati

## Overview

Cleveland is home to just over 500 life sciences company operations, among them BenVenue (a subsidiary of Boehringer-Ingelheim), Orbital Research, Cleveland Medical Devices and Norman Noble. In 2012 alone the cluster attracted three new companies and five company expansions. Among the expansions was a $4.3 million investment for a new U.S. headquarter facility from Valtronic Technologies and a $163,000 expansion by Synapse Biomedical. Cleveland is supported by two major research and academic institutions, Case Western University and the renowned Cleveland Clinic. In August 2012 Case Western University announced that it was the recipient of a $64.6 million federal grant to facilitate innovations from bench to bedside, the first award of its kind in Northeast Ohio.

The Columbus life sciences sector is bolstered by the large presence of healthcare facilities and as such one-third of the 377 industry-related companies are in the medical and diagnostics subsector. Pharmaceutical and medical supply distributor Cardinal Health, one of the state's largest companies, is headquartered in nearby Dublin. In early 2012 Quantum Health, a manager of health benefits for corporations, announced its decision to maintain operations in Columbus, even adding 50 new jobs, due in large part to $7.0 million in city and county incentives. According to Quantum's CEO, the company will add an additional 475 jobs by 2014.

Cincinnati houses roughly 440 life sciences company operations, employing about 10,500 individuals. A majority of companies are in the medical and diagnostics and R&D subsectors, although the area enjoys sizable representation among all sectors of the industry. Five companies announced expansions during the first half of the year, including Valued Relationships, Integra LifeSciences, Hardy Diagnostics, Forest Pharmaceuticals and Cincinnati Test Systems.

## Outlook

Life sciences clusters in Ohio are still enjoying funding opportunities made available by the $1.6 billion Third Frontier Project first launched in 2002. The project was renewed in 2010 with an additional $700.0 million, extending its impact through 2016. So far nearly 50.0 percent of the allotted funds are accelerating life sciences initiatives.

Life sciences continues to be a bright spot among the state's industry sectors, due to employment growth and modest venture capital funding funneling into the state.

Valtronic's new U.S. headquarters in Solon, outside of Cleveland.

**ALLTECH MEDICAL**
expanded at the end of 2011 from 13,500 s.f. at 6551-6571 Cochran Road into 50,000 s.f. at 28900 Fountain Parkway in Solon, outside of Cleveland.

**VALTRONIC TECHNOLOGIES**
purchased 29200 Fountain Parkway, a 60,000 s.f. facility in Solon, for its new U.S. headquarters. The $4.3M investment will allow for 50 new jobs.

**QUANTUM HEALTH**
expanded by 18,000 s.f. at 7450 Huntington Park Drive in Columbus for a total of 40,000 s.f. The company elected to remain and expand in Ohio, rather than moving to rumored Colorado or California, due to local incentives.

**CHRIST HOSPITAL**
announced a $265.0M expansion in February 2012. Plans detail an expansion to the Mt. Auburn campus for a new orthopedic and spine research and clinical program center.

*Although life sciences activity is scattered throughout the state of Ohio, a majority of industry representation and output comes out of the major cities of Cleveland, Columbus and Cincinnati.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

15

*Interest groups are working to develop Salt Lake City's research capacity in hopes of moving beyond its status as a go-to warehousing destination.*

## Global trends

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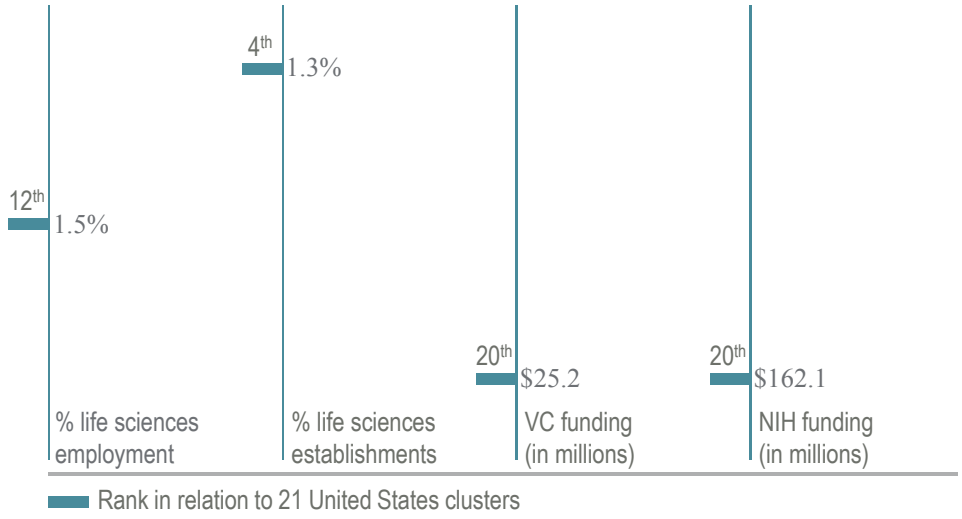
## Salt Lake City market overview

The Salt Lake City life sciences cluster has grown out of its roots as a destination of choice for warehousing drugs and treatments. Currently Salt Lake City is home to only about 500 life sciences-related companies, but these account for a sizable 1.3 percent of the total workforce.

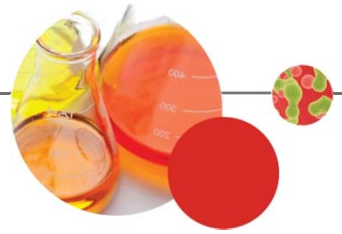
Several of these companies include headquarter operations for research and clinical testing companies Axial Biotech and ARUP Laboratories and biotech companies Myrexis, Amedica and Myriad Genetics. Multinational companies, such as Watson Pharmaceuticals and Cephalon, have sizable office and warehouse presences in Salt Lake City wheras Bard Access Systems, Q Therapeutics and Varian Medical Systems alone comprise over one million square feet of warehouse space.

Public and private groups are increasingly trying to build up Salt Lake City's potential as a research hub. In April 2012, the University of Utah opened its state-of-the-art USTAR building, a 208,000-square-foot, $130.0 million lab, office and conferencing facility. This state-funded development was built to promote collaboration among the university's many scientists. Considering the cluster's relatively low venture capital and NIH funding receipts, public and private groups are hoping initiatives like the USTAR building will demonstrate the area's capacity as a research hub and draw more funds to the area.

## Salt Lake City life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*



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***Although Dallas is still emerging as a life sciences cluster, it has already achieved a sizable corporate presence with over 1,000 companies located in the area.***

## Global trends

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Within the United States, life sciences-focused clusters are at various stages in their evolution. The Northeast and California continue to dominate with their extensive university networks and deep labor pools, but, more and more, emerging clusters offer great talent coupled with more competitive real estate opportunities.

## Dallas / Fort Worth market overview

The Dallas/Fort Worth market has more than 1,000 companies employing over 25,000 employees in the life sciences industry. The largest segments are the pharmaceutical and medical equipment sectors of the industry, which make up roughly 44.0 percent of the existing local industry.

The highest concentration of life sciences companies is along the I-75 corridor from Richardson in the north and south to Northwest Highway; there are also pockets in the medical district along Stemmons Freeway, in Fort Worth, and in the Mid-cities at Airport Freeway and Loop 820.

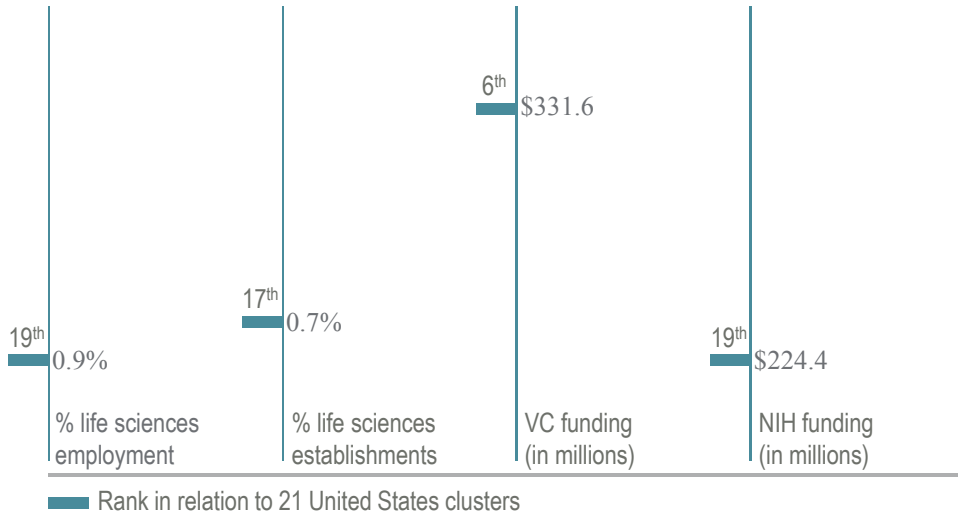
In addition to the established companies, there are over a dozen incubator locations. BioCenter, a 100,000-square-foot, state-of-the-art life science facility in the Stemmons Freeway medical district, is just one example of such incubators. The property was completed in 2009 and is currently 48.0 percent occupied. The property was developed to allow complete customization opportunities for incubator firms looking for fully equipped laboratories and preferential access to the UT Southwestern Medical Centers' Scientific Core.

UT Southwestern, which is highly regarded for its Medical Laboratory Science degree program, along with several other local college and universities offer a broad range of degree programs, which help to fuel the local employment base for the industry. Similar to other emerging clusters, Dallas's relatively low cost of doing business compared to coastal clusters add to Dallas / Fort Worth's attractiveness.

## Outlook

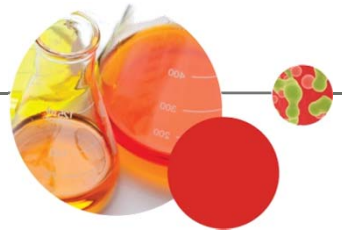
The state of Texas has made a concerted effort to grow the life sciences industry by forming the Texas Life Science Center for Innovation and Commercialization (TLSCIC) in conjunction with Texas Emerging Technology Fund (ETF). Emerging life sciences companies can take advantage of the TLSC's resources as they work toward moving products through the development process.

## Dallas / Fort Worth life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Southern Wisconsin



***Wisconsin's rapidly growing biotech sector ranks among top 10 nationwide for employment growth.***

## Global trends

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## Southern Wisconsin market overview

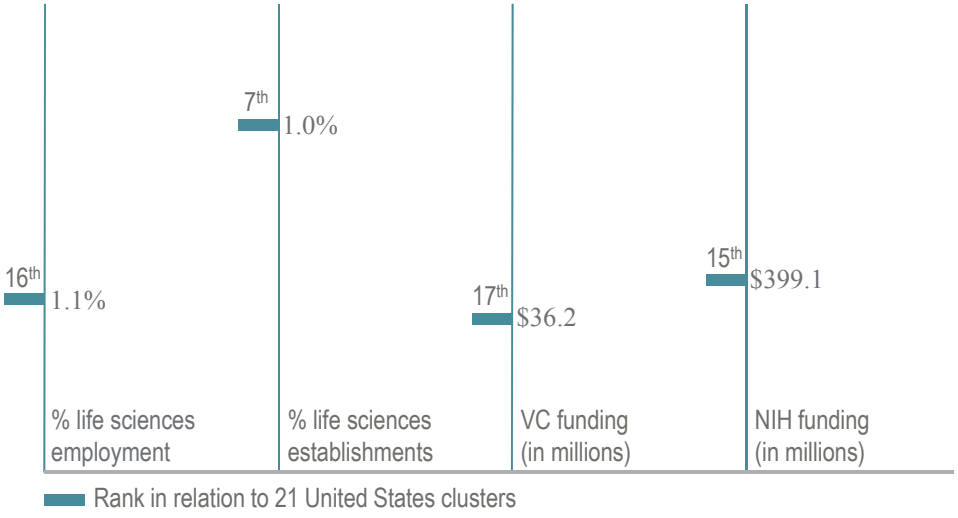
The Southern Wisconsin life sciences cluster benefits from its central location between the nearby Midwestern hubs of Minneapolis and Chicago, with a large amount of activity occurring around the larger cities of Madison and Milwaukee. With roughly 550 companies, employing over 12,000 individuals in the southern half of the state, it's clear that Wisconsin's life sciences industry is a growing and important part of the local economy. In fact, according to the Wisconsin Technology Council, Wisconsin recently ranked among the top 10 states for biotechnology employment growth.

From a funding perspective, Southern Wisconsin struggles to compete with other Midwestern life sciences hubs. However, in 2011, the state introduced two venture capital funds totaling $400.0 million controlled by the newly minted Wisconsin Venture Capital Authority, a move that will likely improve funding levels for life sciences start-ups.

Recently, GE Healthcare, based in Wisconsin, received $12.0 million in investments from parent company General Electric to bolster its already strong medical device business. TomoTherapy, a large medical device company based out of Madison, was acquired by California-based Accuray in mid-2011. Accuray has so far maintained TomoTherapy's presence in Madison, including manufacturing functions.

The Southern Wisconsin cluster will see its life sciences industry mature, due in large part to a growing biotechnology sector, mature presence from medical device and instrument manufacturers and focus from local economic development groups.

## Southern Wisconsin life sciences scorecard

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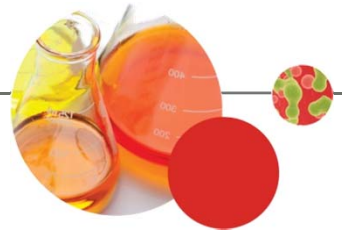

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*Florida is rapidly becoming a major life sciences hub.*

## Global trends

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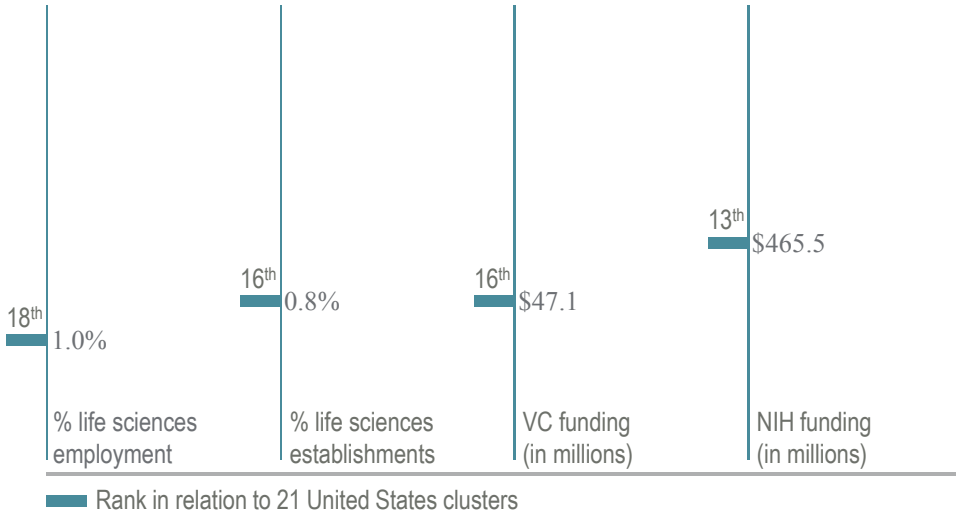
## Central & Southern Florida market overview

With the second fastest growing market for life sciences in the country, Florida is rapidly expanding its presence as a life science hub. Moreover, the state is developing a singular market for life sciences with specific hubs emerging throughout the state. For example, research and development is focused in Central and South Florida. Moreover, in Central Florida research and development is focused on Orlando's Lake Nona Medical City and Florida Hospital Health Village as well as in the area around the University of Florida. Meanwhile, South Florida's research and development community is fixed in Jupiter and Port St. Lucie as well as around the University of Miami's Jackson Memorial Hospital. Tampa Bay is serving as a hub for biotechnology and pharmaceuticals and Northeastern Florida is witnessing the emergence of a medical device cluster.

Although Florida has made large strides in developing its life sciences industry, the industry remains in its early stages, especially when compared to the larger life science hubs. The state still must work to attract venture capital, promote technology transfer and foster a strong start-up environment. Even though these steps still must be taken, we are optimistic that Florida will be a strong player in the life sciences. The state is aggressively pursuing research institutes and luring them into the state with incentives. This should have the desired result of creating spin-off companies that will demand office and lab space. Additionally the state is using its competitive advantages to carve out a life sciences niche. Orlando is already known as a world class site for simulation technology, thus the metropolitan area is leveraging this into the world of medical simulation technology and the opening of USF's CAMLS facility is a major example of this. Florida is also to attempting to leverage its strong tourism infrastructure into a medical tourism industry. Therefore, we believe that Florida can leverage its unique advantages to create niche roles in the life science industry that rival locations and metro areas cannot offer.

## Central & Southern Florida life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Central & South Florida life sciences statistics

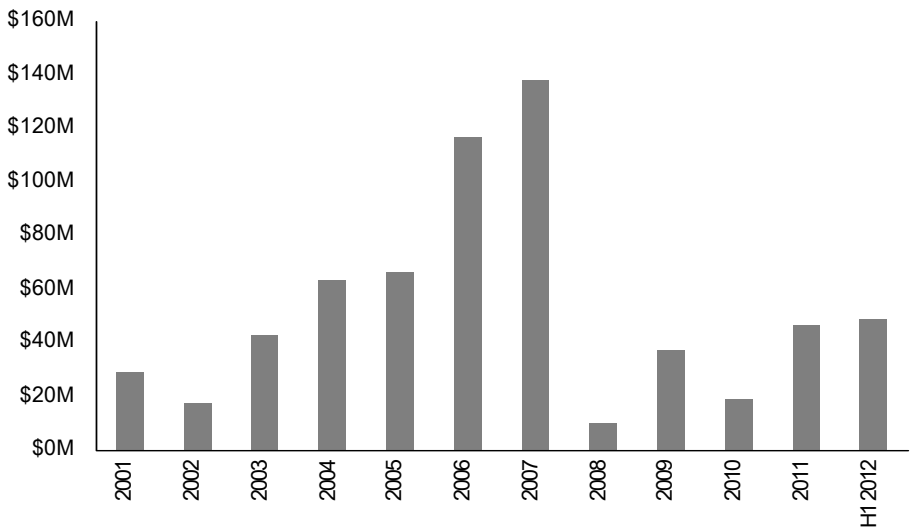
## Major life sciences research parks

| Park name | Acres / entitlements | Existing RBA | Vacancy |
|---|---|---|---|
| Lake Nona Medical City | 650 acres / 7M s.f. | 468,000 s.f. | 0.0% |
| Progress Corporate Park | 204 acres / 180,000 s.f. | 550,000 s.f. | 3.6% |
| USF Research Park | 112 acres / 535,000 s.f. | 428,569 s.f. | 2.0% |
| Tradition Center for Innovation | 120 acres / 410,000 s.f. | 207,000 s.f. | 0.0% |
| Research Park at FAU | 94 acres / 535,000 s.f. | 345,786 s.f. | 26.1% |
| Exploration Park at Kennedy Space Center | 400 acres / 450,000 s.f. | 73,000 s.f. | N / A |
| UM Life Science & Technology Park | 10 acres / 1.8M s.f. | 252,079 s.f. | 38.4% |
| Treasure Coast Research Park | 1,634 acres / 1.3M s.f. | 293,815 s.f. | 0.0% |

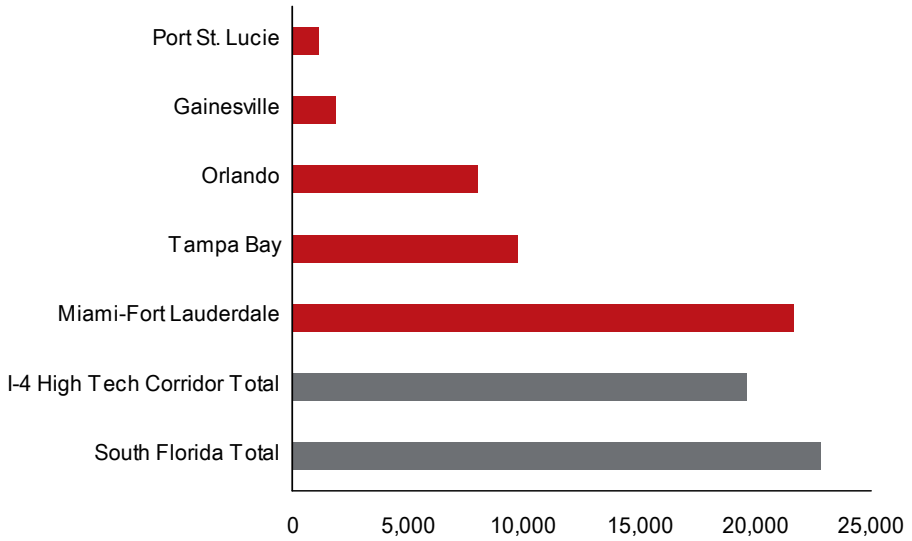
## Major life sciences research institutes

| Institute | Location | Size |
|---|---|---|
| The Scripps Research Institute | Jupiter | 348,000 s.f. |
| Harbor Branch Oceanographic Institute | Fort Pierce | 317,509 s.f. |
| H. Lee Moffitt Cancer Center & Research Institute | Tampa | 190,000 s.f. |
| Sanford-Burnham Medical Research Institute | Orlando | 170,000 s.f. |
| USDA Horticultural Research Laboratory | Fort Pierce | 170,000 s.f. |
| Oregon Health & Science University Vaccine and Gene Therapy Institute | Port St. Lucie | 130,000 s.f. |
| Torrey Pines Institute for Molecular Studies | Port St. Lucie | 103,000 s.f. |
| Max Planck Florida Institute | Jupiter | 100,000 s.f. |
| UF Institute of Food and Agricultural Sciences | Fort Pierce | 90,000 s.f. |

## Venture capital funding




## Employment



# I-4 High Tech Corridor

## Overview

The I-4 High Tech Corridor extends across 23 counties but is anchored at three of Florida's leading research universities: The University of Florida, the University of South Florida and the University of Central Florida. These three research universities, which collectively spent nearly $1.2 billion in research in 2012, are home to six of the state's seven life sciences centers of excellence and the state's two largest biotechnology incubators: the Sid Martin Biotechnology Incubator and the USF Technology Incubator.

Collectively, the areas surrounding these three universities are home to 100 biotechnology companies and a total of 1,280 life science companies, employing nearly 20,000 people. Several of the state's largest research institutes are based in the area including the H. Lee Moffitt Cancer Center and Research Institute, the Sanford-Burnham Institute, the McKnight Brain Institute and the UF/Shands Research Institute.

## Outlook

Florida is a growing market for the life sciences and has made impressive progress over the past decade. Future development seems destined to be centered along the I-4 High Corridor, and most likely in the area surrounding Orlando. Orlando is home to two large life sciences projects, the Lake Nona Medical City and the Florida Health Village. The Lake Nona Medical City alone is expected to employ over 30,000 life sciences professionals and generate an annual economic impact of $7.6 billion by 2017. The Lake Nona Medical City, located just south of Orlando International Airport, is a total of 650 acres with more than 7.0 million square feet of entitlements. Currently, 2.5 million square feet have or are being developed, totaling $1.3 billion. Among these, 468,000 square feet are for three research facilities: the 198,000-square-foot Burnett Biomedical Sciences Building, which is home to the 30,000-square-foot MD Anderson Cancer Center; Sanford-Burnham Medical Research Institute's 170,000-square-foot facility; and UF/Shands Research Institute which will be 100,000 square feet when completed at the end of 2012. Other life science-related tenants include UCF's College of Medicine, Nemours Children's Hospital and the Orlando VA Medical Center. Additionally, Orlando's Florida Health Village is slated to be another life sciences center. Windsor Healthcare Equities is planning to build a 156,000-square-foot Bioscience Building, which already has secured a 62,400-square-foot lease from the Profil Institute for Clinical Research, which will bring 75 jobs to Orlando.

The Sanford-Burnham Institute

**2 RECENT DEALS**
The Profil Institute for Clinical Research leased 62,400 s.f. at the Florida Health Village Bioscience Building.
Lake Nona Medical City Incubator will lease 20,000 s.f. at the Life Sciences Innovation Center.

**CURRENT PROJECTS**
H. Lee Moffit Cancer Center is building a 150,000 s.f. research facility at its McKinley Campus and Univ. of Florida / Shands will open its 100,000 s.f. Life Sciences Innovation Center.

**PROPOSED PROJECTS**
Windsor Healthcare Equities will build a $55M, 156,000 s.f. project called the Florida Health Village Bioscience Building and the Orlando Immunology Center will build a 18,600 s.f. clinic and research center.

**COMPLETED DEVELOPMENT**
USF opened its 90,000 s.f. Center for Advanced Medical Learning and Simulation (CAMLS).

***Florida is a growing market for the life sciences; Orlando, Lake Nona in particular, is likely to be the epicenter for growth.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# South Florida

## Overview

South Florida is emerging as a life sciences hub within the state, partially driven by intense economic development efforts by state and local governments. The arrival of Scripps Florida in 2009 and the completion of the adjacent Max Planck Florida Institute earlier this year have increased South Florida's profile among the life sciences community. The 345,000-square-foot Scripps Florida Research Institute, which received $94.0 million from Palm Beach County in addition to the one-time investment of $310.0 million awarded by the state, opened with a focus on neuroscience, medicinal chemistry and biotechnology, among other fields. Currently, the facility employees 430 people and that number is expected to grow to 550 by 2014. Over the last three years, the Institute has filed over 65 patents and Scripps Florida technology has been licensed 26 times since its creation. Max Planck Florida, which opened its doors earlier this year, is located adjacent to the Scripps facility. It is anticipated that the 100,000-square-foot facility (58,000 of which is laboratory space) will create 1,800 jobs and generate $2.0 billion in economic activity over the next decade. Due to the institutes' success, Scripps Florida and Tenet Florida are collaborating to construct a 30-acre medical center on adjacent land reserved for life sciences / biotech expansions.

The state's vision of a life sciences cluster emerging as a result of its investment in Scripps Florida and Max Planck is beginning to come to fruition, as numerous companies have taken occupancy in close proximity to the Institute, and as many as 14 companies are currently considering relocating to the cluster. Although overall life science employment has not seen significant gains, companies such as Envoy Therapeutics, Dyadic, Somahlution and CHS Pharma have relocated to Jupiter to be near the Scripps and Max Planck.

The other major life sciences facility in South Florida is located at the University of Miami Life Science and Technology Park located in the Miami Health District, which is also home to Jackson Memorials Hospital facilities, the third largest teaching hospital in the United States. The Park is comprised of 252,000 square feet and houses wet and dry labs, offices and lab-ready development suites. Tenants at the facility, which is still expanding, include Advanced Pharma, Andago and the Right Space Innovation Center.

## Outlook

South Florida is beginning to emerge as a stronghold for life sciences; however, the impact on commercial real estate (particularly office space) has been minimal. With most activity taking place in newly constructed university complexes and other nonprofit institutes, significant expansion of lab space and other life sciences office space has yet to materialize, but progress is indeed being made. Local economic development agencies have demonstrated a commitment to expanding the burgeoning life sciences clusters throughout South Florida, and concurrent with highly publicized research achievements and increased federal and grant funding, South Florida is quickly becoming a recognized, viable option as a potential location for life sciences companies.

The recently completed Max Planck Institute's 100,000-square-foot, state-of-the-art facility in Jupiter, FL. Not only is the facility LEED-NC accredited, but it also complies with the Lab 21 environmental performance criteria outlined by the U.S. Department of Energy.

**RIGHT SPACE INNOVATION CENTER**
signed a lease for 24,600 s.f. at the UM Life Science and Technology Park. The shared lab/office space is one of only such four spaces in the nation and the first of its kind in the Southeast United States.

**UMLSTP**
A hospital will be built adjacent to the Scripps Institute in Jupiter. Plans include four more buildings to house lab / office space and retail, totaling 2M s.f.. The plans are flexible and will be implemented upon demand.

**DR VITHALBAI DHADUK**
The neurologist who helped found Somahlution, purchased a 31,000 s.f. building in Jupiter to house the company, as well as Global Pharma Analytics. The building is comprised of 60 percent lab space.

**ONEBLOOD, INC.**
purchased 3000 W. Cypress Creek Road to house operations. The 75,000 s.f. building sold for $9.8 million, or $131 p.s.f. The transaction resolved a troubled situation.

***South Florida's life sciences industry is clustered around university and institutional research campuses, but all signs point to steady expansion in the near future.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

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***Diversified industry presence and strong support from public-private partnerships continue to transform Indy's life sciences community.***

## Global trends

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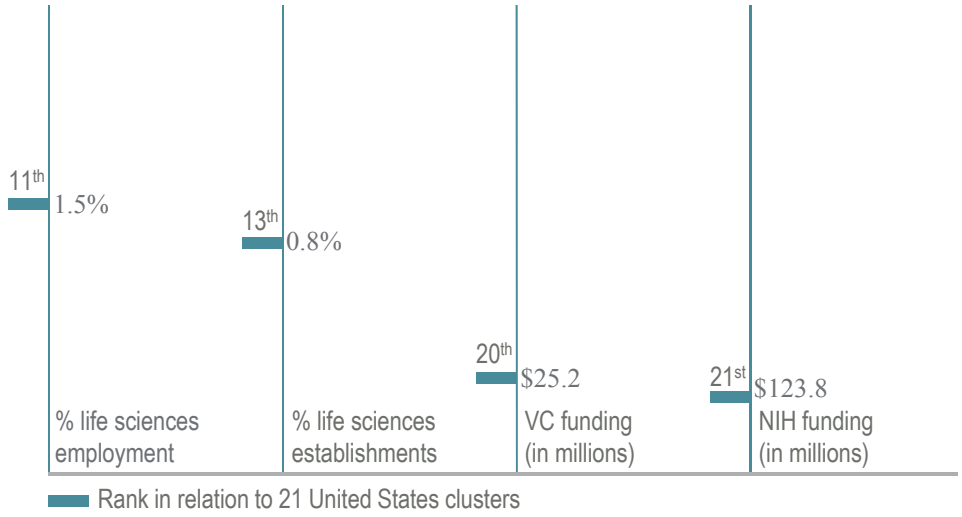
## Indianapolis market overview

Indianapolis is home to a growing life sciences community founded on the presence of many large, pharmaceutical corporations. Most notably, Eli Lilly, Roche Diagnostics, Endocyte and DOW AgroSciences have their headquarter operations within the Central Business District. The broader state of Indiana is also home to a multitude of industry companies, among them medical instrument and apparatus manufacturers Cook Incorporated of Bloomington and Zimmer, Biomet and Depuy Orthopaedics of Warsaw.

Indianapolis is comprised of about 350 life sciences establishments, employing roughly 12,600 people in the technical field. From a sheer size standpoint, Indianapolis does not have as many establishments or employees when compared to industry hubs like New Jersey / New York City and Boston, but interest groups in the state have been working to change that. Through the careful guidance of the area's leading public-private partnership, BioCrossroads, Indianapolis (and the state-at-large) has become a hotbed of activity for start-ups. According to the *Indianapolis Business Journal*, the partnership's efforts have helped launch 330 companies and attracted over $330.0 million in venture capital since its creation 10 years ago.

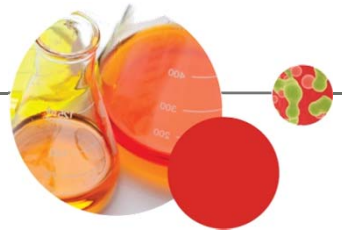
Leaders at BioCrossroads have also leveraged cross-regional partnership with fellow start-up clusters like San Diego and the Research Triangle Region. Due to their careful fostering and partnering models, the cluster has become one of the more successful areas in turning out new biotech companies and innovations.

## Indianapolis life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Southern Michigan



***A budding location for industry start-ups, supported by funding opportunities made available through economic development groups.***

## Global trends

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## Southern Michigan market overview

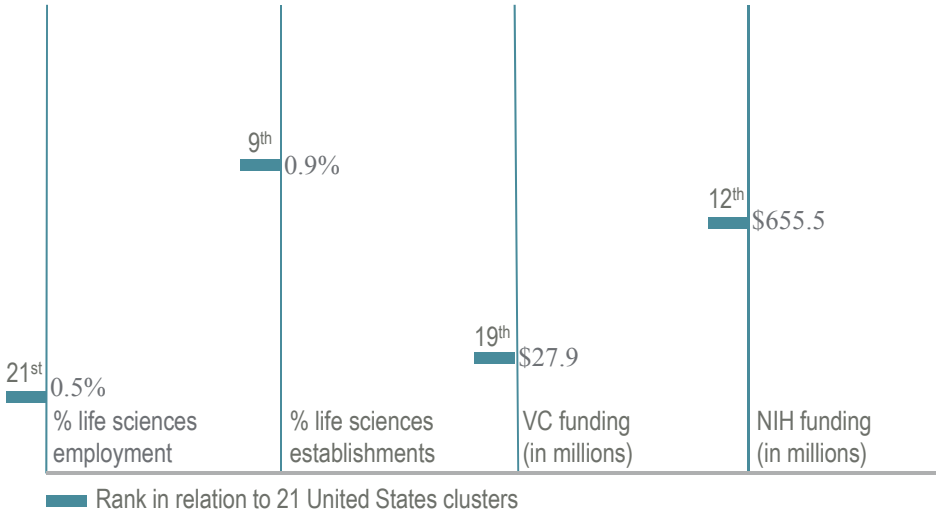
Life sciences activity in Michigan is largely concentrated in the metropolitan areas of Detroit, Grand Rapids, Lansing and Ann Arbor in the southern-half of the state, largely due to proximity to major research universities and the presence of economic development groups focused on the industry.

There are over 1,000 life sciences establishments in the area, employing roughly 12,500 people. A large amount of life sciences research originates in area universities – either among graduate students or via start-ups that spin-out once the scientists graduate.

Economic development and industry-minded groups really help to propel activity within Michigan, such as the Michigan Economic Development Corporation (MEDC), including the Michigan Strategic Fund and Ann Arbor SPARK. The Michigan Life Science and Innovation Center near Ann Arbor, a 57,000-square-foot incubator, is a venture of MEDC and Ann Arbor SPARK (among other private and public groups). Recently the center received $5.0 million in funding from the Strategic Fund to build a new lab; the biosciences division of SRI International, a R&D nonprofit, will be the first occupant in the new lab. Another company who recently chose a Michigan address due to incentive offerings from MEDC is ArticAx, a start-up focused on macular degeneration research. It announced plans to open a 7,500 to 10,000-square-foot lab in Grand Rapids later this year.

Although the industry is still emerging in Michigan, the resources offered by groups like the MEDC should continue to garner interest among start-ups within Michigan's university system and from out-of-state.

## Southern Michigan life sciences scorecard

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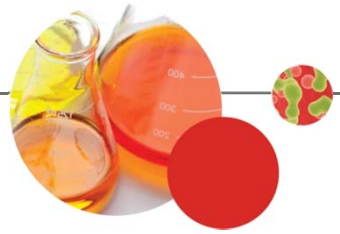

***The life sciences sector is emerging in Atlanta as an increasingly effective economic driver.***

## Global trends

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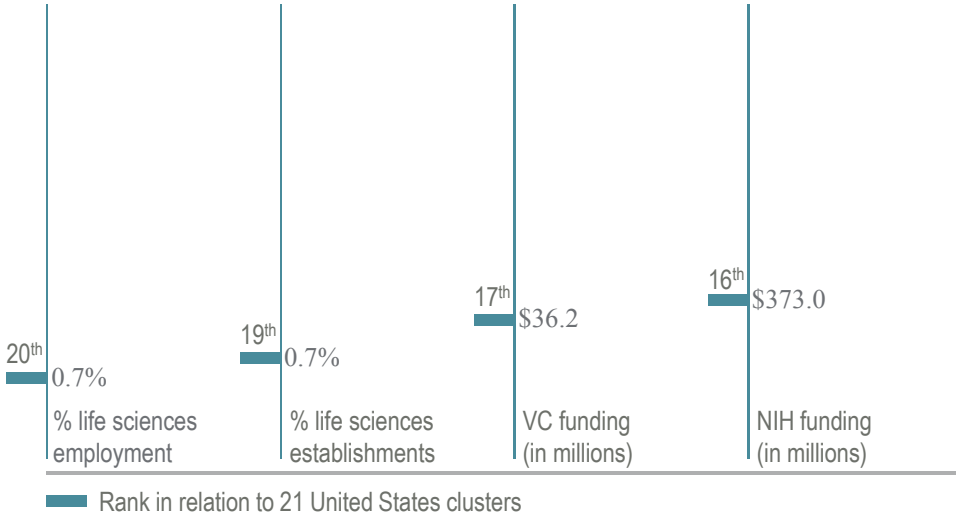
## Atlanta market overview

The life sciences industry is emerging in Georgia as an increasingly effective economic driver. Several factors in play have converged to create the ideal environment for vibrant growth within this sector. Atlanta houses the Centers for Disease Control and Prevention (CDC) and there is a high concentration of world class educational and research programs. The state is already home to more than 900 bioscience companies and lawmakers and economic developers continue to foster initiatives that ensure a favorable corporate climate. There are eight major academic institutions in the area that offer a range of bioscience-related degrees. Many of those schools benefit from fostering by the Georgia Research Alliance, an independent nonprofit that coordinates research efforts between the public and private sectors. Since 1990, a multitude of renowned scientists have been recruited to Atlanta through its Eminent Scholars program. Currently, the industry has an economic impact of $23.0 billion annually for the state.

Recognizing the life sciences industry's positive influence, Georgia has embraced this sector and there are multiple programs in place to spur growth. Atlanta and its home state both enjoy a business-friendly reputation and life sciences companies have access to various incentives that include tax credits, sales tax exemptions, job training, cash grants and property tax relief. Specifically targeted to the industry are services provided by the Georgia Bioscience Commercialization Center, a resource hub that helps entrepreneurs create stronger infrastructure and bring technological innovation from bench to market. The Georgia Research Alliance launches companies around laboratory discoveries at partner universities through its VentureLab program. There is also the Georgia Medical Center Authority – established to advance the life sciences industry through the provision of research, development and manufacturing facilities and programs.

## Atlanta life sciences scorecard




*Sources: Bureau of Labor Statistics, PricewaterhouseCoopers, National Institute of Health*

# Midtown

## Overview

The Georgia Institute of Technology (Georgia Tech) and its biomedical / bioengineering partnership with Emory University are critical drivers of life sciences activity in Midtown. Innovative and best-in-class research has shone the spotlight on the submarket as this industry cluster continues to grow. Tenants are located in traditional tower office space like at Gateway Development's Centergy One Tech Square building as well as in more affordable low-rise B space on the Westside.

## Outlook

Life sciences demand is likely to continue to expand in tandem with the growth of Emory and Georgia Tech's joint initiatives. Emory University already has an unparalleled advanced proton therapy center planned for the area. Midtown is also home to the metro's largest concentration of Millennials, highly educated ones at that, from which bioscience firms can draw employees. These factors ensure that activity in this sector will remain a bright spot for the Midtown submarket.

# Northlake

## Overview

Northlake is a niche office submarket of just 11.0 million square feet that developed around the same time as the neighboring Northeast submarket. With both Emory University's and the CDC's main campuses located on the western edge of the submarket, much of the leasing activity is driven by the need for proximity to those institutions by occupiers in the life sciences industry and vendors to the CDC. Space in the low- to mid-rise buildings that are germane to the submarket is also more affordable than in similarly bioscience-dominant Midtown to the south.

## Outlook

Although the CDC has recently given back large blocks of leased space in a consolidation to recently built government space on its main campus, the institute remains the largest influencer of life sciences demand in Northlake. Many of the tenants currently active in the market provide services to the CDC or rely on its research programs. Add to that the confluence of Emory's research platform and it is evident why Northlake should continue as a bioscience hub for Atlanta.

**GALECTIN THERAPEUTICS**
will move its headquarters and clinical development program from a Boston suburb to Norcross in early October at Northwoods Commons. Galectin specializes in fibrosis and cancer therapeutics.

**BAXTER INTERNATIONAL**
broke ground on a $1.0 billion manufacturing facility for biological medical treatments near Covington in August.

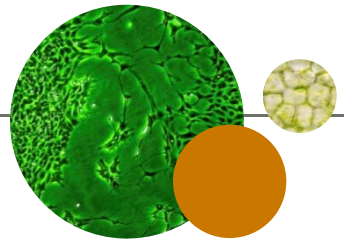
**EMORY UNIVERSITY**
will soon begin construction on a $200.0 million proton therapy center in Midtown for clinical trials and research.

**ETHICON**
plans to invest $185.0 million for capital improvements at its Cornelia facility. A Johnson & Johnson subsidiary, Ethicon produces the majority of the world's surgical suture supply. Ethicon will renovate and expand the facility by 100,000 s.f.

**ELEKTA**
will relocate its North American headquarters to 50,000 s.f. at The Terraces office complex in Central Perimeter. Based in Stockholm, Elekta develops medical devices and dose planning systems.

***Georgia is home to more than 300 global life sciences firms clustered in a state that provides a healthy economic and logistical ecosystem for biotech growth.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



## *Canada has proven to be a world-class contributor to the life sciences industry for many years.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

### Canada market overview

Canada's ability to compete on a global scale is largely driven by the success of a well-structured partnership between government, academic and healthcare institutions as well as the ability to retain a world-class work force. Life sciences-related companies contribute roughly CAD 85.0 billion ($85.0 billion),[1] or more than 7.0 percent of Canada's GDP, and employ more than 400,000 nationally. Canada remains a bastion of stability. Although economic growth has not been buoyant, the economy has shown resilience to conditions abroad; real GDP hovering around 2.0 percent in the last two quarters as well as unemployment rates in the 7.0 to 7.5 percent range. Forecasts point to real GDP growth and stable unemployment levels over the next six to eight quarters.

Government spending continues to hold back growth as federal and provincial governments continue austerity measures to balance fiscal deficits. Notwithstanding, Canada remains the healthiest economy in the G7. Despite recent austerity measures the federal government announced, it will facilitate the biotech industry with CAD 400.0 million ($400.0 million) to support the creation of a new, large-scale venture capital (VC) fund. In addition, the Industrial Research Program will be doubled to CAD 110.0 million ($110.0 million)[1] annually.

[1] Six-month average conversion rate of 1.00 Canadian Dollar (CAD) per U.S. dollar, as of October 2012.

### *Industry statistics*

**8.5** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **21.1%**

**1.9%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **4,550**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Greater Toronto Area

## Overview

The largest cluster of life sciences-related companies in Canada is found in the Greater Toronto Area where upward of 650 companies are located, including: nearly 300 pharmaceutical, medicine and device manufacturers; 167 R&D and testing laboratories; and more than 250 medical equipment and supplies related companies. These firms occupy nearly 30.0 million square feet of space and employ more than 87,000 people in the Greater Toronto Area.

At the heart of Toronto lies the Discovery District, Canada's largest concentration of research institutes, business incubators and business support staff. More than CAD 1.0 billion ($1.0 billion)[1] is directed annually to research activities in this 617.0-acre research park holding 7.0 million square feet of facilities. The newest addition to this cluster is the research incubator MaRS Centre. A 750,000-square-foot facility dedicated to the development and commercialization of innovative technologies. An expansion of this building is currently underway, adding an additional 780,000 square feet of research and office space to the downtown market. MaRS, however, is only one of the many investments made over the past two years, totaling more than CAD 1.2 billion ($1.2 billion).[1]

Toronto is also the home to several large universities such as University of Toronto, York University and Ryerson University all with close ties to the life sciences industry. The University of Toronto, located in the Discovery District, is Canada's largest university housing over 70,000 students, 43.0 percent of which are enrolled in disciplines falling under the Faculty of Medicine.

Outside of the Discovery District, Toronto life sciences companies cluster around Meadowvale, Mississauga. The area is commonly known as "Pill Hill" because of its high density of pharmaceutical companies, including headquarter operations for GlaxoSmithKline and AstraZeneca.

## Outlook

Investment capital that can translate research into commercial opportunities and outcomes continues to be the biggest hurdle for life sciences companies in Canada. In an effort to meet industry needs, both federal and provincial financial incentives are available, such as the Scientific Research and Experimental Development (SR&ED) program giving a tax credit of 35.0 percent up to the first CAD 3.0 million ($3.0 million)[1] of qualified expenditures for SR&ED carried out in Canada. The Ontario Business-Research Institute Tax Credit is a 20.0 percent refundable tax credit program and the Ontario Innovation Demonstration Fund provides up to CAD 4.0 million ($4.0 million)[1] in grants to early-stage companies. Also available is the Imagination, Manufacturing, Innovation, Technology (IMIT) grant which supports new building construction and/or building expansion in targeted sectors.

[1] Six-month average conversion rate of 1.00 Canadian Dollar (CAD) per U.S. dollar, as of October 2012.

Construction progress of the SickKid Research & Learning Tower, January 2012

**HOFFMANN-LA ROCHE**
The Swiss-based pharmaceutical company signed a 15-year, 175,000 s.f. lease at 7070 Mississauga Road in Mississauga, ON.

**THE HOSPITAL FOR SICK CHILDREN**
has invested more than $400.0 million in a 21-story research tower in the Discovery District, projected to be completed by 2013. The facility will house more than 2,000 scientists and staff.

**NORTHWEST HEALTHCARE PROPERTIES REIT**
The Canadian-based REIT recently announced the acquisition of 807 Broadview Avenue, Toronto. The 45,770 s.f. building is 100% leased by Albany Medical Clinic.

**LUMINEX CORPORATION**
is on the market for a renewal of its existing 27,000 s.f. office / laboratory space in downtown Toronto or relocation options.

***Investment capital that can translate research into commercial opportunities and outcomes continues to be the biggest hurdle for life sciences companies in Canada.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Greater Montréal Area

## Overview

The Greater Montréal Area (GMA) holds one of the largest life sciences clusters in Canada, consisting mostly of medical and pharmaceutical research, biotechnology, brand name drug manufacturing, and medical device and equipment manufacturing. The cluster is made up of approximately 620 organizations, 43,000 employees and approximately 16.6 million square feet of office, industrial and lab space. With over 80 multinational pharmaceutical companies and several Canadian headquarters, including Merck, Pfizer, Sanofi-Aventis, Valeant Pharmaceuticals and Bristol-Myers Squibb to name a few, the GMA is a major pharmaceutical center of Canada.

Montréal ranks second among North American cities for the number of post-secondary students per capita and has 11 post-secondary institutions devoted to the life sciences sector. With many students choosing to live and work in the city after graduation, Montréal acts as a global anchor for the industry, and an incubator for talent within Canada.

Recently, Montréal's Life Sciences sector suffered significant loses as major players such as Merck and AstraZeneca shut down their R&D facilities. In contrast, Valeant Pharmaceuticals announced that it would be relocating its head office from Mississauga, Ontario, to the Montréal suburb of Laval. With 117,000 square feet currently under construction to accommodate head office expansions, it is clear that the life sciences are holding strong in the GMA.

## Outlook

The GMA life sciences sector is expected to realize pressure seen elsewhere across the globe with a strong push towards "rightsizing." This "rightsizing" has already translated into the closure of several large scale research facilities and significant job losses.

On the other hand, market conditions remain strong for the manufacturing and distribution sectors which have the potential to make up for the job loses in the R&D sector. Both the federal and Québec governments will continue to offer competitive incentives for life sciences companies looking to set up shop in the province and with over 40 companies providing venture capital for life sciences start-ups, the industry is not likely to suffer from lack of investment or incentives any time soon.

Merck campus for sale

**VALEANT PHARMACEUTICAL**
bought Sanofi-Aventis's 222,533 s.f. head office in Laval. The building sold for $29.5M, or $132.57 p.s.f. Sanofi will be vacating the premises once its new headquarters is complete.

**COVIDIEN**
signed a 5-year, 102,157 s.f lease at 18101 Transcanada Highway, a single tenant industrial building in Kirkland. The building is undergoing major renovation to accommodate the needs of Covidien.

***Montréal acts as a global anchor for the industry, and an incubator for talent within Canada.***

**SANOFI-AVENTIS**
After having sold their head office to Valeant Pharmaceuticals, Sanofi-Aventis is building a new, LEED-certified 66,000 s.f. head office in Laval's Biotech City.

**MERCK FOR SALE**
Situated on 53.8 acres with approximately 300,000 s.f. of Class A and B office space and a total of 414,000 s.f. of R&D, manufacturing, packaging and distribution space.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

[1] Six-month average conversion rate of 1.00 Canadian Dollar (CAD) per U.S. dollar, as of October 2012.

***While still in its budding stages, Brazil's life sciences economy is well diversified, with ample focus on human health, animal health and agricultural biotechnology.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## Brazil market overview

Brazil has enjoyed one of the fastest growing economies over the past few decades and continues its upward momentum as a leading South American economy. Advancements to its national healthcare system and growth in generic pharmaceutical manufacturing, agribusiness and biofuel research lay the ground work for Brazil's rapidly growing life sciences industry. International companies make up a majority of the country's players, particularly through acquisitions of local firms and products. Pfizer, Amgen and Sanofi have all recently made headlines for their investments in Brazilian companies.

According to a recent report from Burrill & Company, Brazil's pharmaceutical industry was valued at BRL 46.3 billion ($22.9 billion) in 2010. It is now the seventh largest in the world and is expected to grow at a rate of 12.0 percent per year. A rise in the country's middle class has led to increased spending on healthcare and a shift in the types of diseases and maladies plaguing the local population. Chronic diseases more common in affluent nations are beginning to affect Brazilians, and thus creating a demand for more specialized and costly drugs. The government hopes to reduce its dependence on drug imports and is improving the funding and intellectual property (IP) protection landscape to encourage domestic achievements in innovation.

[1] Six-month average conversion rate of 2.02 Brazilian Real (BRL) per U.S. dollar, as of October 2012.

## *Industry statistics*

**1.4** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **12.2%**

**1.2%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **2,705**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Brazil

## Overview

Over 75.0 percent of Brazil's life sciences companies are clustered among the three states of São Paulo, Minas Gerais and Rio de Janeiro, with 40.5 percent, 24.4 percent and 13.1 percent of companies in each state, respectively. The development of technological innovation is heavily linked to university research centers among these three states.

According to the Brazilian Association of Research Biotechnology, Brazil has around 237 national life sciences companies, most of which are small and have been active for less than 10 years. Half of these companies began operations inside university incubators and shared R&D centers whereas 20.0 percent of them are still in development phase and have not realized any revenue. Although 85.0 percent of these companies employ fewer than 50 employees, they all use a highly educated subset of the workforce, with 40.0 percent PhDs and 20.0 percent Masters of Science.

Over the past two decades, the Brazilian government has encouraged development of the nation's innovative industries. With the passage of the intellectual property laws in 1996, patents on pharmaceutical products were granted for first time, marking a major turning point. Since that time, the government has added protections for innovation. The Innovation Law of 2004 offers incentives for developing partnerships between private companies, research institutions and universities; incentives for universities and research institutions to participate in innovation; and incentives to promote innovation within private institutions. The Law of Goods offers private sector incentives to invest in R&D. Additionally, the government's industrial policy prioritizes the development of domestically owned, private pharmaceutical manufacturers. Most notably, the Profarma-Innovation program, operated by the government's development bank, Banco Nacional de Desenvolvimento Econômico e Social (BNDES), is investing about BRL 2.5 billion ($1.24 billion)[1] in the industry through 2012.

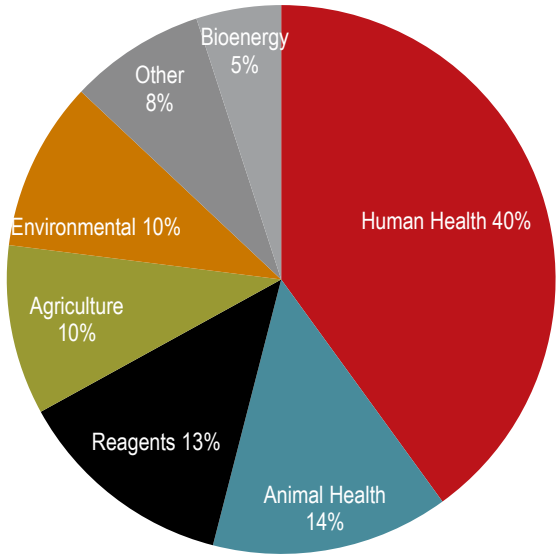
## Outlook

Regarding regional differences, the government has encouraged changes in the geographic distribution of graduate programs in order to strengthen the north, northeast and midwest. It also plans to invest in post-graduation programs, to further bolster the highly-educated Brazilian workforce.

Only 1.2 percent of GPD, including public and private investment, was invested in R&D in 2009. According to the Ministry of Ministry of Science, Technology and Innovation, 45.7 percent of this investment in R&D is done by companies. To compare, more highly technical and innovative countries typically benefit from 70.0 percent of private-funded R&D investment. Lack of seasoned industry professionals and R&D facilities combined with leery foreign and domestic investors will continue to challenge Brazil's development of a high-tech hub.

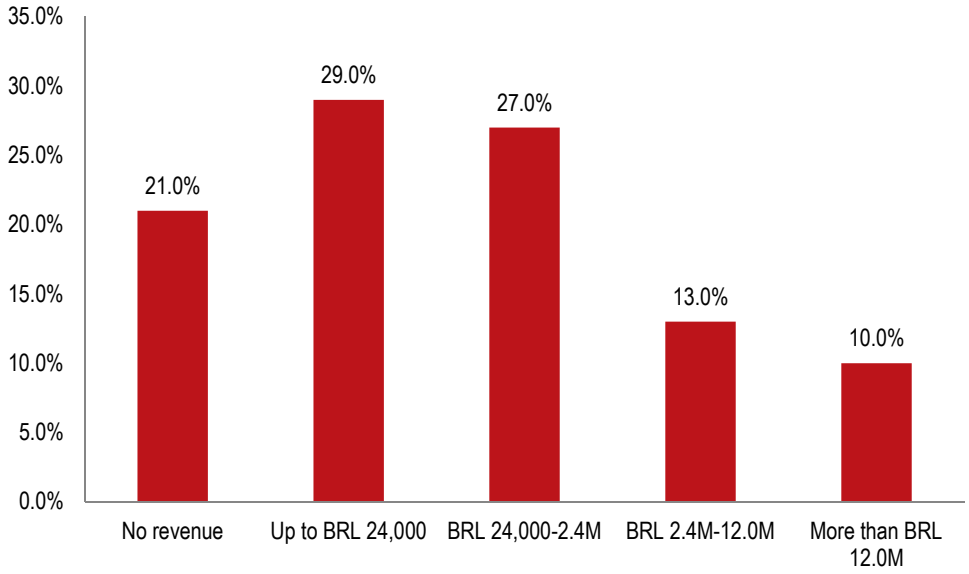
[1] Six-month average conversion rate of 2.02 Brazilian Real (BRL) per U.S. dollar, as of October 2012.

## Brazilian life sciences companies by application

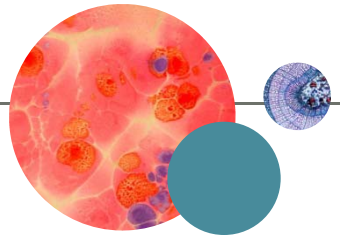



*Source: BRBIOTEC & CEBRAP, 2011*

## Brazilian life sciences companies, percent by revenue[1]




*Source: BRBIOTEC & CEBRAP, 2011*



***Colombia's higher value-added sectors such as agro-industry, pharmaceuticals and mining are some of the key beneficiaries of recent trade liberalization policies.***

## Global trends

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## Colombia market overview

With Latin America's fourth largest population and fifth largest economy, Colombia has been on the radar in recent years as one of the hottest emerging markets in the world. The Colombian economy has experienced considerable growth over the past decade, with national GDP more than double what it was just 10 years ago. The catalyst for this has been an aggressive campaign to strengthen national security, which has engendered confidence in the population and has opened the door for new investment opportunities. Traveling throughout the country is now much safer, and therefore, international commerce and tourism have benefitted immensely.

Another crucial factor in Colombia's growth has been its focus on trade liberalization, as it is committed to several bi- and multilateral agreements with the United States, the European Union, Canada, Chile, Mexico, Peru, Brazil and Venezuela. Additional Free Trade Agreements are currently being negotiated with South Korea and Israel and should be implemented within the next two years. Higher value-added sectors such as agro-industry, pharmaceuticals and mining are some of the key beneficiaries of these agreements. A conscious effort is being made to reduce reliance on commodities, as past overexposure to external fluctuations in these markets has created significant turbulence.

Colombia's main export partners include the United States (32.0 percent), Venezuela (17.0 percent) and Netherlands (4.0 percent) while main import partners are the United States (28.0 percent), China (11.0 percent), Mexico (7.0 percent), Brazil (6.5 percent), France (4.5 percent) and Germany (4.0 percent). Exports have increased from COP 6.0 trillion ($3.3 billion)[1] in 2010 to COP 8.9 trillion ($4.9 billion)[1] in 2011 while imports have increased from COP 6.6 trillion ($3.6 billion)[1] to COP 8.4 trillion ($4.6 billion)[1] over the same time.

The largest cities are Bogotá, Medellin, Cali, Barranquilla, Cartagena and Bucaramanga. The majority of the population resides in the central mountains while the entire southeastern half remains largely underdeveloped and sparsely populated.

[1] Six-month average conversion rate of 1,824.00 Colombian Peso (COP) per U.S. dollar, as of October 2012.

### Industry statistics

**0.4** Researchers in science, per thousand total employment

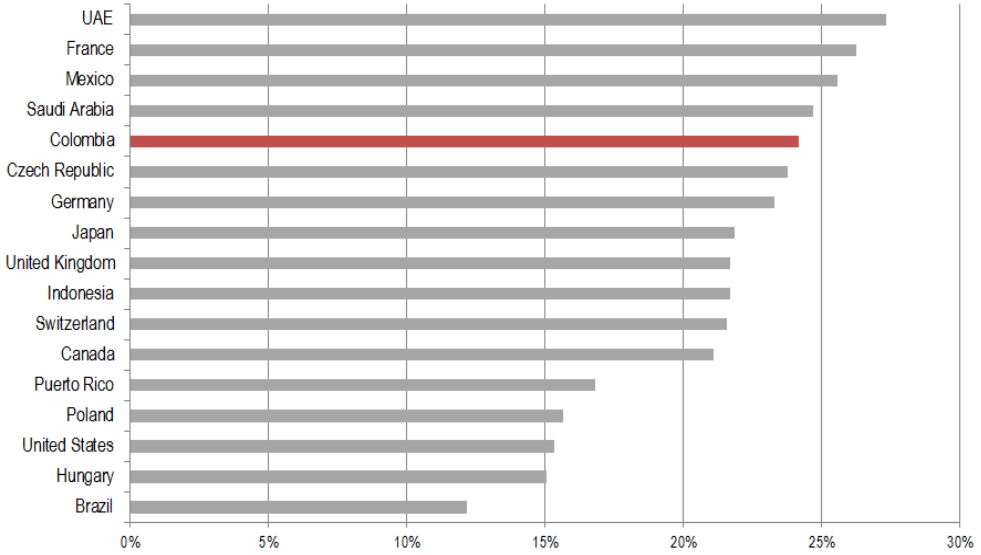
Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **24.2%**

**0.2%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **133**

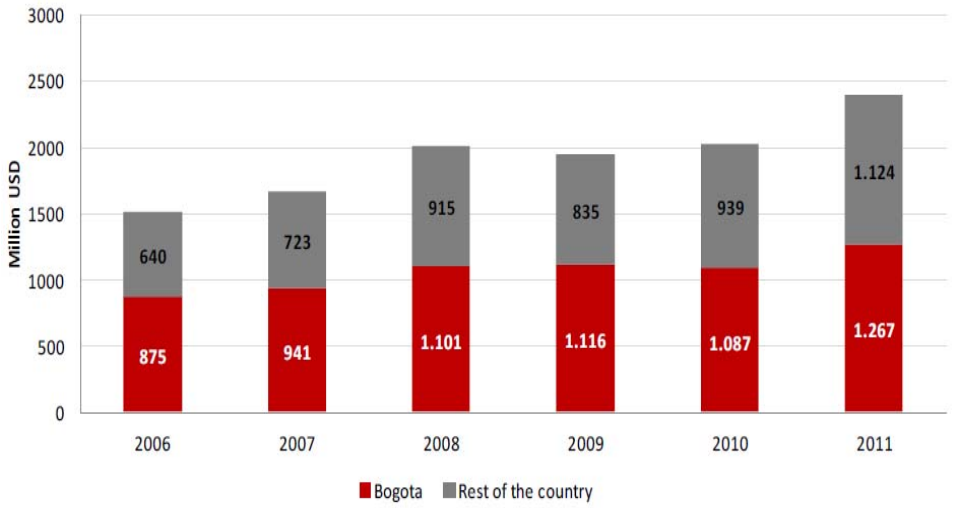
*Sources: UNISCO Institute for Statistics, the World Bank*

## Graduate students in life sciences, as a % of total graduate students (2009)




*Source: UNESCO*

## Pharmaceutical sales in Bogotá vs. Colombia




*Source: Superintendencia de Sociedades (2011)*

## Bogotá market overview

Bogotá is the industrial, economic and cultural center of Colombia, accounting for approximately 25.0 percent of national GDP, annually. It is considered the fourth-most influential financial center in Latin America and also serves as a hub for the pharmaceuticals, textiles, publishing, construction and food production industries. Its relative proximity to the United States, Mexico and Brazil make it a convenient entry point into South America for many firms, which explains its growing attraction to multinationals. Its strategic location and growing industry are further illustrated by the fact that El Dorado International Airport is Latin America's busiest in terms of cargo traffic.

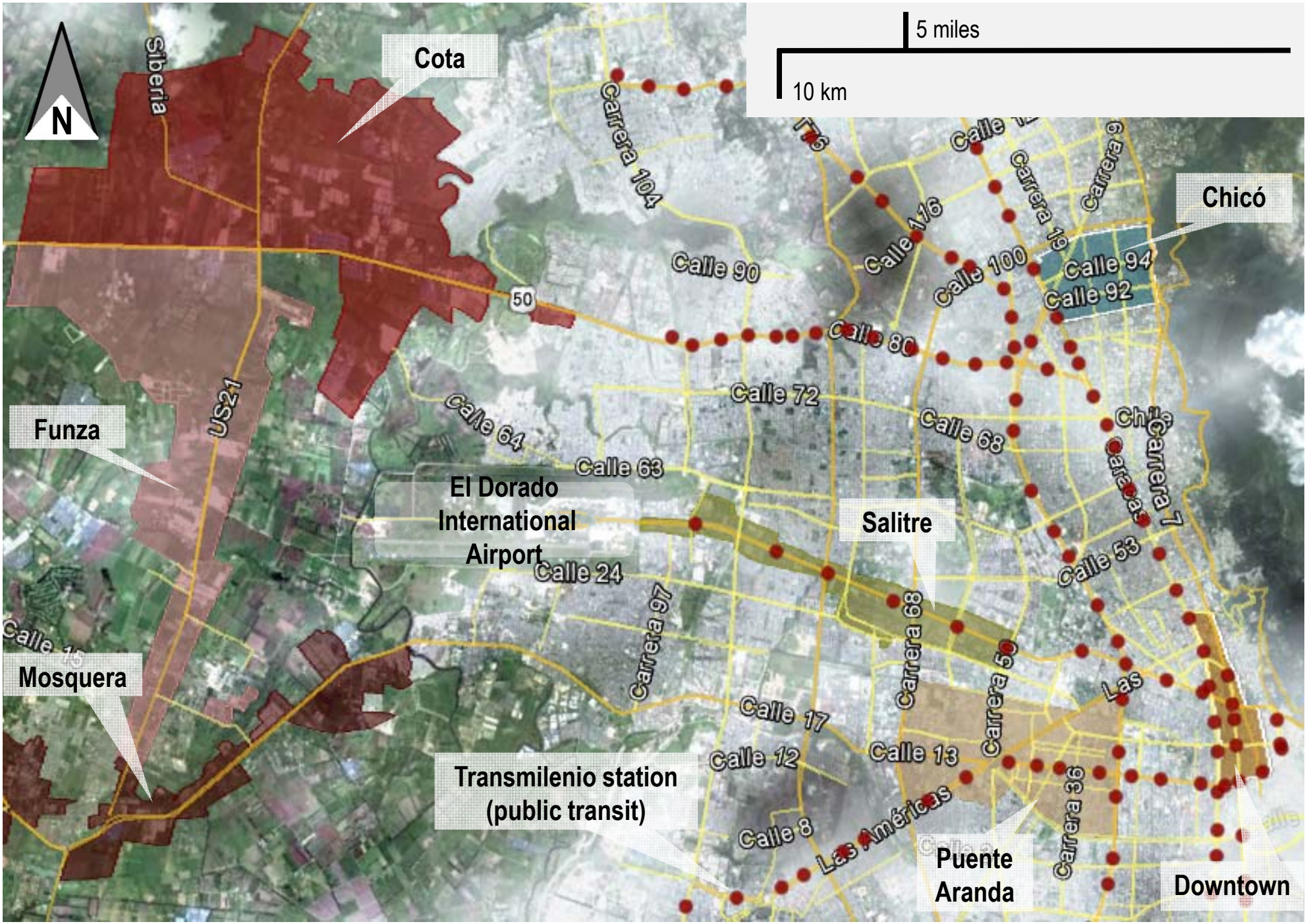
Colombian culture highly encourages scientific disciplines such as medicine and engineering; 24.2 percent of all graduate students are studying to go into a life sciences field, a statistic that ranks among the highest in the world. This is evident in Bogotá as its top universities (Universidad Nacional, Universidad Los Andes and Universidad Javeriana) are all committing increasingly larger investments in science faculty, facilities and science scholarships. As a result, Bogotá has become a leader in Latin America for these fields due not only to its immense and growing consumer market but also to a high availability of skilled labor. It is worth noting that other Colombian cities such as Medellin and Bucaramanga are attracting clusters of life science firms, although on a smaller scale.

Several pharmaceutical companies have established a regional headquarters in Bogotá in recent years. Colombia ranks as the fourth largest pharmaceutical consumer market in Latin America, and sales have been growing steadily since 2006. Pharmaceutical sales in Colombia approached COP 4.4 trillion ($2.4 billion)[1] in 2011, over half of which were in the capital city. Approximately 24,000 people are employed in the industry in Colombia, with 55.0 percent based in Bogotá.

Bogotá is also home to several agro-industry firms, many of which have factories and logistics facilities in the western suburbs of the city such as Mosquera, Funza and Cota. The rapid industrialization of this sector has profoundly transformed these places from the quiet, flower-cultivating towns just 15 years ago to a hub of industrial activity comprising of over 5.0 million square meters of industrial floor area. These western suburbs are the new industrial center, not only of Bogotá, but of all Colombia, as there is an abundance of available land here able to accommodate large operations.

The key life sciences clusters in Bogotá apart from agro-industry are Chicó, Salitre and Puente Aranda. Chicó is a high-end office submarket where many tech-related firms have their headquarters. Salitre is a decentralized office submarket that has larger buildings with large floor plates, and is thus better able to accommodate larger multinational administrative operations. Puente Aranda, home to several multinational pharmaceutical manufacturing and laboratory operations, is the old industrial sector of Bogotá.

[1] Six-month average conversion rate of 1,824 Colombian Peso (COP) per U.S. dollar, as of October 2012.


N
5 miles
10 km
Cota
Siberia
Funza
Mosquera
Chicó
Salitre
El Dorado International Airport
Transmilenio station (public transit)
Puente Aranda
Downtown
Carrera 104
Calle 90
Calle 176
Calle 100
Calle 94
Calle 92
Calle 80
Calle 72
Calle 68
Calle 64
Calle 63
Calle 24
Calle 53
Calle 17
Calle 12
Calle 13
Calle 8
Carrera 97
Carrera 68
Carrera 50
Carrera 7
Las Américas
US21
50

# Chicó

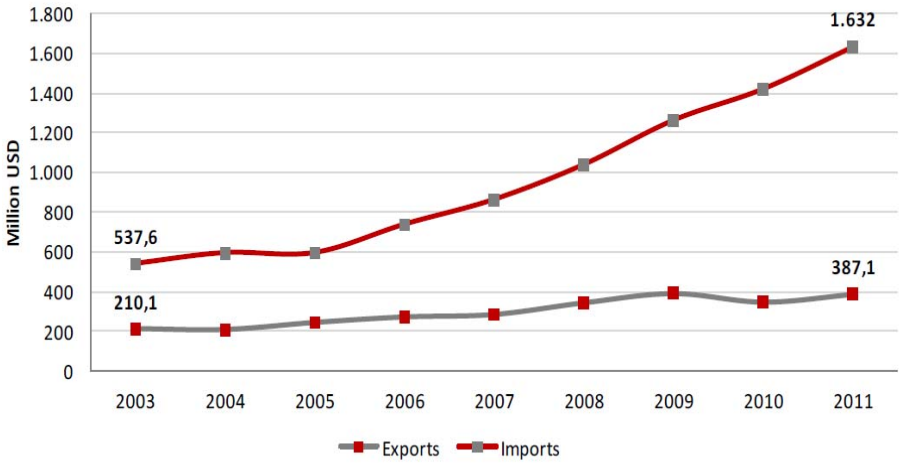
## Overview

Chicó contains the largest quantity of corporate quality office stock in the city with over 400,000 square meters of built space. Many of the properties in the Chicó area are smaller, focusing on the local market and / or multinationals with smaller operations. However, many large buildings are located along Calle 100 (100th Street), one of the main thoroughfares and a business hub in the city. Several of the most influential pharmaceutical and tech companies are located here as it is the most expensive and in-demand place to work in the city. Among the firms with headquarters in Chicó are Merck Sharp & Dohme, Novartis, Sanofi, Clover and Abbott.

## Outlook

At 8.1 percent, vacancy in this submarket is currently above the city average. However, vacancy for Class A space is around 5.5 percent while vacancy for AB offices is at 9.5 percent, illustrating the difficulty in finding larger spaces here. Consequently, rents have been climbing steadily for a few years and are now around COP 58,368.00 to 69,312.00 ($32.00 to $38.00)[1] per square meter for Class A and COP 51,072.00 to 58,368.00 ($28.00 to $32.00)[1] per square meter for Class AB space. This could be alleviated in the next two years as over 100,000 square meters of office space are expected to be delivered in the Chicó area by the end of 2014, although many of these projects are smaller buildings of 6,000 square meters or less.

### Colombia Foreign Trade in Pharmaceuticals




*Source: Asociacion Nacional de Empresarios (2011)*

# Salitre

## Overview

El Salitre is the city's newest office submarket. As the traditional business clusters of Bogotá have become built out with very few parcels available for new construction, Salitre has become the popular option for development as there is abundant land and it is conveniently located directly between downtown and El Dorado International Airport. The scale and quality of office development here can be attributed to the proximity of the international and domestic airports, coupled with large amounts of developable land. Salitre currently has approximately 245,000 square meters (16.0 percent of the total office stock). It will see the largest influx of future development, with another 150,000 square meters to be delivered by the end of 2014. Some large tech and pharmaceutical firms are beginning to locate here, as the abundance of available land facilitates larger and more efficient workplaces. Rents are also lower than offices in northern Bogotá, ranging from COP 54,720.00 to 60,192.00 ($30.00 to $33.00)[1] per square meter for Class A space and from COP 45,600.00 to 54,720.00 ($25.00 to $30.00)[1] per square meter for Class AB. GlaxoSmithKline, among others, has its headquarters and manufacturing facility along this corridor. Several pharmaceutical and agro-industry firms are renting or purchasing warehouse space in Salitre closer to the airport to use as a base for transporting goods to other parts of Colombia and beyond.

## Outlook

Salitre has seen the most movement in the past few years, with over 58,000 square meters delivered and 60,000 square meters absorbed in the past year, thus keeping the vacancy rate somewhat low at 8.5 percent. The demand for space in Salitre is largely comprised of government agencies who are expanding and multinationals who benefit from proximity to El Dorado Airport. However, with over 150,000 square meters in planned construction here in the next two years, we are expecting an over supply of office space that should keep prices reasonably low in the near future compared with other parts of the city. A new office tower dedicated exclusively to the operations of life science firms, Torre Salud, is in the planning stages, although it is currently stalled.

[1] Six-month average conversion rate of 1,824 Colombian Peso (COP) per U.S. dollar, as of October 2012.

# Western Suburbs (Cota, Funza, Mosquera)

## Overview

Bogotá's western suburbs have been transformed in the past decade from quiet farms to large-scale industrial conglomerations. Several food manufacturing plants are located in these corridors. Agricultural warehousing space is also prevalent here, as goods coming from other parts of the country are stored before entering Bogotá, or vice versa. A few biotech firms looking for low-profile, low-rent warehouse space have also relocated here. These municipalities are offering very competitive incentives to lure production into their jurisdictions such as reductions in local commerce tax, payroll tax and property tax. There are also three Free Trade Zones either operating or in the planning stages that offer a reduction in corporate income tax from 33.0 percent to 15.0 percent, in addition to complete exemption of customs duties on equipment and merchandise sold.

## Outlook

Industrial production in the western suburbs has been startling, with over 2.2 million square meters of industrial floor area having been constructed since 2009. This trend will continue through 2014 as several industrial parks and a handful of Free Trade Zones will be built and or expanded. However, this area is likely to be oversupplied thus keeping rents down. Life sciences companies looking to take advantage of newly implemented Free Trade Agreements should consider this area as a low-rent option with good access to El Dorado Airport as well as road transport to Medellin and the coffee region.

**Latin America Cities of the Future**

| Rank | City | Country |
|---|---|---|
| 1 | Santiago | Chile |
| 2 | Lima | Peru |
| 3 | Monterrey | Mexico |
| **4** | **Bogota** | **Colombia** |
| 5 | San Jose | Costa Rica |
| 6 | Guadalajara | Mexico |
| 7 | Queretaro | Mexico |
| **8** | **Barranquilla** | **Colombia** |
| 9 | Hermosillo | Mexico |
| 10 | Sao Paulo | Brazil |

*Source: FDI Magazine (2011)*

# Puente Aranda

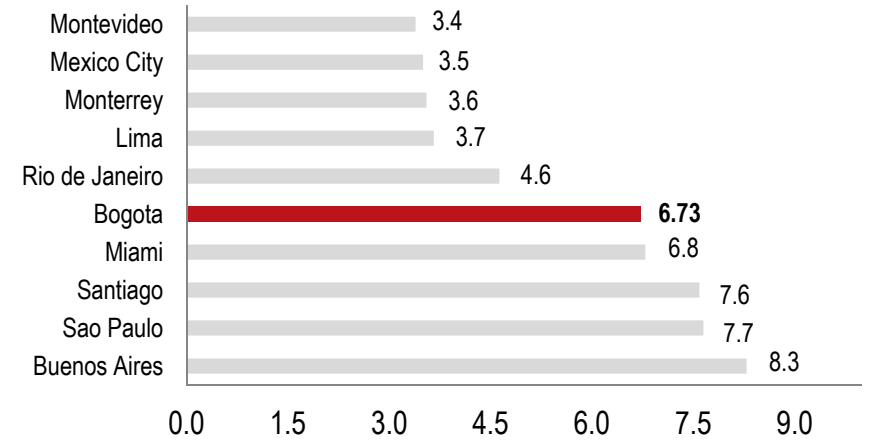
## Overview

Puente Aranda is the oldest industrial sector of the city with stand-alone warehouses and factories dating back to the 1940s. The industrial supply here is primarily owner occupied factories and distribution centers with few modern, quality spaces. However, it is a hub of pharmaceutical production with several major players owning factories here: Boehringer Ingelheim, Bayer, Roche, Merck Sharp & Dohme, Biogen, Laboratorios California and Genfar. Most of these companies have been operating in Puente Aranda for several years, and are enjoying very low rents with a shorter commute.

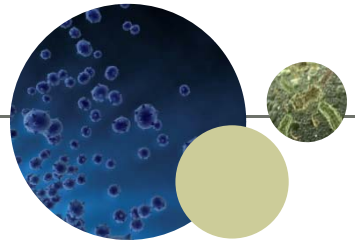
## Outlook

Puente Aranda is the epicenter of Bogotá's urban redevelopment plans, and the municipality is taking active steps toward pushing industrial land use outside of the city while encouraging residential development in more centralized areas. Although land prices here are still among the cheapest in the city, the buildings are often outdated and in poor condition. This, coupled with the tax incentives that suburban municipalities are offering, is pushing many companies out of Puente Aranda and into the western suburbs. The pharmaceutical companies are less likely to relocate however, as they have much more invested in their buildings than most companies operating in Puente Aranda.

**Best Latin American Cities for Innovation**




*Source: America Economia Magazine (2011)*



***Mexico is a leading country in the Americas with regard to life sciences product production and consumption, and ranks ninth worldwide.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## Mexico market overview

The life sciences industry is currently estimated at MXN1.3 billion ($96.0 million),[1] or 2.4 percent of GDP, according to the Mexican Association of Pharmaceutical Research Industries (AMIIF). According to PricewaterhouseCoopers, the industry market value is estimated to reach MXN 17.3 billion ($1.3 billion)[1] by 2020. With growth projected upward of 12.0 percent, greater attention is being paid to regulation, safety and enhancements to the overall R&D and patent development processes. Mexico's geographic proximity to the United States is a major factor in its anticipated growth. Several multinational companies have already moved certain operations to the county and additional investments are expected.

Currently, about 200 companies have operations in Mexico, with the domestic production of drugs concentrated in Mexico City, State of Mexico, Puebla, Morelos and Jalisco states. According to KPMG's report on the local pharmaceutical industry, 85.0 percent of drug production occurs through the subsidiaries of multinational firms, and even though local companies have made efforts to improve on R&D and innovation, many still lack the ability to produce their own medicines and therefore rely on the experience of large multinationals. As such, life sciences companies in Mexico are largely responsible for the manufacturing, distribution and exportation aspects of the value chain. Given the large manufacturing presence in the country, improvements to healthcare programs to increase public access to drugs and enhancements to IP protection and regulatory framework are top of mind to support both consumer and business growth in the coming years.

## Outlook

One of the greatest threats to Mexico's growing life sciences industry is its rampant illegal market, currently estimated at MXN 1.3 billion ($100.0 million)[1] annually by the Pharmaceutical Industry National Chamber (Canifarma). Canifarma continues to emphasize the need to combat smuggling, piracy and the gaps in IP protection, realizing progress on all factors are needed to maintain and encourage further investment by foreign companies.

[1] Six-month average conversion rate of 13.31 Mexican Pesos (MXN) per U.S. dollar, as of October 2012.

## *Industry statistics*

**1.0** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **25.6%**

**0.4%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **951**

*Sources: UNISCO Institute for Statistics, the World Bank*

# EMEA

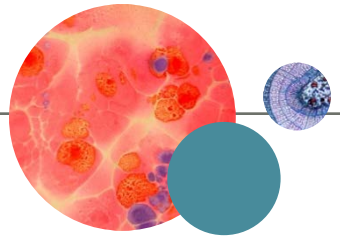
***A rich mixture of factors, including high-quality infrastructure, stability, a history of innovation, ease of doing business and some of the world's best educational establishments, continue to attract life sciences companies to Europe.***

Like the United States and other mature life sciences markets, Europe is increasingly facing challenges to its primacy from emerging markets across the globe. But, despite the challenges and changing geographic scope of global life sciences companies, major established European clusters are sure to remain critical for the industry going forward.

The life sciences landscape in EMEA continues to undergo significant change, impacting heavily on the real estate strategies of life science companies. As portfolios and location strategies adapt to the new geographies of growth and emerging markets, rightsizing and disposal activity in mature markets has been a major driver of activity. Creative solutions are being sought and implemented for complex asset disposal, and partnering with real estate service providers to ensure optimal outcomes has become increasingly common. M&A and consolidation continue to drive churn and change in real estate strategy, often providing larger life sciences companies an opportunity to review and optimize global portfolio locations, functions and supply chains. A thorough analysis and understanding of the broader context for investment and relocation decisions is crucially important, with access to grants and incentives a key component of the decision-making process, alongside access to talent.

Identification of ways and means to remove excess cost from real estate remains high on the agenda for life sciences companies in Europe. Real estate strategies are increasingly being required to flex to suit financial and operating objectives. But this cost awareness is coupled with growing efforts to enhance productivity and efficiency in occupation, often through better space utilization. Among all of these real estate trends, continuing efforts to drive workplace change and transformation, throughout life sciences organizations and asset types, could be most challenging for the sector in 2013.

**Established**
France
Germany
Netherlands
Switzerland
United Kingdom



## *France is one of the leaders in the European life sciences industry, thanks in large part to the size of its market.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

### France market overview

France is first in Europe in terms of medicine production by volume and among the main global pharmaceutical exporters. The French life sciences industry produces yearly revenue of about EUR 47.0 billion ($59.5 billion)[1] and reinvests more than EUR 1.0 billion ($1.3 billion)[1] each year. The country is acknowledged for the quality of its research and for its history of therapeutic innovation and benefits from the best health system in the world, according to the OECD.

The biopharmaceutical sector in France employs more than 104,000 people. Education is also an important asset, with more than 18,000 new, highly qualified graduates produced by the French higher education system each year and bolstered by the presence of the national territory of renowned research institutions such as Inserm, CENR, CEA, Inra, Ifremer, IRD and the famous Pasteur and Curie Institutes.

The sector benefits from significant investment, with about EUR 4.9 billion ($6.2 billion)[1] spent annually on R&D, according to 2008 figures. The industry can also count on a significant commitment from the French government. The Strategic Council for the Health industries, chaired by the president, includes government agencies and industry leaders to establish specific measures such as tax credits for research, more efficient clinical testing, or budgets that include funds to assist biotech companies.

In terms of geographical spread, the French landscape is clearly dominated by the Paris region, hosting almost all of the largest pharmaceutical headquarters, both French and international (only a few of them are settled in other regions, like Pierre Fabre in the southwest, or Merial in Lyon). Paris is also home to many high-level research institutes. As for pharmaceutical production, it is much more widely distributed: essentially in the Paris region, the centre of France (the "Pharma Valley") and the southeast (Rhône-Alpes). Lastly, several dedicated research centres focused on high-tech biology or new therapies have been created throughout France.

[1] Six-month average conversion rate of 0.79 Euros (EUR) per U.S. dollar, as of October 2012.

### *Industry statistics*

**8.9** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **26.2%**

**2.3%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **14,748**

*Sources: UNISCO Institute for Statistics, the World Bank*

# The Paris Region

## Overview

Paris and its suburbs are home to the highest concentration of pharmaceutical headquarters in France. The region benefits from its strategic location, highly educated population and rich concentration of prestigious hospitals and high-tech research capabilities.

Most of the laboratories are located in the first western inner suburb including Roche, Ipsen, Johnson & Johnson and Pierre Fabre at Boulogne; Servier at Suresnes; Bayer and Schering at Puteaux; and AstraZeneca and Bristol-Meyers Squibb at Rueil Malmaison. A few are located in the southern suburb, such as Sanofi at Gentilly.

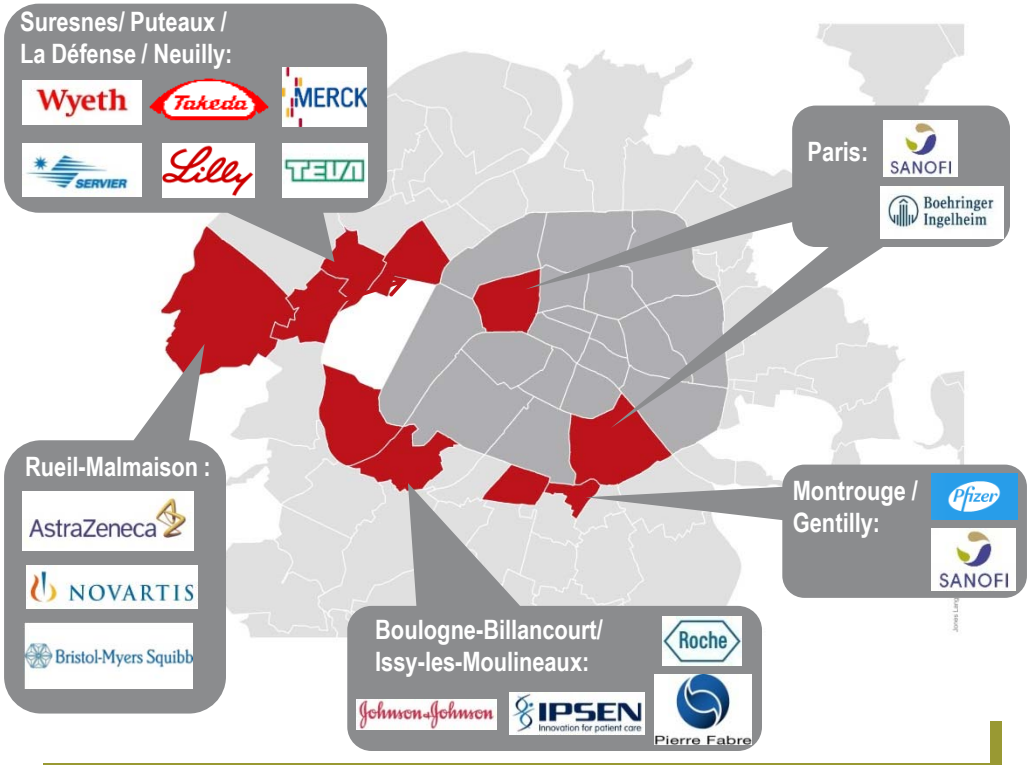
The ambitious plan for "Grand Paris," a major urban planning project aimed at reinforcing the position of Paris as a leading city on the international scene, should also favor a concentration of high-level research institutes around the Medicen cluster located in the southern suburb.

Real estate costs are naturally higher in the Paris area, compared to other regions, but the proximity to outstanding intellectual capacity, the good infrastructure and the higher visibility still outweigh the premium. Sanofi, which has settled in its new world headquarters in the central business district of Paris, at a very prestigious and renowned address, is a good example of the unwavering appeal of Paris.

## Outlook

The life sciences market in France, like many mature life sciences markets globally, is in the midst of significant change, accelerated in the past months due to the sovereign debt crisis and reinforced by the politics of healthcare expenditure control. In France, many pharmaceutical companies are confronted with the end of their patents (and the expansion of generic drugs), which translates into a drop in fiscal resources available for innovation. Restructuring of operations, consolidation, mergers and acquisitions are therefore impacting the overall shape and geography of the sector, leading many industry participants to challenge and re-think the way they structure and coordinate their activities.

Hence, an important issue for life sciences companies is cost reduction via the rationalization of the real estate portfolio. Many large groups are looking at multisite consolidation options and lease renegotiation. Business rationalization is also having a clear impact on space utilization and translates directly into real estate strategies: for instance, via the introduction of more open plan designs for headquarters, increased densities or portfolio restructuring. Recent activity from Sanofi, Merck and Roche illustrate well the trends of real estate restructuring and rationalization. Sale-lease back transactions have also been favoured by some. Merck and Bristol-Meyers Squibb are two recent examples of companies that have chosen this route to raise capital and increase occupational flexibility.




***The Paris region is home to almost all of the largest pharmaceutical headquarters, due to its strategic location, highly educated population and rich concentration of prestigious hospitals and high-tech R&D.***

# The Lyon Region

## Overview

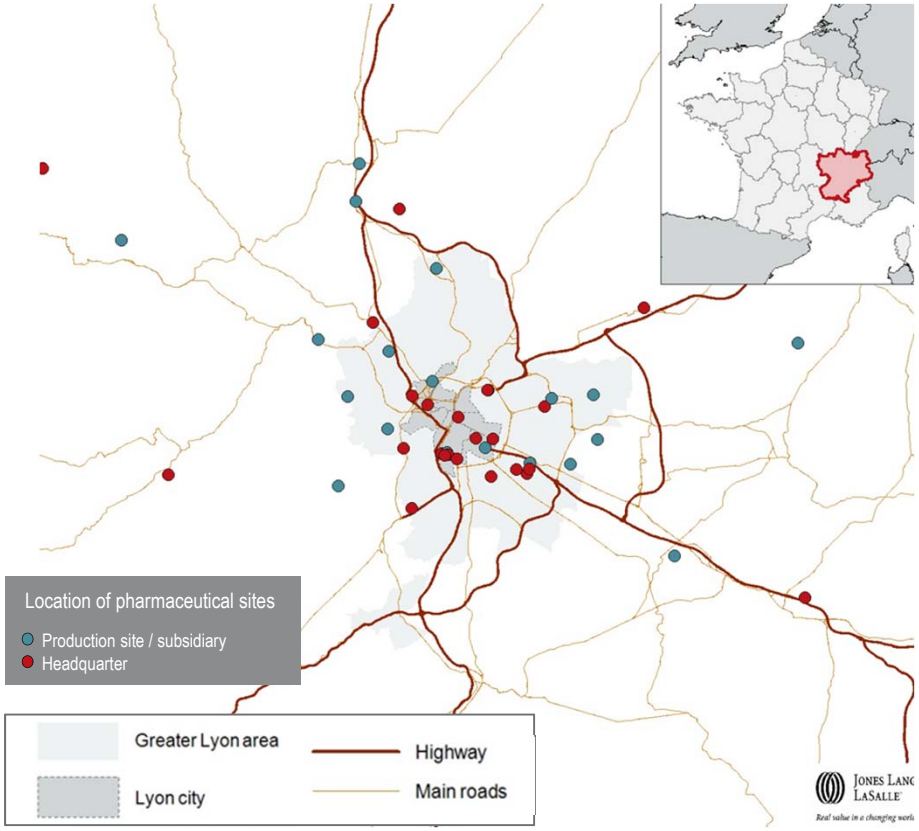
Apart from the Paris region, the French life sciences industry lies on several poles of excellence, spread across the country.

Among them, Lyon and its surroundings stand out as an important regional cluster, gathering some major headquarters, a high concentration of renowned research institutes and a good network of innovative startups and small ventures. The region also plays host to a significant proportion of the national pharmaceutical production facilities. Lyon is the top European centre for vaccine production and ranks second, behind Paris, for the number of life sciences-related jobs.

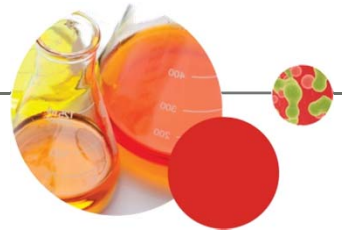
This importance of the Lyon region is linked to both historical and economic reasons.

First, the life sciences industry anchorage in the region is historically significant, with Sanofi Pasteur (number 1 in the world for human vaccines), Merial (number 1 for veterinary products) and bioMérieux (number 1 for bacteriologic diagnosis) – all major pharmaceutical laboratories that were created in Lyon and maintain their headquarters through today.

Second, this regional dynamism is supported by the city governance. The biotechnology industry has been designated as a major asset to develop the city, with many favorable policy measures developed to ease the emergence of Lyon Biopole, a cluster specialized in vaccines and the diagnosis of infectious diseases.




***The Lyon region stands out as an important regional centre of excellence for the pharmaceutical industry, benefiting from an important concentration of R&D and production units, favored by the local policy, together with the historical anchorage of some major laboratories.***



## *Germany's life sciences sector is primarily anchored around the major cities of Munich and Berlin.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

### Germany market overview

The life sciences sector in Germany continues to grow in importance and is one the largest in Europe. Biotechnology is a particular area of focus, with revenues of dedicated biotechnology companies up 10.0 percent in 2011 compared to 2010, and the number of employees saw an increase by 5.0 percent.

Although R&D expenditures remained relatively high, they dropped slightly below the EUR 1.0 billion ($1.3 billion)[1] level in 2011 for the first time since 2007. However, expenditures for research (an indicator of innovation activity) remained relatively stable. A major challenge for the sector continues to be the securing of financing, the EUR 187.0 million ($236.7 million)[1] of fresh capital that was invested in 2011 represents a very low volume.

To ease this situation, a second round of the High-Tech Start-up Fund (HTGF) was announced in 2011. Some EUR 290.0 million ($367.1 million)[1] will be provided to support young technology firms in the start-up stage. Further initiatives, like the "Spinnovator" fund or public-private partnerships, which are supported among others by the Federal Ministry of Education and Research, also will direct funding into the sector.

The pharmaceutical industry employs around 126,000 people in Germany and is growing. In addition to global companies such as Merck KGaA and Boehringer Ingelheim, Germany supports a large number of smaller life sciences companies. Germany ranks first in Europe for production of chemicals and biopharmaceuticals.

Life sciences has become a major driver of innovation for many other industry sectors. The biotechnology industry shows a continued growth, despite financial restraints. There are signs of better times ahead, as indicated by the rising number of venture capital funds. Federal government commitment and support is being provided by the National Research Strategy BioEconomy 2030 and the Health Research Framework Program. These initiatives provide subsidies of around EUR 8.0 billion ($10.1 billion)[1] for the industry.

[1] Six-month average conversion rate of 0.79 Euros (EUR) per U.S. dollar, as of October 2012.

### *Industry statistics*

**8.1** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **23.3%**

**2.8%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **47,047**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Berlin Capital Region

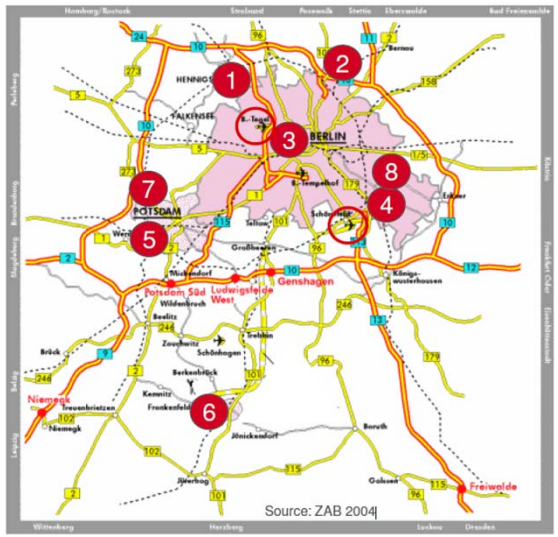
## Overview

With 120 clinics, 280 medical technology companies, 215 biotechnology companies and 4,100 employees, the Berlin capital region is one of Germany's most important life sciences locations as it is the county's number one biotech location and among the top five in Europe. In addition, 30 pharmaceutical companies are located here, employing more than 10,000 people.

The region is home to the largest domicile of the Fraunhofer-Gesellschaft, the largest location of the Leibnitz-Gesellschaft, and to the biomedical research centre of Helmholtz-Gesellschaft. The concentration of 24 large research facilities and life sciences research universities in this relatively confined area is unique in Europe. The positive growth in the Berlin biotech sector continued in 2011 with the main growth driver being research activity.

## Outlook

It is expected that the number of employees in the Berlin region healthcare industry will continue to grow, from 350,000 currently to about 368,000 in 2030, generating a gross value added of approximately EUR 20.0 billion ($25.3 billion).[1] With regard to public funding, the city of Berlin invests 3.4 percent of the GDP to extend its status as a successful research location – this is above average compared to other German cities.




*The Berlin area provides various technology parks, including the Max-Delbrück-Centrum for molecular medicine and the Leibnitz Research Institute for molecular pharmacology, both located on Campus Berlin-Buch.*

Source: ZAB

# Munich / Bavaria

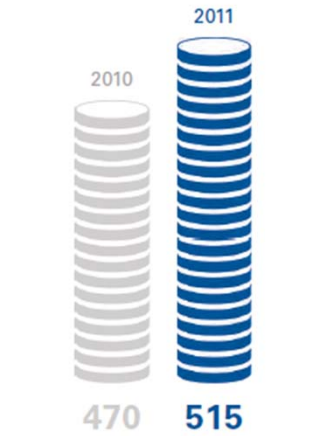
## Overview

More than 30.0 percent of all German biotech small and medium-sized enterprises (SMEs) are located in Bavaria. The number of biotech and pharmaceutical SMEs in Bavaria amounted to 166 in 2011, with 126 of them located in the Greater Munich Area. Of the additional 35 national or international subsidiaries biotech firms in Bavaria, the Roche Diagnostics in Penzberg, 60 kilometers south of Munich, is the largest with more than 4,800 employees. Nuremberg-Erlangen, the so called "Medical Valley" (a Centre of Excellence for Medical Technology), combines world-leading big and smaller enterprises like Siemens and Wave. Taking all biotech companies, SME and non-SME, together, the workforce amounts to 10,300. In addition to the jobs in the life sciences industry, there are also some 10,000 people working in the departments of Bavarian research institutions.

## Outlook

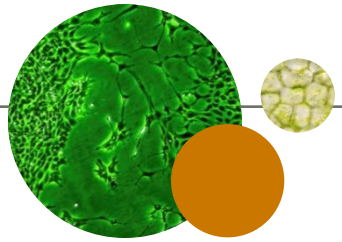
The growth of this sector is set to continue. Various start-up initiatives, often with public subsidies, will help foster this sector. The fact that Bavaria was able to attract more than half of the external biotech funding for Germany underlines its importance as Biotechnology Cluster and its future viability.

[1] Six-month average conversion rate of 0.79 Euros (EUR) per U.S. dollar, as of October 2012.




*The Munich Biotech Region has been awarded at the Leading Edge Cluster competition by the German Federal Ministry of Education and Research. The support connected with this initiative will benefit the biotech sector.*

Source: BioM Biotech Cluster Development GmbH 2012



***The Dutch life sciences cluster has grown in size and output despite the economic downturn and shows a high increase in the amount of private investments raised.***

## Global trends

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## Netherlands market overview

The Netherlands hosts a wide variety of life sciences occupiers whose locations are strongly influenced by presence of existing clusters or "knowledge campuses." The wide variety of life sciences occupiers provide a sizable contribution to the Dutch gross domestic product and the market is growing due to the aging population, higher occurrence of certain diseases and related medical innovations. As a result, the Dutch government has indicated that the life sciences sector is one of their main priorities and a "top sector," a sector in which the Netherlands excels globally and is a government priority.

The resultant action plan provides the government, industry and science with the opportunity to target investment in this sector. This is intended to enhance the attractiveness of the Netherlands in the global life sciences market and will hopefully have a positive effect on all local life sciences clusters and campuses.

The geographic focus of the broader life sciences industry in the Netherlands is widespread due to the variety of life sciences occupiers and subsectors. Despite the spread, companies are largely concentrated in Eindhoven and Groningen. The sector located in Eindhoven is centred around R&D activities from Philips on the largest life sciences campus in the Netherlands, the High Tech Campus Eindhoven.

Medical-related life sciences companies are primarily located in the southern part of the Provence Limburg and areas proximate to the Randstad conurbation. The decision to locate here is largely influenced by the presence of medical-related knowledge institutes. The agro-food sector is primarily concentrated in Wageningen (Food Valley) and the Kop van Noord-Holland region.

## *Industry statistics*

**5.2** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **14.0%**

**1.8%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **2,575**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Amsterdam

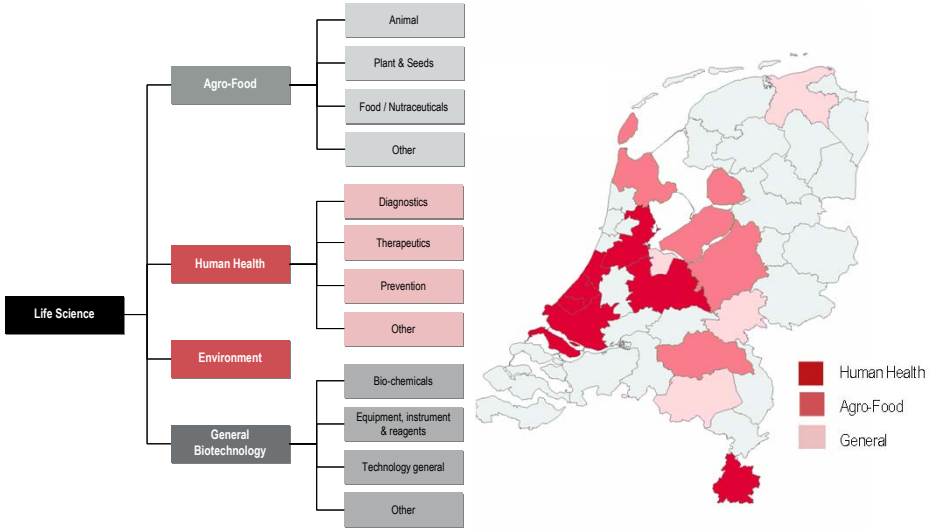
## Overview

The presence of several knowledge institutes, close cooperation with the city's two universities, the close proximity of the airport and a world class IT infrastructure all add to Amsterdam's appeal. In the Netherlands, the Amsterdam region has the largest concentration of research and education establishments focused on the medical sector. There are more than 4,000 researchers employed within the life sciences sector and approximately 6,000 students are currently getting their degrees within the life sciences and medical sectors. The largest life sciences cluster in Amsterdam is the Science Park Amsterdam, located on the east side of Amsterdam. It covers an area of 70.0 hectares and is home to the UvA Faculty of Science.

## Outlook

In 2012, Amsterdam University College (AUC) will also be based here with an expected 2,500 students enrolled in science-related disciplines. In the longer term a business accommodation and laboratories (phased building work on 25,000 square meters) are planned as well.

**Dutch life sciences sector diversification**




*Sources: Senternovem, Jones Lang LaSalle, 2012*

# Eindhoven

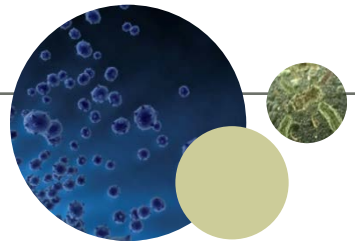
## Overview

Eindhoven is generally considered the "Brainport" of the Netherlands as 45.0 percent of all R&D investments funnel into the region. Particular attention is paid to the High Tech Campus in Eindhoven (HTCE). The campus serves as a magnet to high-tech companies and research institutes and this in turn helps to strengthen the image of Brainport.

The HTCE is a business campus of over 100.0 hectares and currently houses more than 100 companies and institutes with over more than 8,000 employees. Campus companies strategically decide what knowledge, skills and R&D facilities they share in order to achieve faster, better and more customer-oriented innovation and are responsible for nearly 50.0 percent of all Dutch patent applications.

## Outlook

Currently, a new HQ for Soliance Solar is being built – a 4,300-square-meter building that can be divided into approximately 1,900 square meters of office and 2,400 square meters of cleanroom. This development will be completed by end 2013.



## *Switzerland ranks No. 1 in the Global Competitiveness Report of the World Economic Forum and is home to several large leading life sciences companies.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

### Switzerland market overview

Switzerland is one of Europe's most established life sciences locations. Switzerland was again rated number 1 in the World Economic Forum's Global Competitiveness Report 2012–2013, reflecting its advantages for the life sciences industry and other research, production and service companies. Switzerland is also a leader in education and is one of the world's most active countries in research.

Aided by the proximity of top pharmaceutical companies such as Roche and Novartis, and by the strong financial sector in Zurich and Geneva, academic excellence in the biomedical sciences serves as a motor for innovation in the biotech and medtech sector. Therefore the density of biotech companies in Switzerland is unparalleled worldwide. Numerous joint activities of universities and private companies provide favourable conditions for young start-up companies. Benefits such as low-cost rental space at the university's labs during the first years and the availability of biotech parks and business incubators in and around Zurich also support life sciences growth. The main clusters of life science activity can be found in Basel (BioValley), Zurich (Greater Zurich Area) and in Geneva (BioAlps).

As a result of the appreciation of the Swiss franc, caused by global macroeconomic uncertainty and Switzerland's safe haven status, short-term growth rates around 1.5 percent are forecasted. Despite the lower growth rate and increasing competition, Switzerland is likely to remain one of the world leaders in life sciences innovations. The strong position is supported by a balanced mix of academia, concentration of private life sciences companies and optimal infrastructure.

Large Swiss companies like Novartis, Roche, Syngenta and Nestle are traditionally owners and occupiers of their real estate properties. Other large developments, for example the Novartis Campus in Basel, are built-to-suit-projects. Jones Lang LaSalle estimates that about 75.0 percent of all properties used by life sciences companies in Switzerland are built-to-suit by their occupiers.

### *Industry statistics*

**6.0** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **21.6%**

**3.0%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **1,622**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Basel (BioValley)

## Overview

The area around the city of Basel is one major centre of the life sciences industry and approximately 40.0 percent of the world's pharmaceutical companies are located in this area. Its superior location in the border triangle of Germany, France and Switzerland leads to a highly international cluster of institutions and competences. More than 600 pharmaceutical and medtech companies, 10 universities, 15,000 scientists and various technology and life sciences parks offer an optimal infrastructure.

Established pharmaceutical and chemical companies like Novartis, Roche or BASF have large R&D and production sites located around Basel. As this infrastructure is specialized for the specific tenant's requirements, the market for this type of real estate is limited. Office and laboratory space in different price ranges is available in the numerous business parks.

## Outlook

Novartis is planning a long-term campus development on a former production site. After the second construction phase, it will offer office space for up to 10,000 employees. Next to the R&D and headquarter facilities, the company plans to consolidate different smaller sites in Basel and to offer optimal surroundings for knowledge transfer.

*Optimal conditions for researchers paired with the concentration of pharmaceutical multinationals favours Basel as one of the most important locations for life science companies.*

Source: www.biovally.com

# Zurich (Greater Zurich Area)

## Overview

The life sciences market in Zurich is influenced by the University of Zurich and the Swiss Federal Institute of Technology Zurich (ETH), which bear many promising spin-offs and start-ups each year. Additionally many international companies, including Bayer (Switzerland) AG and Novo Nordisk Pharma AG, value the high standard of life in Zurich and have chosen to locate offices or headquarters here. The high-quality infrastructure grants national and international connectivity and numerous technology parks within Zurich offer premium laboratory infrastructure and support the relationship between start-ups and universities. The Life Sciences Platform, a laboratory for biomedical research built by the ETH, will strengthen Zurich's international positioning.

With 21,000 employees in the life sciences field this submarket is the second-largest after the life sciences sector in Basel. The annual revenue accounts for CHF 40.0 billion ($41.7 billion) and reflects nearly 4.0 percent of the GDP of the canton of Zurich.

## Outlook

The newly reinforced organization Life Science Zurich put in a lot of effort to market the life sciences sector in and around Zurich. Spin-offs from some of the best universities in the world will generate additional demand for office and laboratory space during the next few years.

[1] Six-month average conversion rate of 0.96 Swiss Franc (CHF) per U.S. dollar, as of October 2012.

*The newly built laboratory at the ETH and the accumulation of knowledge firms Zurich's important role in the life science market.*

# Lake Geneva (BioAlps)

## Overview

The Lake Geneva area is an attractive life sciences location due to an extensive network of research and academic intuitions, more than 570 multinational companies, great infrastructure and the extraordinary accumulation of capital. The high concentration of international enterprises leads to a remarkable centre of competencies, which is why this area is favoured not only by established companies like Nestle and Merck Serono, but also by emerging biotechnical or medtech companies. The close proximity to one of the world's top the universities, the École Polytchnique Fédéral de Lausanne (EPFL), boosts the attractiveness of the Lake Geneva area as it generates various spin-offs.

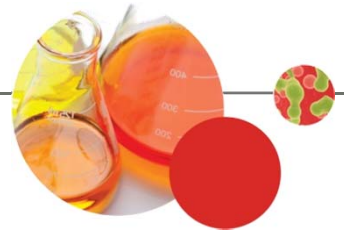
Due to limited availability of supply, large life sciences tenants in the market have focused on build-to-suits when considering relocation to this area. The science parks offer state-of-the-art premises such as The Science Park (PSE) offered by EPFL and the Y-Parc in the canton of Vaud.

## Outlook

As the Arc Lémanique area continues to experience an increase in activity, a change in the type of necessary infrastructure is expected. However, the high build-to-suit fit-outs will prevent numerous transactions.

*The EPFL and projects like CERN will increase the demand for life sciences facilities.*

# United Kingdom





***The United Kingdom's long-established and strong science base is one of the significant factors driving investment and development in the life sciences sector.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## United Kingdom market overview

The life sciences sector in the United Kingdom is among the largest in the world, and includes more than 3,500 medical and biotechnology companies that, combined, generate annual revenue of GBP 15.0 billion ($23.8 billion).[1] When combined with pharmaceutical exports of GBP 18.0 billion ($28.6 billion)[1] the United Kingdom (UK) is a major supplier of life sciences products and services across the globe.

The life sciences industry in the UK has a record of cutting-edge research and is renowned for developing innovative, effective solutions to global and local health issues. It has also served as a hub for scientific and business collaboration, bringing together funding from private and public sources to support innovation and create routes to market. According to U.K. Trade & Investment (UKTI) figures, United Kingdom industries spend around GBP 7.5 million ($11.9 million)[1] each day on R&D, and have attracted major R&D investments from a range of the world's top life sciences companies. As a direct result, the United Kingdom has created one in four of the world's top 100 medicines and 45.0 percent of all pipeline products in Europe.

## Outlook

Despite the economic instability of the last few years, the life sciences sector has continued to show resilience and stable performance in the United Kingdom. Overall private sector employment in the United Kingdom is growing, and the government has recently announced a strong commitment to encourage growth in high-tech and R&D-led industries with a number of tax credits and incentives.

Restructuring and productivity gains from United Kingdom operations remain an important focus for life sciences companies as they adapt functions and locations in response to strategic pressures. Such rationalization has fuelled some disposal activity and selective head count reductions in some locations. But a significant level of new investment has also been seen through 2012, with a range of companies committed to expand and increase investment in facilities in the United Kingdom and other mature European markets. This combination of selective investment and continuing efforts to optimize productivity from existing operations is likely to dominate the outlook for life sciences over the next 12 to 24 months.

[1] Six-month average conversion rate of 0.63 British Pound (GBP) per U.S. dollar, as of October 2012.

## *Industry statistics*

**8.9** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **21.7%**

**1.9%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **15,490**

*Sources: UNISCO Institute for Statistics, the World Bank*

# Cambridge

## Overview

Cambridge is one the United Kingdom's leading clusters based upon the strengths of Cambridge University. Cambridge University alumni account for 20.0 percent of the world's Nobel Prize winners in medicine and chemistry. The cluster is home to around 25.0 percent of Europe's biotechnology companies and the world's largest medical research charity, the Wellcome Trust, also has a base there.

Due to consistently high demand for lab and office space in Cambridge, the availability of large or self-contained units can be limited, although pockets of smaller space are more widely available. Rents range from GBP 18.00 ($28.57)[1] per square foot per annum for shell and core lab space, to GBP 30.00 ($47.62)[1] per square foot per annum for fully fitted space.

## Outlook

Cambridge continues to attract strong interest from life sciences occupiers and this is expected to continue over the coming 12 to18 months. Construction activity is relatively limited in Cambridge and surrounding markets which keeps availability of space low. For those companies looking to take space in the centre of Cambridge, as opposed to the science parks located in peripheral areas, the market is particularly constrained.

*Due to consistently high demand for lab and office space in Cambridge, the availability of large or self-contained units can be limited.*

# South East of England

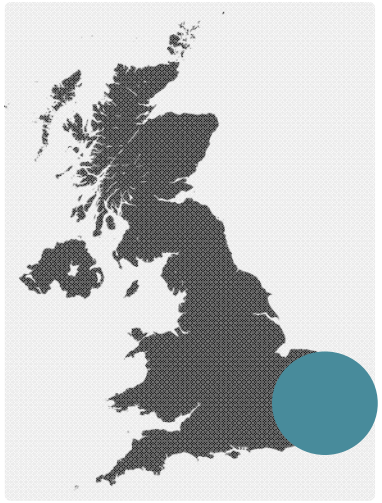
## Overview

The South East of England is an important cluster for a wide range of life sciences companies. Benefiting from proximity to London and the world's busiest international airport, Heathrow, the South East submarket is a mature cluster that provides research sites for three of the top 10 major global pharma companies and a number of biotechnology firms.

Oxford is another cluster of importance for life sciences within the broader southeast region, with more than 100 biopharmaceutical / healthcare companies taking advantage of close links to the city's Oxford University. Much of the office and lab space is located out of town in science and business parks. The Oxford real estate market is stable with limited new construction keeping supply relatively limited. Conventional Grade A office space is available at GBP 22.50–GBP 25.00 ($35.71-$39.68)[1] per square foot per annum, with fitted lab space available at around GBP 27.50 ($43.65)[1]. Availability of office space is greater in the broader southeast, and the Western Corridor region, west of London, remains popular with life sciences companies.

## Outlook

Oxford is expected to continue to benefit from international demand for office and lab space, based on research links to the university. The lack of new development will keep availability constrained. In the broader southeast, and western corridor region, availability is greater in out-of-town submarkets, with rents facing upward pressure and lower availability in town-centre locations.



*The South East of England is an important cluster for a wide range of life sciences companies, benefiting from proximity to London.*

[1] Six month average conversion rate of 0.63 British Pound (GBP) per US dollar, as of October 2012

# London

## Overview

Although many larger pharmaceutical and biotech companies base their operations outside central London, the cluster has representation of more than 100 bioscience businesses, not to mention 28 universities and five renowned medical schools. It is also home to UCL Partners, one of Europe's largest academic health science partnerships of hospitals and medical research centres.

London's West End is one of the most expensive office markets in the world. Although some life sciences companies maintain a small office presence in the exclusive areas of Mayfair and St. James, for practical purposes most locate in or around submarkets such as Paddington and Kings Cross near to the major hospitals, universities and research facilities. New Grade A office space in these hubs is available from GBP 55.00–GBP 60.00 ($87.30-$95.24)[1] per square foot per annum.

## Outlook

Although rental growth is forecast to remain stable over the final quarter in 2012, providing the economy gains some forward momentum, we are likely to see prime rental growth return to the market in 2013 as pent-up demand starts to transact and we see a further tightening in supply.

Availability of prime space remains low, although availability is higher for Grade A and Grade B stock, and in secondary or peripheral submarkets.

*Although many larger pharmaceutical and biotech companies base their operations outside central London, the city remains an important life science research hub.*

# North West of England

## Overview

North West England is the United Kingdom's third largest bioscience cluster, with a number of global life sciences companies operating there. Manchester University is one of Britain's largest universities and recently collaborated with GlaxoSmithKline and AstraZeneca on a new research centre. AstraZeneca is one of the global pharmaceutical companies with a large base in the area.

The North West of England is further supported by the strong academic research capabilities of the Universities of Liverpool, partner hospitals and locally based national support facilities such as the National Biomanufacturing Centre.

Prime office space in Manchester city centre is available at GBP 30.00 ($47.62)[1] per square foot per annum. Incentives remain tenant favourable with around 30 to 36 months achievable on a 10-year term dependent upon grade, type, characteristics and location of the building.

## Outlook

It is anticipated that incentives will begin to reduce shortly – particularly for the more attractive stock in Manchester. Given the lack of development financing we are likely to see few new wholly speculative starts, although we can expect refurbishment of existing stock.

[1] Six-month average conversion rate of 0.63 British Pound (GBP) per U.S. dollar, as of October 2012.

*North West England is the United Kingdom's third largest bioscience cluster, with a number of global life sciences companies operating there.*

# Scotland

## Overview

Scotland is another important hub in the United Kingdom life sciences sector, with more than 500 life sciences companies, increasing by an average of 20.0 percent a year. Edinburgh is a hotbed of life sciences innovation with particular achievements in recent years in the field of stem cell research. The Queen's Medical Research Institute brings together four world class research centres specializing in Cardiovascular Science, Inflammation Research, Reproductive Biology and Regenerative Medicine. The Institute houses more than 600 researchers and aims to tackle a wide range of diseases at the most fundamental cellular level.

The supply of prime office space in Edinburgh is limited, and currently costs around GBP 27.50 (43.65)[1] per square foot per annum with incentives still generous at around 36 to 42 months achievable on a 10-year term. Glasgow's office market is also experiencing limited availability of prime office stock; however, there is greater availability of Grade B stock in more peripheral locations.

## Outlook

Grade A office supply in both Edinburgh and Glasgow remains constrained with very limited new Grade A space currently available. This is likely to exert upward pressure on rents for this segment of the market. Occupiers faced with dwindling choice in the city centre locations may begin to seek good quality alternatives out of town. In particular, Edinburgh Park could become more compelling as a location for occupiers given the tram extension scheduled for completion in 2014.

***Scotland is another important hub in the United Kingdom life sciences sector, with more than 500 life sciences companies, increasing by an average of 20.0 percent a year.***

[1] Six-month average conversion rate of 0.63 British Pound (GBP) per U.S. dollar, as of October 2012.

# Asia Pacific

***The attractiveness of Asia Pacific as a market, as a research location and as a manufacturing base keeps growing. Demand for medicines is rising rapidly in countries such as China, India, Indonesia, Thailand and Vietnam. Manufacturing standards are improving region-wide and the talent pool is enlarging.***

Japan ranks second globally in terms of prescription drugs, after the United States, and has the region's second highest total health expenditure. Demand driven by the country's growing elderly population, faster new drug launches and easing pricing policies might not be enough to compound the weak growth of the domestic pharmaceutical market. On a buying spree, Japanese multinational companies are getting serious about expanding overseas.

By 2016, China will leapfrog Japan as the region's largest and the world's second biggest pharmaceutical market. China's eroded cost advantage as a production base is balanced by the quality of its talent pool, by its massive yet still largely underpenetrated domestic consumer market and by government support for the sector. Life sciences clusters in China are quickly emerging as top investment destinations. Beyond the major hubs that are already on Western multinationals' radars, Chinese domestic companies are taking position in less known clusters.

Fueled by a large population base and a growing middle class, India's life sciences industry has achieved double-digit growth in many areas and the country has the potential to become a major pharmaceutical hub and a lucrative destination of clinical trials for global giants. Foreign companies, however, may still encounter some challenges, such as legal infrastructure, when operating in the country. Existing clusters will benefit from progress made in high-tech infrastructure and human capital.

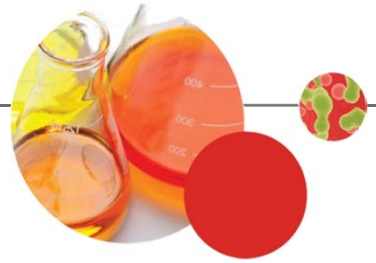
Another double-digit growth market, Indonesia, is anticipated to rank as the sixth largest pharmaceutical market in the region by 2016. Change in legislation will boost the attractiveness of this "pharmerging" market. The country is also set to tap into increasing outsourcing opportunities from Western countries.

Already housing contract research and manufacturing activities, Singapore's life sciences clusters are aiming to develop in the high-tech aspects of research and innovation. Supported by strong intellectual property protection laws, stable political structures and favorable tax policies, growth in the industry is expected to continue, in particular in the biologic sector on the back of massive investment by several large biotech and pharmaceutical multinational companies.

Four of the largest global pharmaceutical companies already earn a third of their revenues outside of their traditional markets of the United States, Western Europe and Japan. A vast majority of the sector's multinationals are reinforcing their presence in Asia Pacific. At the same time, domestic pharmaceutical companies are consolidating and expanding outside their home bases, competing with Western multinationals for space in the region's most dynamic life sciences clusters.

**Established**
Japan

**Emerging**
China
India
Indonesia
Singapore



***China is quickly emerging as a top destination for life sciences investment due to its huge market potential (large population, improving public healthcare systems and increasing healthcare expenditure as a percentage of GDP) and relatively low cost manufacturing sector.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

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## China market overview

China's pharmaceutical industry has enjoyed massive growth over the past decade. With the world's largest population, second largest economy and a growing middle class, China's prospective consumer base is unmatched by any country worldwide. The country's emergence onto the radar screen of multinational life sciences companies parallels its growth into one of the world's dominant economies with an increasingly open and inviting marketplace and waves of foreign investors lined up to take part. As for multinational companies that have been active in China for decades, they are changing strategy and shifting their focus away from merely exporting to domestic markets.

In the past, one of the primary reasons for interest in China was its low-cost manufacturing capabilities, but this advantage is gradually diminishing. Historically, Western pharmaceutical makers enjoyed a 30 to 50 percent cost savings by relocating the manufacturing of intermediates, APIs, starting materials and some finished drugs to China. Today, effort has shifted toward expanding capabilities beyond production into more high-tech R&D functions, as manufacturing costs and wages have increased and concerns over the protection of intellectual property are diminishing.

The life sciences industry has expanded beyond traditional clusters in China's eastern and southeastern regions to new areas around major cities in central and western China. Clusters remain the strongest around the sources of the best talent, so Shanghai and Beijing remain the key pharmaceutical R&D candidate bases, due to the presence of China's top five universities and proximity to renowned hospitals. For example, Merck rolled out a five-year, RMB 9.5 billion ($1.5 billion)[1] project to build a new facility in Beijing for 600 researchers focused on drug discovery and translational research. Other clusters include cities such as Tianjin, Guangzhou, Suzhou, Wuhan and Xi'an.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

***Industry statistics***

**1.5** Researchers in science, per thousand total employment

Total patent applications, residents only **293,066**

**1.7%** Gross expenditure on R&D, as percent of GDP

*Sources: UNISCO Institute for Statistics, the World Bank*

Active manufacturing clusters include:

- China Medical City in Taizhou China Medical City High-Tech Zone – AstraZeneca, Boehringer-Ingelheim, Takeda and other leading pharmaceutical companies have construction projects here
- Greater Hangzhou region – MSD, Novartis, Lilly and Sanofi Aventis have operations here
- Greater Tianjin - where companies such as GlaxoSmithKline, Takeda and Novo Nordisk are based
- Yangtze River Delta (which includes Suzhou, Taizhou, Hangzhou and Wuxi) and Tianjin – two key candidate regions considered by multinational pharma firms

China is estimated to have over 4,500 pharmaceutical manufacturers and 8,000 distribution companies, with a fairly even distribution among state-owned, private domestically owned and foreign-owned enterprises. The market is fragmented, with no dominant domestic companies.

Chinese pharmaceutical manufacturers largely focus on nonbranded generics, whereas large foreign companies have so far been interested primarily in manufacturing. However, state funding and a return of domestic talent from abroad have fueled the rapidly growing biotechnology sector. Domestic start-ups and multinational companies now compete in this growing market. Domestic companies involved in bio and pharmaceutical R&D include C&O Pharmaceutical Technology headquartered in Hong Kong, NYSE-traded Wuxi Pharmatech in Jiangsu Province, Shijiazhuang Pharma Group from Shijiazhuang in Hebei Province, state-owned Harbin Pharmaceutical Group, NASDAQ-traded Sinovac Biotech in Beijing and Zensun Sci & Tech Co in Shanghai.

Multinationals are taking bolder steps to secure a strong foothold in the market, as highlighted by AstraZeneca's announcement in 2011 to invest over RMB 1.3 billion ($200.0 million)[1] on a new plant in Taizhou Medical High Tech Zone (China Medical City). This investment represents AstraZeneca's biggest ever investment in a single production facility and is in addition to the group's decision to open its China Innovation Center in Pudong, Shanghai, in June 2012. The facility will turn out injectable and oral drugs for the domestic market.

In a decision strengthening China's position as a leading destination for contract research organizations (CRO), Quintiles announced in June 2012 that it would invest RMB 88.3 million ($14.0 million)[1] to build its new regional headquarters in Shanghai and establish a partnership with the Shanghai Clinical Research Center (SCRC) to provide lab testing capabilities for local customers. Pharmaceutical multinationals are increasingly outsourcing and the list of companies looking to Chinese CROs to slash R&D budgets, lower development costs and enter the China drug market is growing. Beijing-based Pharmaron is in a partnership with Merck Serono since 2011 and inked a multiyear deal with AstraZeneca in 2012. The deal adds a few hundred scientists to AstraZeneca's China team of about 300 and is its biggest move in China to date. It was preceded by another CRO deal with WuXi PharmaTech to develop and commercialize a biologic product.

In 2011, Pfizer decided to relocate its antibacterial research unit from Groton in the United States to Shanghai, where it is setting up its new Pfizer China Research and Development Center. The move was meant to get closer to important hubs for science and technology research and to give the company better access to the Chinese drug market. Other large pharmaceutical companies with research operations in China include Eli Lilly, Roche, Novartis, Bayer, Bristol-Myers Squibb, Novo Nordisk and Sanofi-Aventis.

The drug distribution system in China is highly fragmented with innumerable small-scale, local distributors, generating huge inequalities between urban and rural patients and increasing the risk of counterfeit drugs entering the supply chain. To fight these issues, improve delivery times and reduce costs, the latest "Five-Year Plan" emphasizes the goal of building up the distribution network for pharmaceutical products, following more mergers and acquisitions by biotech companies. The plan envisions that, by 2015, China will have up to three Tier I pharmaceutical distributors with a national reach and revenues of RMB 100.0 billion ($15.8 billion).[1] The plan also suggests the establishment of 20 Tier II regional distribution businesses with revenues of RMB 10.0 billion ($1.6 billion).[1]

## Industry framework

### Intellectual capacity

The lack of a workforce with specialized knowledge and skills relevant to the pharmaceutical industry used to pose a real challenge in China, as in most emerging markets. To combat this, the government has been working to attracting expatriates. Financial incentives and modern laboratories offered by the government as part of the "Five-Year Plan" have, to date, attracted 150,000 Chinese professionals back to their native country, along with the education and industry experience they gained abroad. Over 80,000 PhDs in the life sciences from Western establishments have returned to China, bringing expertise to a wide range of fields. Today, the talent availability is excellent, thus companies can hire increasing numbers of science graduates who have globally competitive skills.

### Innovation capital

Since 2010, China has invested massive amounts of capital in order to become a center for pharmaceutical R&D with global status via its national R&D drug research programs. For example, the five-year Mega New Drug Program launched in 2009 includes a stimulus package for new drug development of RMB 12.0 billion ($1.9 billion)[1] to be invested between 2011 and 2015.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

Traditional Chinese medicines (TCM) are also receiving unprecedented government support and funding to develop drugs and diagnostic tools targeted at chronic illnesses. Researchers are encouraged to identify and reproduce active ingredients from roots and herbs to submit them to Western-style clinical tests to gain wider acceptance. A few TCM are already recognized worldwide, such as the malaria treatment artemisinin.

Although the main recipients are likely to be domestic laboratories and e-pharmaceutical companies, foreign firms and universities with industry expertise or proprietary technology can also partner with Chinese groups and thus access this attractive funding and large domestic patient pool.

Several research parks, some of them funded by the government, are located throughout the country, supporting budding science and technology enterprises. They include Zhangjiang Hi-Tech Park in Shanghai, Zhongguancun (ZGC) Life Science Park in Beijing Municipality and Suzhou BioBay in Dushu Lake Science and Innovation Education District.

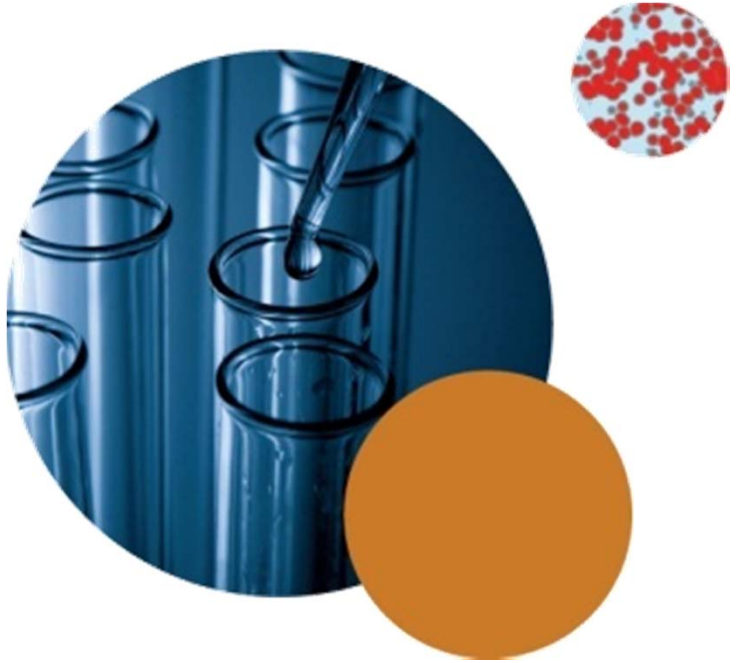
**Fiscal and political resources**

The Chinese government is trying to entice foreign and domestic investments in the life sciences industry, spending billions on the advancement of science and technology. The "12th Five-Year Plan" proposes a budget dedicated to biotechnology applications in the life sciences industry; the Chinese government will reportedly use RMB 10.0 billion ($1.6 billion )[1] to fund major new drug innovation, with an average funding of RMB 5.0 to 10.0 million ($792.4 million to $1.6 billion)[1] per project from 2011 to 2015.

Recognizing the potential of its emerging life sciences industry, the government is working on multiple initiatives to encourage further development. As part of an economic stimulus package, the government allocated over RMB 850.0 billion ($134.7 billion)[1] for healthcare improvements and intends to strengthen its basic health system while deepening reforms during the 2011 to 2016 period. Thanks to the RMB 782.4 billion ($124.0 billion)[1] boost supplied during the first tranche of the 2009 to 2020 Healthcare Reform Plan, the country's health spend as a percentage of GDP increased to 5.1 percent, from 4.7 percent, and national medical insurance coverage now exceeds 90.0 percent.

As part of this national effort, price controls were put in place on several hundred drugs by the National Development and Reform Commission (NDRC) to improve their affordability. Biotechnology – including agricultural biotechnology, bio-manufacturing and fuels – is one of seven strategic emerging industries identified in the "12th Five-Year Plan." The plan calls for government spending of over RMB 12.0 billion ($1.9 billion)[1] to support the growth of the biotech sector through 2015.

New Good Manufacturing Practices (GMP) rules became effective in March 2011, rolling out elevated standards and greater emphasis on pharmaceutical quality control systems. Although the new GMP rules are expected to raise manufacturing and production costs, the enhanced standards will level the playing field in terms of quality and safety of drugs produced in China. Multinational companies and Chinese manufacturers already operating at high GMP standards will be largely unaffected.



## Outlook

IMS Health predicts that, by 2016, China will leapfrog Japan as the second biggest pharmaceutical market in the world behind the United States, with sales of about RMB 1.0 trillion ($160.0 billion).[1] The expected 15.0 to 18.0 percent growth rate to be derived mainly from government spending will be made possible by economic growth and rising healthcare demand as the insurance market matures. Further, for 37.0 percent of pharmaceutical and life sciences CEOs interviewed by PwC for its 15th Annual Global CEO Survey, China is a top source of future growth.

As a production base, China's cost advantage has been eroded by inflation, rising wages, currency appreciation and challenges to the many tax reductions and rebates that China has traditionally offered to its own exporters. These various pressures will certainly reduce China's ability to undercut foreign markets. Balancing these trends, current talent availability, the improved funding environment via government support and the increase in quality facilities will all change the manner in which China competes in the industry. China no longer has to be viable as a low-cost destination to attract industry interest and investment. Certainly, the outlook for life sciences in this immense and growing economy is good. Challenges faced by pharmaceutical companies include China's rising but still weak protections for intellectual property and GMP compliance, navigating the legislative environment and ensuring market access comparable to domestic companies.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

# Industry Framework Trends

**Venture Capital funding incentivized by opportunities beyond manufacturing**

Capital has flowed into China's medical and pharmaceutical industries in growing volumes over the past few years as companies look to secure a strong market share in one of the most promising sectors in one of the world's strongest economies.

In 2011, total investment in the form of private equity and venture capital investment reached a high of RMB 5.7 billion ($907.0 million).[1] During the same year, foreign direct investment in the industry grew to an all-time high of RMB 7.6 billion ($1.2 billion).[1] More and more, foreign pharmaceutical companies are looking beyond China's low-cost manufacturing capability, and are now motivated to increase their investment in the country to access the domestic market for healthcare products and services.

**Government support is key to the long-term growth of a life sciences cluster in China**

In addition to implementing stimulus measures to improve investment and resource allocation to the industry as a whole, municipal governments continue to play a key role in the planning and development stages for major clusters such as Zhangjiang Hi-Tech Park and Zhongguancun Life Science Park.

Zhangjiang Hi-Tech Park, sometime referred to as the Silicon Valley of China, has become the destination of choice for pharmaceutical companies in Shanghai thanks to its long track record of investment by multinationals and its convenient location – a 45-minute drive from downtown Shanghai in Pudong District.

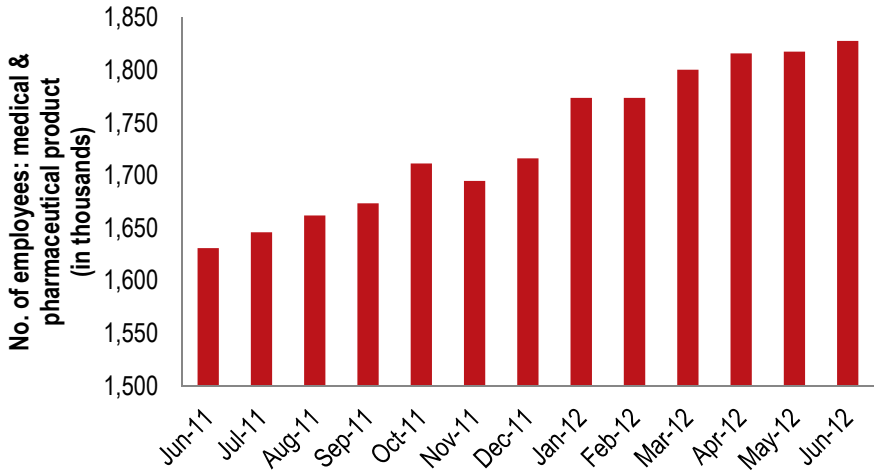
**Industry employment steadily increases**

Employment in this industry has grown rapidly alongside the increase in investment and resource allocation for medical and pharmaceutical products in China. As of June 2012, employment in the medical products field had grown to more than 1.8 million workers, adding an impressive 196,000 workers from one year earlier.

Higher quality education and industry experience abroad have ensured that the talent necessary for growth in China can now be sourced from within the country rather than relying primarily upon outside talent. As the government continues to encourage medical industry education and as Chinese professionals return in growing numbers from abroad to work in life sciences-related fields, employment shows no signs of slowing down in the future.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

**Employment**




*Source: CEIC*

# Beijing Daxing District

## Overview

Compared with other science parks, the most competitive advantage of Daxing District is the industrialization and the efficient public service platform for the life sciences industry. The government provides strong support for innovation and new drug approval.

There are two parks oriented toward life sciences in Daxing District: the Beijing Economic and Technological Development Zone (BDA) and the Daxing Biomedicine Industrial Base (CBP).

Known as "medical valley," BDA is one of the three national biological pharmaceutical innovation incubator bases. Biomedicine is one of the leading industries in BDA. Foreign and domestic companies based here include Bayer, Sanofi, Tide and Tongrentang. Since its integration in Daxing District in 2010, BDA has counted life sciences among its six leading industries. The area offers many advantages in terms of fiscal incentives, tax concessions, innovation, talent and distribution. The E-town Biomedical Park, located in BDA east zone, is the public biomedical service platform of technology support, public infrastructure and incubation, with 178,176 square meters of gross floor area (GFA).

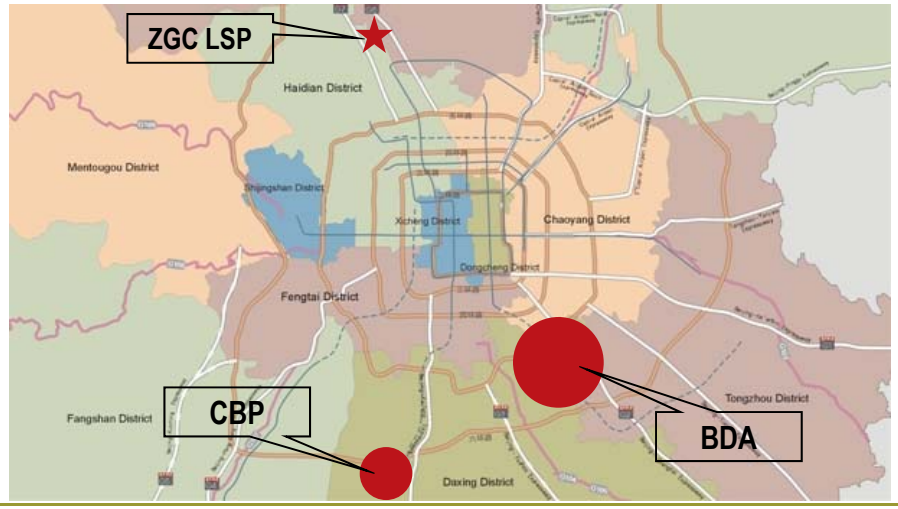
Conveniently located at the intersection of Jingkai Expressway and South Sixth Ring Road, CBP covers a 9.6-square-kilometer phase I planning area. In 2006, the park was allocated into the Zhongguancun Science Park and benefited from the ZGC's "1+6" policy. CBP's revenue reached RMB 9.1 billion ($1.4 billion)[1] in 2011, with its industrial activities having diversified from pure manufacturing to R&D, as well as high-end manufacturing and health services.

## Outlook

The Daxing District aims to become a leading modern biomedical industry hub, covering all aspects of the life sciences industry chain, from R&D and manufacturing to sales and service.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

(left to right): the Tongrentang CBP factory and the Bayer BDA factory




**BIOCYTOGEN**
leased a whole floor of 2,000 sqm in the E-town Biomedical Park. The asking rental rate was RMB 2.90 per sqm per day in mid-2012.

**CRO / CMO SERVICE PLATFORM**
The CBP cooperated with several outsourcing enterprises to establish a CRO and CMO service platform to facilitate the application of R&D into production.

**BEEHALL**
In February, BeeHall purchased 25,060 sqm industrial land in CBP, the turnover was RMB 25.5M with land price of RMB 1,018 per sqm.

**BIOTECH PHARMA**
In May, Biotech bought 17,759 sqm industrial land in BDA core area, the land price was RMB 1,100 per sqm with planning GFA of 35,517 sqm.

***Compared with other parks, BDA and CBP's unique competitive advantages are the convenient drug approval procedure and the strong support to innovation. The Daxing District is trying to become a national biomedical innovation base with global influence.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Beijing Zhongguancun (ZGC) Life Science Park

## Overview

Developed by the Beijing municipal government, Zhongguancun (ZGC) Life Science Park includes a two-phase master plan that will cover over 240.0 hectares. Phase I of the project includes a new enterprise incubation center, a small business development center, R&D facilities, industrial production facilities and a medical service area, totaling roughly 540,000 square meters. Phase II includes 830,000 square meters of medical care and commercial space that integrates the clinical, research and teaching resources of the Chinese Academy of Medical Sciences and the Peking Union Medical College. In April 2012, Zhongguancun Development Group and China State Construction established a joint venture to carry out Phase III that will focus on three functions: high-end industrial transfers, R&D centers and the regional headquarters of major global biopharmaceutical and healthcare companies.

## Outlook

In August 2012, Zhongguancun Life Science Park was identified as the first batch of foreign trade transformation and upgrade by the government. The Beijing Commercial Municipal Commission will introduce a foreign trade service platform and upgrade the branding and the distribution network to attract more world-leading biomedical companies to the life sciences park.

**J&W BIOTECH**
a recent JSR and Wantai JV, leased 600 sqm of manufacturing space from Wanhai.

**BOYA C-CENTER**
is the only project for sale, with a 117,000 sqm GFA and an asking price of RMB 17,000 per sqm.

**PHASE II**
A 45,000 sqm GFA Biotech R&D Center is under construction, and will be completed at the end of 2012.

**PKUCARE PARK FOR LEASING**
Phase I (80,000 sqm) will be on the market in Q4 2012, the asking rent is RMB 3.50 per sqm per day.

*After the Changping subway line opened in 2010, the convenience of travel to the ZGC Life Science Park attracted more attention from global pharmaceutical enterprises.*

*To date, the park owns seven state-level R&D centers, and has received over RMB 20.0 billion in investment.*

# Suzhou Industrial Park's BioBay

## Overview

Located in Suzhou Industrial Park's Dushu Lake Science and Education Innovation District, the Suzhou BioBay park spans 86.3 hectares and offers innovation incubator and accelerator support for the development of the emerging biological and nanotechnology industries. Suzhou BioBay includes an industrialized area, an administrative office and several residential facilities. The Suzhou Institute of Nano-tech and Nano-bionics and the Chinese Academy of Sciences are present at Suzhou BioBay.

Suzhou BioBay has developed capabilities for gene technology and nanotechnology with the most complete industrial chain and the highest industrial agglomeration level in China. The gene technology cluster covers the complete industrial value chain consisting of the gene reagent development, gene detection service, gene diagnostic and gene therapeutic drug research and development (R&D), gene engineering drug and vaccine R&D. Based on the strength of the existing microelectronic and photoelectric manufacturing in Suzhou Industrial Park, BioBay's nanotechnology cluster focuses on developing five major nanotechnology applications: new nano materials, nano-photoelectronics, nano-biopharmaceutical, micro/nano system manufacturing, nano energy saving and environment protection.

## Outlook

Phase III of BioBay will be completed in late 2012 and will contain larger size R&D offices, laboratories and light factories.

**APPTEC**
Mid-2012, Apptec leased a build-to-suit (BTS) building of about 6,000 sqm.

**SHURE**
is in the market for 20,000 sqm, including manufacturing, R&D and administrative space.

**BIOBAY PHASE III**
To be completed in 2012, Phase III includes larger size R&D offices, laboratories and light factories.

**SUZHOU INT'L SCIENCE PARK VIII**
To be completed in 2014, includes lab, R&D, office and manufacturing

*Led by strong incentive policies and professional services along the industry chain, BioBay has successfully attracted over 160 companies and gained an annual revenue of over RMB 880.0 million.*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space

# Chengdu's TLSP and CIHC Parks

## Overview

Tianfu Life Science Park (TLSP) in High-Tech Zone and Chengdu International Health City (CIHC) in Wenjiang Zone are Chengdu's two life sciences-oriented parks.

As the gateway for the life sciences industry in Western China, TLSP is supported by the Chengdu municipal government and the Chengdu High-Tech Zone. Foreign and domestic companies located in TLSP include Renhe Pharmaceutical Group, Jiangsu Hengrui Medicine, ChemPartner and West China Hospital.

Approved in 2008 by the Chengdu Municipal Government, the CIHC project is a professional, international, diversified medical rehabilitation and health service platform covering a total area of 30.0 square kilometers. CHIC is a pioneer as a Chinese modern medical industry cluster that integrates health interventions, health services, medical tourism, education and research and business supports.

## Outlook

The biomedicine and health sector is included in Chengdu's "12th Five-Year Plan" as a major developing industry, and benefits from fiscal incentives, tax concessions and other supporting policies for innovation, talent and distribution. CIHC will pool domestic and international resources to develop this industry. TLSP will reinforce its role as a cooperation platform between international and western China medical institutions

(left to right): Chengdu International Health City and Tianfu Life Science Park.

**TLSP ASKING RENTS**
At TLSP, the approximate asking rental price is RMB 1.33 per sqm per day in 2012.

**CIHC ASKING RENTS**
At CIHC, the asking rental price for an office building is around RMB 1.50 per sqm per day.

**MEDICAL TRANSFORMATION CENTER FOR SALE**
The asking sales price for West China Hospital's 17,500-sqm Medical Transformation Center is about RMB 6,500 per sqm.

**DEVELOPMENT COMPLETE**
Construction of TLSP's 221,553-sqm area, including seven R&D buildings, two offices and one incubation center, is completed and is available for sale and leasing.

***With strong support and attention from the Chengdu municipal government, the biomedical and health industry is expected to attract more leading companies. Both TLSP and CHIC are aiming to become national best practice parks.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

# Shanghai Zhangjiang Hi-Tech Park

## Overview

Zhangjiang Hi-Tech Park was established in Shanghai in 1992 as China's state-level, high-technology, industrial development zone. A multitude of national companies are based here, in addition to start-ups and other companies looking to benefit from its incubator program. According to the "12th Five-Year Plan," Zhangjiang Hi-Tech Park will maintain its investment in industrial fixed assets at RMB 20.0 billion ($3.2 billion)[1] a year to total RMB 100.0 billion ($15.8 billion)[1] by year-end 2015. Earlier this year, EMD Millipore opened a 2,601-square-meter Biopharmaceutical Technical and Training Center in the park to support manufacturers in the area with GMP compliance.

Zhangjiang Biotech and Pharmaceutical Industrial Base was founded in 1994 as the core area of the Shanghai State Bio-Industrial Base. After more than 15 years of development, the base has gathered over 400 domestic and foreign life sciences companies, research institutes and related service institutions.

## Outlook

There were 69 new projects under construction in 2012 in Zhangjiang Hi-Tech Core Park and Shanghai Pudong Kangqiao Industrial Park. Ten projects in Shanghai International Medical Zone (SIMZ) exceed a total construction volume of 4.0 million square meters, with a total investment of RMB 3.8 trillion ($602.2 billion)[1] over an area of 689,300 square meters. SIMZ's ambition is to become a modern medical science hub with advanced technology and sustainable design. The most representative project is the Shanghai International Medical Center, which has a total investment of RMB 800.0 million ($126.8 million).[1] It will form "1+x," a complex hosting a general hospital and many specialized hospitals providing high-end medical service for patients from the Yangtze River Delta Region.

[1] Six-month average conversion rate of 6.31 Chinese Yuan Renminbi (RMB) per U.S. dollar, as of October 2012.

(left to right): Zhangjiang Pharma Valley and Dupont R&D center in Zhangjiang.

Source: www.zjpark.com

**RISING RENTAL RATES**
Due to the lack of new supply in the Zhangjiang Biotech & Pharmaceutical Industrial Base, the average asking rental rate reached RMB 3.7 per sqm per day in 2012, up 12 percent from 2011.

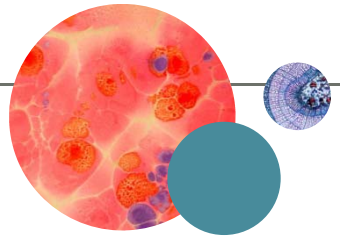
**4.0M SQUARE METERS UNDERWAY**
Major industrial projects kicked off in 2012 in Zhangjiang Hi-Tech Park, amounting to a GFA of 4.0M sqm for a total investment of RMB 26.0 billion.

***Zhangjiang Hi-Tech Park was recently expanded to incorporate Kangqiao Industrial Park and Shanghai International Pharmaceutical Park. Its total area reached 75.9 square kilometers after the three areas merged together.***

**INDUSTRIAL LAND SALE**
In January 2012, a domestic biochemical enterprise purchased 40,806 sqm of industrial land in the South Zhangjiang area. The average land price is RMB 3,071 per sqm.

**ROCHE**
is in the market for 20,000 sqm in Shanghai.

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



***India's pharmaceutical market is largely driven by its domestically produced generic drugs. Although the life sciences industry has achieved double-digit growth in many areas, its size remains proportionately small for a nation with a billion people.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## India market overview

The Indian life sciences industry is one of the country's flagship sectors and the third largest producer of pharmaceutical products worldwide (by volume); the sector is growing at a rate of 15.0 to 20.0 percent per year. The Centre for Monitoring Indian Economy (CMIE) reported that the India pharmaceutical market reached INR 104,944.0 crore ($19.2 billion)[1] in the 2010 to 2011 period, driven by the high economic growth and high-value chronic therapy segment (such as oncology, diabetology and cardiology) reflecting the growing lifestyle changes in the population.

Indian pharmaceutical companies continue to move to the center stage of the global pharmaceutical market, driven by their increasingly strong biotech and drug synthesis skills, high-quality and vertically integrated manufacturing assets, differentiated business models and significant cost advantages. In 2009, Ernst & Young reported that over 120 facilities in India were approved by the United States Food and Drug Administration (FDA), the highest number outside the United States.

A self-reliant industry with tangible production-related cost advantages, the industry in India produces a full range of products and meets around 70 percent of the country's demand for the full suite of pharmaceutical products. India's life sciences industry is predominantly made up of manufacturing entities, contract manufacturing organizations (CMOs), and has a small, but fast-growing, representation in biotechnology.

The production of generics, for both domestic and global use, is India's most robust sector of the industry. Domestic demand for pharmaceuticals has increased in recent years due to improved access to medical care and rising average income. On the export front, India produces more than

[1] Six-month average conversion rate of 54.7 Indian Rupee (INR) per U.S. dollar, as of October 2012.

### *Industry statistics*

**0.4** Researchers in science, per thousand total employment

Total patent applications, residents only **7,262**

**0.8%** Gross expenditure on R&D, as percent of GDP

*Sources: UNISCO Institute for Statistics, the World Bank*

20.0 percent of the world's generics and exports its products to over 200 countries around the world, with the United States being the largest export destination. It continues to gain the interest of global companies due to cost savings and the large presence of FDA, UK Medicines Control Agency (MCA) and European Medicines Agency–approved facilities.

The life sciences industry is largely situated among three of India's 28 states, namely Maharashtra, Andhra Pradesh, and Gujarat, with smaller representation in the states of Goa and Karnataka. The first three states make up most of India's pharmaceutical presence. Formation of these clusters was aided by sector-specific Special Economic Zones (SEZ) and a mix of government-developed and privately owned industrial parks.

The Indian life sciences industry is highly fragmented. The organized sector of the industry accounts for about 70.0 percent of the total market value, with the top 10 players holding a third of the total market share. Among the top 20 big pharmaceutical companies worldwide, 15 have a presence in India. Most large multinational pharmaceutical companies, such as Pfizer, Novartis, GlaxoSmithKline and Merck, have listed subsidiaries in India to target the expanding domestic market, as well as other countries in Asia. For example, West Pharmaceutical Services plans to serve markets like Vietnam and Indonesia from India, launching a 10-year plan to build a 37,700-square-meter packaging facility in Sri City.

Domestic players include Ranbaxy, Dr. Reddy's Laboratories, Lupin, Cipla, Sun Pharmaceutical and Zydus Cadila. The average export component for these top domestic performers accounts for more than 60.0 percent of their consolidated net sales. Globalization among domestic companies is well underway as many of India's largest players are expanding into clusters outside of the region. Zydus Cadila, for example, is headquartered in Ahmedabad but is active across the United States, Europe, Japan, Brazil, South Africa and many other emerging clusters. Hyderabad-based Natco Pharma reportedly planned to rise over INR 120.3 crore ($22.0 million)[1] to fund its expansion plans and research activities.

## Industry framework

### Intellectual capacity

India benefits from a well-educated, English-speaking labor force and enjoys a sizable share of chemists, all crucial components of its robust manufacturing business. In the past, low levels of academic collaboration and a shortage of high-tech, industry professionals limited the growth of R&D. Recently, this has been partially offset by an increase in the number of Indian scientists who have opted to return home from abroad. Today, different studies have estimated that the scientific talent pool of 4.0 million Indians constitutes the largest English-speaking community outside the United States.

The clinical trial business in India, running at about INR 4,500.0 crore ($823.0 million)[1] in revenue annually, benefits from the country's large, genetically diverse and medically naive population, which means trials can be conducted quickly and at low cost compared with trials in the West. On average, the cost to conduct a trial India is 50.0 to 75.0 percent lower compared to the United States or European Union.

### Innovation capital

Historically, one of the biggest challenges for India's budding biotechnology sector was lackluster R&D investment. To meet new challenges in an open market, many Indian pharmaceutical companies are progressively increasing their R&D investment, and a few large companies are investing in New Drug Discovery Research (NDDR). Top domestic pharmaceutical players such as Ranbaxy, Dr. Reddy's Laboratories, Sun Pharma and Wockhardt are investing more than 10.0 to 12.0 percent of their revenues in R&D, up from 5.0 to 10.0 percent not so long ago. They are not far from catching up with the average 15.0 percent spent by Western pharmaceutical companies. Some companies are also scaling up via R&D collaboration with other companies.

### Fiscal and political resources

Recognizing the importance of current and future states of the life sciences industry, the central and state governments have developed measures to support various aspects of the industry. On the biotechnology front, the Indian central and state governments have put competitive tax concessions in place to encourage R&D and support the formulation and distribution aspects of the value chain. In addition, they created an "abbreviated new drug application" to reduce product approval delays.

Key initiatives by the Indian government for the pharmaceutical industry include:

- Allowing 100.0 percent foreign direct investment (FDI) under the automatic route for Greenfield projects as well as for Brownfield projects in the drugs and pharmaceuticals sector, including those involving the use of recombinant technology, after government approval (Department of Industrial Policy and Promotion).
- Preparing to set up a INR 3,498.4 crore ($639.6 million)[1] venture capital (VC) fund to give a boost to drug discovery and strengthen the pharmaceutical infrastructure in the country.
- Issuing an expression of interest for technical and financial bids needed for the selection of a global-level consultant. The consultant will prepare a detailed project report to develop India as a drug discovery and pharmaceutical innovation hub by 2020.
- Approving in principle the Drugs and Pharmaceuticals Manufacturers Association (DPMA)'s proposed Special Economic Zones (SEZs) for pharmaceuticals, bulk drugs, active pharmaceutical ingredients (APIs) and formulations to be located at Nakkapalli Mandal in Visakhapatnam District.

The Biotechnology Industry Partnership Programme (BIPP) has been launched by the Department of Biotechnology (DBT) to support high-end biotechnology research capable of generating globally recognized intellectual property. Additionally, the Biotechnology Regulatory Authority of India (BRAI) has been created, an autonomous body formed specifically to regulate the biotechnology segment and reduce regulatory overlap.

[1] Six-month average conversion rate of 54.7 Indian Rupee (INR) per U.S. dollar, as of October 2012.

In 2009, the Union Ministry of Health and Welfare, in collaboration with the pharmaceutical industry and airport developers GVK and GMR, conceptualized a plan to support the distribution channels used by the producers of generic drugs and CMOs. The measure has yet to implement the setting up of dedicated cargo zones to handle pharmaceutical imports and exports.

Price controls are carried out on certain drugs by virtue of the Drugs Price Control Order (DPCO), supervised by the National Pharmaceutical Pricing Authority (NPPA). There are talks about putting new price caps on branded drugs as well. The Indian government's Department of Pharmaceuticals has started opening medicine shops called Jan Aushadhi in various locations to sell generic medicines at lower prices than their corresponding branded medicines. About 3,000 Jan Aushadhi stores are planned for 2012 and 2013.

**Outlook**

According to India's Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, the income and net sales of drugs and pharmaceuticals for the periods of 2011 and 2012 are anticipated to achieve an annual growth of about 14.1 percent and 13.5 percent, respectively. The same source projects the market to reach INR 481,000.0 crore ($87.9 billion)[1] by 2020, whereas other analysts have valued the country's pharmaceutical market at upward of INR 273,500.0 crore ($50.0 billion)[1] by 2020. Helping to propel this growth is strong local demand, fueled by the large population base and a growing middle class.

India has been making progress in tackling the challenges that foreign companies are likely to encounter when carrying out business in the country, such as legal infrastructure. In particular, the regulation around ownership of public companies and the management of intellectual property. Although the industry is supported by Intellectual Property Protection regime, licensing of most drugs and pharmaceutical products has ended. Manufacturers are now free to produce any drug duly approved by the Drug Control Authority, potentially hindering global players accustomed to more regulated environments. Intellectual property protection is still weak, which downgrades the attractiveness of the country.

Beyond domestic demand, the area has created a positive reputation in areas essential to the future of the life sciences industry. India already has a strong CMO base and will continue to expand this area of the industry as global companies outsource to drive margins. In addition, with the large number of drugs coming off patent, the robust generic manufacturing market is poised to take advantage of new product areas. Although the biotechnology market is still new, there is a market share to be had in the realms of biosimilars and contract research given the advancements to high-tech infrastructure and talent pool capabilities that are being made.

[1] Six-month average conversion rate of 54.7 Indian Rupee (INR) per U.S. dollar, as of October 2012.

# Industry Framework Trends

### Government interested in increasing biotechnology venture capital funds

Asian capital firms, most notably Chinese and Indian, are very active in the biotechnology sector both at home and abroad, with the majority focused on early-stage opportunities. Indian investment firms have also received funding assistance from overseas venture capital firms in the United States, Israel, Europe and, more recently, Japan and China. To date, the pharmaceutical sector has been less targeted by private equity investment because of the prohibitively high valuations. However, the country is actively working to attract more funding into the biotechnology sector. The Indian government is in discussion with export finance institution Exim Bank to set up an INR 2,000.0 crore ($365.6 million)[1] venture capital fund to invest in pharmaceutical R&D.

### India opens up to foreign investment

There are indications that the country will again welcome outside investments in the domestic pharmaceutical sector, with the Indian finance ministry approving roughly INR 180.0 crore ($33.0 million)[1] in investments by foreign companies, which came on the heels of a government decision to permit foreign investors to own up to 49.0 percent of established Indian firms. Significant foreign deals include Abbott Laboratories buying Mumbai-based Piramal Healthcare's Indian business for INR 20,348.4 crore ($3.7 billion)[1] in 2010 and Daiichi Sankyo gaining controlling interest of giant generics maker Ranbaxy Laboratories for INR 22,974.0 crore ($4.2 billion)[1] in 2008.

The current rule allows foreign investors to start a company in India once they have obtained approval to get a share of a domestic drug company on conditions that they won't stop making the cheap drugs they currently produce and that they will keep investing in R&D with Indian partners for five years.

### The Indian clinical research organization (CRO) market

Frost & Sullivan estimates that the CRO market reached INR 2,653.0 crore ($485.0 million)[1] of revenue in 2010 to 2011 and will cross 5,470.0 crore ($1.0 billion)[1] in 2016, growing at an 11.0 percent to 13.0 percent rate as India builds its track record, creates a favorable environment for clinical trials and gains increasing credibility as a base for global phase I-IV clinical trials.

Looking to include the country as a preferred clinical trials site for their studies, multinational CROs still dominate the market of global trials. Indian CROs and multinational pharmaceutical companies are also into global trials, whereas Indian pharmaceutical companies usually conduct local trials. The reliability of well-established CROs, emerging areas such as diagnostic research, low costs and high-standard practices are expected to drive India's CRO market. However, there still are challenges to overcome, such as quality concerns with small-scale CROs and lack of quality infrastructure in smaller tier II sites.

# Andhra Pradesh

## Overview

Hyderabad, certain areas of the Medak district and Vizag in the Andhra Pradesh have emerged as important biotech and pharmaceutical research and manufacturing hubs in India. Called Genome Valley, the biopharmaceutical zone spreading across several Hyderabad suburbs initiated the development of a biotech and pharmaceutical cluster. Its centers of excellence include the Centre for DNA Fingerprinting and Diagnostics, as well as the US Pharmacopeia, in addition to smaller research parks such as the IKP Knowledge Park and the Alexandria Knowledge Park. Companies such as Biological E Limited, Dr. Reddy's, Aurobindo Pharma, Pfizer, Zenotech, Vimta Labs and GVK Bio are present there. They are highly active in formulations, R&D and bulk generic manufacturing.

The cluster has matured as a life sciences destination catering not only to the domestic market, but with a significant export component as well, having around six Special Economic Zones (SEZs) dedicated to the life sciences, totaling nearly 300.0 hectares.

## Outlook

Andhra Pradesh is expected to grow as a life sciences destination in India, given the availability of quality research and active state government support. The latter helped to develop the pharmaceutical and biotechnology industry through specific policies, promoting a knowledge-based cluster approach with financial incentives and appropriate infrastructure support. Industry-specific R&D offered by the Institute of Clinical Research and the Centre for Cellular and Molecular Biology is also expected to boost the cluster's growth.

The Shapoorji Pallonji Biotech Park, which was recently renamed Alexandria.

**TWO RECENT LEASES***

**Lupin** (long) leased 11.0 hectares of land at INR 2,720 / sqm in JNPC, Vizag.

**Granular Technologies** (long) leased 4.8 hectares of land at 2,065 / sqm in JNPC, Vizag.

**JNPC**

Jawaharlal Nehru Pharma City (JNPC) was developed especially for pharmaceuticals, bulk drug, chemical and allied industries on 971.7 hectares of land in Vizag, with proposed investment of INR 25,000.0 crore.

***Andhra Pradesh has evolved as a key state in India for the life sciences industry because of its enabling environment and state-level fiscal incentives for the sector.***

**PROCTOR & GAMBLE**

is setting up a new plant in Mahboobnagar, near Hyderabad, on 68.8 hectares of land with proposed investment of INR 500.0 crore. The land price is around INR 1,250 per sqm of land.

**UNDISCLOSED TIM**

An America-based global pharmaceutical and biotech Fortune 500 company is exploring Hyderabad for setting up their manufacturing plant in around 25 hectares of land.

***The Hyderabad knowledge corridor, spreading over 8,000 hectares, is envisaged as one of the leading developments in the knowledge industry, including life sciences research.***

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space

*In India, manufacturing industries typically buy (outright or long lease) the land instead of leasing (short term) ready-built spaces. Deals quoted here are recent land deals.

# Gujarat

## Overview

Gujarat, with concentration in the cities of Ahmedabad, Vadodara and Ankleshwar, lists more than 1,600 pharmaceutical manufacturing licenses and more than 50 biotechnology companies. Companies in the area support a range of industry functions including bulk manufacturing, formulations and R&D for large domestic companies such as Zydus Cadila, Intas Pharmaceuticals, Claris, Alembic, Lupin, Sun Pharmaceutical and Dishma Pharma. Gujarat is a thriving industrial state and a hotbed for investment that accounts for 15.1 percent, or INR 626,315.0 crore ($114.5 billion),[1] of the total investments (IEM+LOI+DLI) in India. Over 135 life sciences companies signed a memorandum of understanding (MoU) for investing in Gujarat during the Vibrant Gujarat Summit in 2011. Gujarat's pharmaceutical and biotech exports are supported by a pharmaceutical Special Economic Zone (SEZ) covering more than 400.0 hectares.

## Outlook

Excellent infrastructure (42 ports, 14 airports and an extensive road and rail network) is expected to drive the state's industrial future. Gujarat also boasts 24 / 7 power supply and a 2,200.0-kilometer, statewide gas grid that supplies the industrial areas. Large-scale investments in the Delhi–Mumbai Industrial Corridor (DMIC), the Dholera Special Investment Region (SIR) and the Dahej Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIR) are expected to put Gujarat in the driver seat of industrial development, with the life sciences sector being one of the state's focus industries.

**ABBOTT***
is setting up a neutraceuticals plant in Jhagadia, 200.0 km south of Ahmedabad. Lease is at INR 820 per sqm of land.

**TEVA / P&G JV**
is setting up a new OTC plant on 15.8 hectares in Sanand GIDC. Asking price was at INR 3,225 per sqm of land.

**SANAND GIDC**
Developed on an area of 1,500.0 hectares in Sanand for integrated industrial purposes.

**BIOCON, LTD.**
The Indian biotech major is debating investing nearly INR 3.0 billion to set up a plant in Gujarat.

*Excellent physical infrastructure, proactive government support and an attractive business environment have made Gujarat the fastest-growing state for industrial investment. Several large-scale industrial developments are planned, such as a Special Investment Region at Dholera and a SEZ at Dahej.*

*In India, manufacturing industries typically buy (outright or long lease) the land instead of leasing (short term) ready-built spaces. Deals quoted here are recent land deals.

# Maharashtra

## Overview

Maharashtra accounts for 18.4 percent of the country's output of pharmaceuticals by value, according to the Maharashtra Industrial Corporation (MIDC). Mumbai, Pune, Nashik and Aurangabad are the state's major life sciences hubs, with over 3,100 pharmaceutical manufacturers registered in these areas. Maharashtra positions itself as the top destination in India for the pharmaceutical sector, with a strong presence across nearly the full spectrum of the value chain including active pharmaceutical ingredients (APIs), formulations, bulk manufacturing and R&D. Global industry players with facilities in the state include GlaxoSmithKline, Johnson & Johnson, Pfizer, Abbott, Alkem, Bayer, Aventis and Baxter. As India's leading producer of vaccines in India, the state is also a major export hub, with an area of more than 600.0 hectares designated as a Special Economic Zone (SEZ) to promote export in the life sciences sector. Availability of skilled manpower, excellent research environment, diverse feeder stock and investor-friendly policies have made Maharashtra a breeding ground for newer domains in new chemical entities (NCEs), clinical research, contract manufacturing and biosimilars.

## Outlook

Being the frontrunner in terms of economic contribution, Maharashtra has the advantage of being easily accessible by all international markets. Academic and industry R&D joint ventures (Indira Gandhi Institute of Development Research, Indian Institute of Chemical Technology and MGM Institute of Health Sciences) are expected to drive the life sciences cluster's growth.

[1] Six-month average conversion rate of 54.7 Indian Rupee (INR) per U.S. dollar, as of October 2012.

**2.4 HECTARES***
2.4-hectares land parcel leased for INR 1,480 per sqm in Shendra MIDC at Aurangabad for an unnamed pharma company.

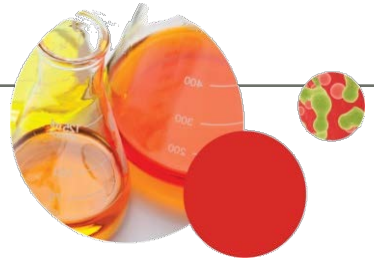
**NIPRO MEDICAL CORPORATION**
purchased 8.9 hectares of land at Khopoli.

**INSPIRA INFRA**
is developing a state-of-the-art industrial park for life sciences industry in nearly 101.0 hectares of land in Aurangabad.

**UNDISCLOSED TIM**
An America-based global pharma leader is looking for around 45,000 sqm of office space in Mumbai.

*Maharashtra is the frontrunner of economic development in India with a 21.0 percent contribution to the national industrial output. Large-scale infrastructure developments like the Navi Mumbai Airport, the Delhi–Mumbai Industrial Corridor and the National Industrial Manufacturing Zone are expected to put the state on a high-growth trajectory.*

*Activity key:* Leasing | Development | Sales | Tenants in the Market | Large blocks of space



***Reflecting the rising disposable incomes of the population, Indonesia's pharmaceutical market has seen double-digit growth since 2009 and is anticipated to rank as the sixth largest pharmaceutical market in the region by 2016.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## Indonesia market overview

The country's share in the Southeast Asia pharmaceutical market is already around 37.0 percent. The Indonesian government and IMS Health estimate the total pharmaceutical GAGR at 12.7 percent from 2009 to 2014. This is higher than the average annual 3.0 percent growth estimated for the global pharmaceutical industry.

The market is estimated to reach IDR 46.2 trillion ($4.9 billion)[1] by year-end 2012 (estimate to be a 10.0 to 12.0 percent year-over-year growth) according to the Indonesian Pharmaceutical Association, GP Farmasi. This is a relatively small market value for a country with 240.0 million people and partly due to low drug consumption per capita, when compared to neighboring countries, as many Indonesians have to pay out-of-pocket for a majority of their medical bills. According to a Ministry of Health source, only around 3.0 to 5.0 percent of the population take medicines.

The sector has also so far been held back by the following: a lack of local raw materials, leaving producers at the mercy of fluctuating global prices and high import tariffs; a slow bureaucracy; the lack of intellectual property protection (some estimates report counterfeit products make up as much as 20.0 percent of the overall market), regulatory barriers against international investment; high distribution costs resulting from poor infrastructure; and a lack of innovation.

However, these deterrents are offset by inexpensive production and labor, an increasingly attractive attribute for foreign investors. Furthermore, the Indonesian government treats healthcare as a top priority and intends to double its healthcare expenditure to around 5.0 percent of GDP by 2014. Economic prospects and changes in lifestyle, coupled with the sheer size of the population, make the Indonesian pharmaceutical market attractive.

The majority of pharmaceutical manufacturers are located in Java. More than 240 domestic companies account for 63.0 percent of the market share, roughly 40 foreign-owned companies hold a 30.0 percent market share and four state-owned companies comprise the remaining 7.0 percent.

[1] Six-month average conversion rate of 9,430.46 Indonesian Rupiah (IDR) per U.S. dollar, as of October 2012.

## *Industry statistics*

**0.2** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **21.7%**

**0.1%** Gross expenditure on R&D, as percent of GDP

*Sources: UNISCO Institute for Statistics, the World Bank*

The eight biggest local companies are Sanbe Farma, Kalbe Farma, Dexa Medica, Bintang Toedjoe, Tempo Scan Pacific, Kimia Farma, Konimex, Phapros and Indofarma. The leader, Kalbe Pharma, is Southeast Asia's largest publically listed pharmaceutical company with a market capitalization of IDR 37.7 trillion ($4.0 billion).[1] The company dominates the OTC market with an estimated 14.0 percent share of the overall pharmaceutical market. Kalbe is preparing for the expansion of Indonesia's market and expects to achieve IDR 46.0 trillion ($4.9 billion)[1] in 2012. After opening a new generic plant in Cikarang in 2011 to increase production capacity by 30.0 to 50.0 percent, the company plans to open new distribution centers in Medan, Palembang and Makassar in addition to the centers it currently has in Jakarta and Surabaya. Kalbe setting aside IDR 100.0 billion ($10.6 million)[1] a year for R&D. Combiphar, another domestic player, is also boosting R&D and upgrading its plant to meet higher global standards and make its products exportable.

Although the market is already concentrated with the top 20 companies accounting for 80.0 percent of the total production, press reports point to further consolidation. Cash-rich Kalbe Pharma is said to be in talks with several pharmaceutical companies in Indonesia to build up its domestic consumer health and nutritionals businesses.

The majority of the local pharmaceutical companies achieved better sales growth in the past couple of years. This growth was supported by improved macro-economic conditions and stable raw material import prices. This is an important factor because it is estimated that Indonesian companies import close to 95.0 percent of the pharmaceutical raw materials needed, mainly from China, and to a much smaller extent, from India and Europe. Both government and industry players aim to reduce dependence on imports for pharmaceutical basic material to only 20.0 percent by encouraging and boosting domestic production, but the trend has not reversed yet and imports are forecasted to reach IDR 11.4 trillion ($1.2 billion)[1] in value in 2012 (an 8.5 percent increase).

The country's exports of pharmaceutical products are very limited, with more than 75.0 percent of locally produced drugs consumed domestically, but they may increase thanks to terms of the ASEAN Free Trade Area (AFTA) and adherence to Good Manufacturing Practice (GMP) standards by more domestic producers.

Pfizer, Bayer and GlaxoSmithKline collectively hold about 8.0 percent of the market, a very small share due to a series of entry barriers. A large growing population, combined with low affluence levels (today, only the middle and upper income markets can afford costly, branded drugs), warrants different market penetration tactics in Indonesia. Unlike start-ups and technology vendors, which still focus on China and India, large multinationals have different views on emerging markets where they are more willing to scout for local partners.

In September 2012, Merck Sharp and Dohme (MSD) opened a IDR 198.0 billion ($21.0 million),[1] 4,900-square-meter facility in Pandaan, Pasuruan, East Java, to manufacture packaging for cardiovascular, hypertension, respiratory, oncology and diabetes drugs, among others – about a quarter of which will be for domestic consumption and the rest for exports.

Ownership is limited to 75.0 percent for foreign investments and regulation 1010/2008 obliges foreign companies to set up local manufacturing operations. However, the government recently announced a plan to allow a 100.0 percent foreign ownership of drug firms, resulting in increased overseas investment, and indirectly in higher volume, and quality of local production.

## Industry framework

### Intellectual capacity

One of the issues hampering the development of the pharmaceutical sector in Indonesia is the lack of skilled labor and trained staff, particularly at the PhD level, but some projects exist to forge more scientific collaborations between Indonesian and foreign researchers. In July 2011, Indonesia received a IDR 10.4 billion ($1.1 million)[1] research grant through a new USAID project to invest in biodiversity-related projects; it is open to Indonesian scientists participating in the United States National Science Foundation research projects with U.S. scientists.

### Innovation capital

Product development by domestic companies has so far overwhelmingly relied on foreign licenses or on expired patents. For foreign companies, high production costs combined with low selling prices squeeze profits and leave less cash available for R&D. However, the domestic pharmaceutical industry is looking to expand production and R&D capacity as several areas of opportunity exist:

- As income rises, consumers begin to demand higher quality, thus encouraging local drug companies to innovate.
- The wide variety of tropical diseases could make Indonesia suitable for some R&D activities in this field.
- Herbal medicine ("jamu") is one area where Indonesia could create a competitive advantage, given the increased interest and growing imports of alternative medicines in Western countries. Raw material is abundant (30,000 of the 40,000 of available medicinal plant species are found in Indonesia) and the Ministry of Health ensures jamu is safe and backed up by research.
- The government would like the country to become a global hub for Halal-labeled products.

### Fiscal and political resources

The pharmaceutical industry will benefit from healthcare becoming a top priority for the government, evidenced by its intention to double healthcare expenditures to 5.0 percent of GDP by 2014 and to increase by 26.0 percent the 2011 healthcare budget allocations. Indonesia's government is committed to addressing pharmaceutical sector challenges. Indonesia will continue to represent a high reward but high risk pharmaceutical market for Western multinationals to operate in, on account of its deficient regulatory and intellectual property rights (IPR) enforcement regime, price cuts of branded generics, a new import tax imposed on raw materials for drug manufacturing and long registration procedures. Also posing a challenge is the inclusion of Indonesia in the United States Trade Representative's Special 301 Priority Watch List in 2011 due to the prevalence of counterfeit pharmaceuticals.

[1] Six-month average conversion rate of 9,430.46 Indonesian Rupiah (IDR) per U.S. dollar, as of October 2012.

# Industry Trends

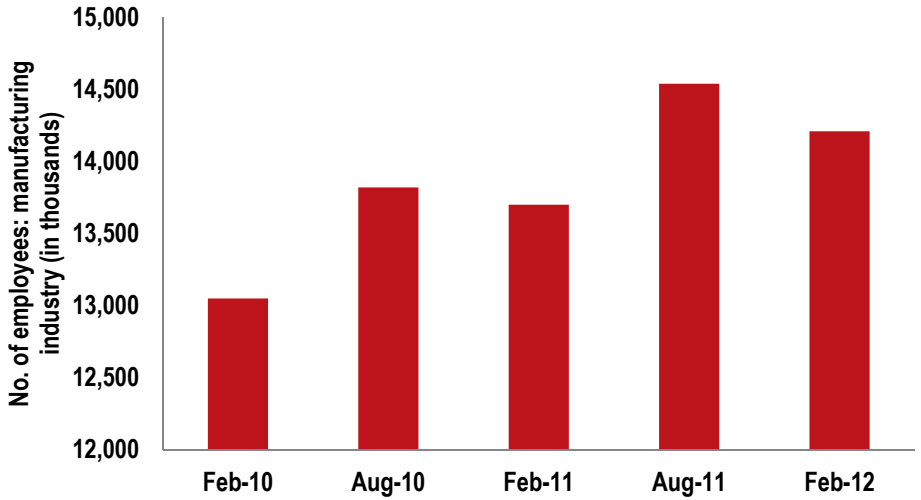
### Jamu: From traditional herbal products to an Indonesian brand

Traditional medicines are used by 80.0 percent of the population in Africa and Asia, reports the World Health Organization (WHO) and, in Indonesia, nearly half of adults consume jamu, a traditional medicine, according to a 2010 study by the Health Ministry. Jamu products are starting to be used in pediatric remedies for cough, cold and allergy and have continued to grow in popularity in 2011. Affiliates to the Association of Indonesian Jamu Producers (GP Jamu) collectively employ 3.0 million people at 1,300 factories, and report an annual turnover of IDR 10.0 trillion ($1.1 billion).[1]

In 2011, Indonesia had only six phyto-pharmarceutical herbal medicines with clinically proven effectiveness, plus 38 standardized herbal medicine in the preclinical trial phase, all of them integrated into existing healthcare services. The country is facing a public health issue with the distribution of counterfeit, poor quality or adulterated herbal medicine, hence the importance of the "Certification of Phytopharmaca" delivered by the Indonesian National Agency for Food and Drug Administration (FDA). Dexa Medica was among the first companies to received this certification for their herbal products.

[1] Six-month average conversion rate of 9,430.46 Indonesian Rupiah (IDR) per U.S. dollar, as of October 2012.

**Employment**




*Source: Statistics Indonesia*

However, the Indonesian Health Ministry's focus on improving the country's regulatory and business environment encourages multinational drug makers to set up local manufacturing operations:

- A signatory to the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) has led to an improvement in patent protection—extending the term of protection from 14 to 20 years—and the introduction of the reversal of the burden of proof onto the defendant in intellectual infringement cases.
- The introduction of Good Manufacturing Practices (GMP) as well as the ASEAN Common Technical Dossier and requirements will also encourage local companies to increase quality standards.

### Outlook

Domestic demand for low cost drugs is likely to increase. With increased spending on healthcare, a growing population and rising incidence of chronic diseases, Indonesia is among the 17 "pharmerging markets" where IMS Health expects double-digit increases through 2015. The country's huge generic drugs sector is likely to see consolidation, but will remain challenging as long as part of it is cannibalized by counterfeit drugs. The steady growth of health supplements and OTC medication is expected to continue, buoyed by increased self-medication, accessibility to more affordable drugs and the 2014 roll-out of a health insurance scheme covering basic healthcare for all Indonesians.

Steady projected sales growth provides substantial incentives for companies to operate in the country, and the main challenges to investment in Indonesia are easing. Manufacturing standards are improving and government reforms are underway, such as efforts made to better protect intellectual property rights in order to encourage investment. For companies facing post-loss of exclusivity (LoE) issues, Indonesia is one of the APAC countries offering opportunities for volume plays. For example, Sanofi-Aventis recently launched a second, cheaper brand of platelet-lowering product to defend its market share against further generic erosion in Indonesia.

Although the Indonesian pharmaceutical market is largely import driven, exports are likely to increase as more domestic producers adhere to Good Manufacturing Practice (GMP) standards. Additionally, in light of efforts to improve Indonesian pharmaceutical regulations and Good Clinical Practice (GCP) standards, the country is becoming an increasingly attractive location for clinical trials, especially in Java Island. Change in legislation will give the industry renewed growth, and allowing 100.0 percent Foreign Direct Investment in Indonesia will attract foreign pharmaceutical companies. The healthy number of mergers and acquisitions and the rationalization of operations that we are starting to see hint that a shift is about to take place in the sector as companies are well aware of Indonesia's potential.

# Jababeka Industrial Estate

## Greater Jakarta Industrial Estate

Although Indonesia has about 55 industrial park firms providing land and services, none are wholly dedicated to the life sciences industry. However, Java is seen as a choice destination and contains 75.0 percent of the country's industrial estates. The province of West Java contains about 50.0 percent of all industrial estates countrywide. This includes Bekasi and Karawang, located within the Jakarta metropolitan area. Called the Greater Jakarta Industrial Estate, this area that covers Tangerang, Bogor, Bekasi and Karawang is where most of the biggest pharmaceutical companies are located.

Many big pharmaceutical companies are located at Jababeka Industrial Estate, Pulo Gadung Industrial Estate (JIEP) and Bogor industrial zoning area. In Bogor, for example, PT Bayer Indonesia has a pharmaceutical products plant in Cibubur and is investing IDR 200.0 billion ($21.1 million)[1] to enhance another production capacity of OTC pharmaceuticals in Cimanggis. Both plants market products in the country and also export to other Asia Pacific countries.

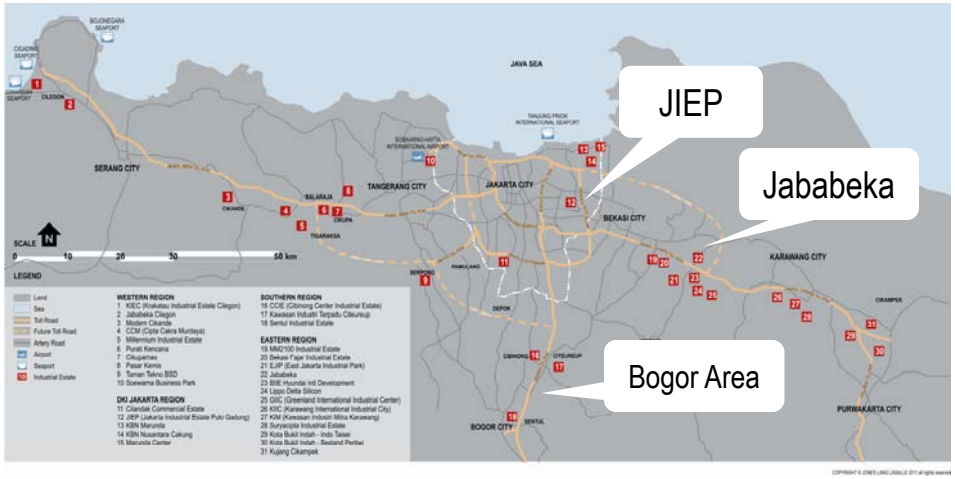
## Jababeka Industrial Estate

Spanning 1,570 hectares of land, the Jababeka Industrial Estate is located at Cikarang, Bekasi Regency, 31.0 kilometers away from Jakarta City. Described as the first modern Indonesian eco-industrial estate, the Jababeka Industrial Estate was jointly developed with ProLH GTZ under a technical cooperation program between Indonesia and Germany. Jababeka Industrial Estate is meant to be a comprehensive, one-stop industrial development solution, offering industrial land as well as build-to-suit factory buildings. Its Cikarang Dry Port provides cargo handling and logistics for international export and import. Jababeka has its own medical city and is home to many renowned international and domestic enterprises such as Dexa Medica and AstraZeneca.

## Outlook

Jababeka plans expansion as demand surges. The nearby Medical City has the ambition of becoming the premier location for scientific research in Indonesia. Jababeka's ongoing projects include a 130-megawatt power plant worth IDR 1.1 trillion ($141.0 million)[1] and a new seaport near the area.

[1] Six-month average conversion rate of 9,430.46 Indonesian Rupiah (IDR) per U.S. dollar, as of October 2012.




**LEASING ACTIVITY**
The industrial leasing market in Jababeka remained quiet in 2012. The average asking rental price for a factory or warehouse in Jababeka is around IDR 38,000 per sqm per month.

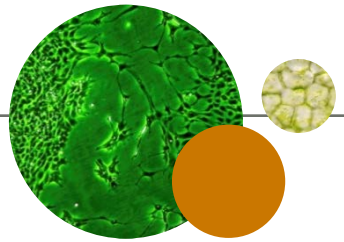
**MEDICAL CITY**
A medical city is to be built on 72.0 hectares of land in Jababeka. 10 hectares are apportioned for hospital, 5 for research labs, and the rest for student dorms, a hotel, pharma companies and the President Univ. School of Medicine.

**JABABEKA**
sold 19.0 hectares of land with a value around IDR 329.0 during Q1 2012. This represents an increase of 34 percent in revenue compared to the same period in 2011. No pharmaceutical company entered during this period.

**KIMIA FARMA (KAEF)**
signed a joint venture agreement with Tianjin Pharmaceutical Group Co., to set up an injection corticosteroid plant in Cikarang, West Java. The plant is scheduled to begin operations in 2014.

*Compared with other industrial parks, Jababeka has the most complete facilities and is the most convenient for drug approval procedures. The park's leading status will be reinforced by the proximity of the Medical City to be built on a 74-hectare property in Kota Jababeka.*

*Activity key:* Leasing | Development | Sales | Tenants in the market | Large blocks of space



***A leading importer of prescription drugs, Japan presents global life sciences industry players with a large market, ranking number 2 in consumption of prescription drugs, behind the United States. As a manufacturing country, Japan is industrialized well ahead of other Asian countries and its pharmaceutical groups produce a large range of drugs, although in comparatively small quantities and with some degree of reliance on overseas research.***

## Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

## Japan market overview

A large middle class, massive wealth and an aging population make Japan an attractive long-term destination for pharmaceutical companies. Japan's pharmaceutical industry (including manufacturing, wholesale and retail) is one of the world's largest with an annual shipment of more than JPY 7.0 trillion ($88.7 billion).[1] Imports rose 9.3 percent to JPY 2.5 trillion ($31.7 billion)[1] in 2011, led by "ethical" (prescription) drugs.

Since 1990, important regulatory reforms created a conducive environment for domestic pharmaceutical companies to expand their overseas operations and thus become more globalized. In particular, the country made its industry regulations match closely with those in developed Western countries, facilitating not only Japanese players to develop in foreign markets, but also American and European counterparts to operate in its domestic market.

Japan's production of pharmaceutical products reached JPY 6,987.4 billion ($88.5 billion)[1] in 2011, an increase of 3.1 percent year-over-year. Prescription drugs made up the bulk of production at JPY 6,344.5 billion ($80.4 billion),[1] according to the Ministry of Health, Labor and Welfare. For the full 2012 year, the domestic market is expected to grow more moderately, owing to downward pressures on drug prices and to a shift to generics.

Exports are mainly to the United States (JPY 60.0 billion, or $760.0 million[1]), followed by China (JPY 18.4 billion, or $233.0 million[1]) which recently leapfrogged South Korea into second place. Shrinking by 4.2 percent to JPY 138.4 billion ($1.8 billion)[1] in 2011, exports are expected to continue stagnating due to patent expirations and the forecasted 25.0-percent drop in U.S. sales by 2017.

[1] Six-month average conversion rate of 78.95 Japanese Yen (JPY) per U.S. dollar, as of October 2012.

## *Industry statistics*

**10.5** Researchers in science, per thousand total employment

Graduate students in science, engineering manufacturing & construction, as a % of total graduate students **21.9%**

**3.4%** Gross expenditure on R&D, as percent of GDP

Total patent applications, residents only **290,081**

*Sources: UNISCO Institute for Statistics, the World Bank*

Deregulation and generic drug alternatives have significantly increased competition between domestic and foreign pharmaceutical companies, intensified consolidation and boosted acquisitions that transformed Japanese companies from mostly domestic players to multinational groups with strong overseas sales.

Takeda is by far the largest of Japan's big nine pharmaceutical producers in terms of sales. Other top manufacturers include Astellas, Daiichi Sankyo and Eisai. In the past five years, Mitsubishi Tanabe Pharma, Dainippon Sumitomo Pharma, Kyowa Hakko Kirin Company, Shionogi & Co Ltd and Otsuka have achieved the biggest growth rates among domestic pharmaceutical establishments. Recent domestic projects include Asahi Glass, investing JPY 800 million ($10.1 million)[1] in a new production line, doubling its Tafluprost active pharmaceutical ingredient (API) capacity at its Obama site, in addition to its Chiba plant. The new facility is scheduled to enter service in March 2013.

Due to fierce competition and climbing R&D costs, large Japanese companies such as Takeda and Daiichi Sankyo relocated part of their operations overseas. Takeda, for example, has set up operations in several Asian countries such as India, China, Indonesia and Singapore. Japanese firms have primarily focused on Western companies when undertaking overseas mergers and acquisitions. For example, Astellas purchased U.S. drug maker OSI Pharmaceuticals for JPY 315.8 billion ($4.0 billion)[1] in 2010 to gain long-sought access to cancer treatment and to the U.S. market. In 2011, Takeda wrapped up a JPY 1.1 trillion ($13.7 billion)[1] mega-deal to buy Swiss drug maker Nycomed.

Among foreign pharmaceutical firms in Japan, Pfizer is the leader and ranks second in Japan after Takeda, with a 5.6 percent market share in 2011. Also in the country's top 10, Roche and Novartis (both ranking number 5 with a 4.4 percent market share) and Merck (ranking number 9 with 3.7 percent) are all poised to take advantage of dynamism of the market and of profit margins higher than those recorded in other Asian countries. Pfizer increased Japanese sales to JPY 576.0 billion ($7.3 billion)[1] in 2011, beating the market rate of 6.9 percent. GlaxoSmithKline's sales in Japan jumped by 28.0 percent in 2011 and in first quarter 2012, marking it the fastest-growing among large drug producers. With substantial growth ambitions and drug approval targets, Merck and Novartis aim to reach the top three, and Eli Lilly, the top 10. By merging its Japan subsidiaries Taiyo Pharmaceutical Industry and Teva-Kowa Pharma, Israel's Teva Pharmaceutical Industries is creating a new company with sales of approximately JPY 70.0 billion ($886.6 million),[1] equal to Japan's largest generics manufacturer Nichi-Iko.

New drug launches have increased due to regulatory reforms and loosening pricing policies by the government. In July 2012, Japan approved a series of products, such as Merck's HPV vaccine Gardasil, AstraZeneca's stomach drug Nexium and GlaxoSmithKline's rotavirus-beating Rotarix.

Japan's biotechnology market is one of the world's largest and a key contributor to the Japanese economy, having received tangible support from the government and scored many achievements in various fields, such as gene analysis, genetic recombination and bioinformatics. Meanwhile, Japan's generics market is the sixth largest worldwide, and is still growing. Currently generic drugs make up 23.0 percent of the market, the cost-conscious government hopes to increase that share to 30.0 percent by March 2013. As such, Pfizer and Mylan are preparing to increase their share of the branded generics market with a deal to make and sell 350 of their off-patent drugs there. The OTC pharmaceuticals market generated revenues of JPY 1.0 trillion ($13.0 billion)[1] in 2010, representing a moderate 2006 to 2010 CAGR of 1.7 percent. A third of sales are generated by the lucrative segment of traditional medicines. The 2010–2015 CAGR is expected to slow down to 1.5 percent, with a market value of JPY 1.1 trillion ($14.0 billion)[1] by year-end 2015. Vaccines are an underdeveloped, but expanding, segment of the overall market. The government has introduced preferential measures and subsidies to revive the manufacturing of vaccines in Japan. Several large Japanese manufacturers, such as Takeda, have already taken advantage of the incentives to launch vaccine production. Supported by its Nycomed acquisition, Takeda plans to increase the scale of its vaccines operations with the launch in 2012 of a global vaccines division.

Pharmaceutical distribution in Japan remains largely dominated by large wholesalers. Intense consolidation has reduced the number of players in the past decade by 70.0 percent to about 120 distributors. The top four wholesalers, Medipal, Alfresa, Suzuken and Toho, held a 90.0 percent share of overall Japanese pharmaceutical distribution market in 2011.

Common drugs are frequently introduced in Japan market by partnerships such as the following. Several examples include: GlaxoSmithKline and Daiichi Sankyo's 50 / 50 joint venture to distribute new vaccines in Japan; Novartis' 2011 agreement with Eisai to distribute three lung drugs; Shire's commercialization of ADHD drugs with Shionogi; and Pfizer's license granted to Astellas Pharma to make and sell its Lipitor cholesterol drug in Japan. In August 2012, Takeda Pharmaceutical signed an exclusive distribution deal with Johnson & Johnson K. K. Consumer Company to market seven OTC brands. After Takeda Pharmaceutical stops distributing 13 Pfizer drugs at year-end 2012, Pfizer will begin selling them on its own. GlaxoSmithKline is also seeking direct access to its market with a recent investment in a new call center in Okinawa where pharmacists will respond to requests from medical professionals as well as consumers.

## Industry framework

### Intellectual capacity

Most top Japanese universities have a life sciences–related faculty, which trains future medicine professionals and undertakes various academically oriented R&D programs with leading Western counterparts. Japan's workforce is also strengthened by those Japanese nationals who possess overseas education and research experience. Japan's pharmaceutical industry underwent a fast and steady development course after World War II, with a push on research starting in the 1990s. That shift generated more laboratory-based cooperation between Japanese researchers and foreign scientists and more participation in collective and cross-border projects.

### Innovation capital

The Japanese government has designated a few locations to lead the development of the life sciences industry, where selected projects are eligible for government funding. Kobe Biomedical Innovation Cluster is the most important of these projects and is profiled in this report. Another one

[1] Six-month average conversion rate of 78.95 Japanese Yen (JPY) per U.S. dollar, as of October 2012.

is Tsukuba Science City, located 60 kilometers northeast of Tokyo and covering an area of 28,400 hectares. In its center, a Research and Education District covers about 2,700 hectares and includes national research and educational institutes, as well as a residential area with parks. The suburban district covers about 25,700 hectares where systematic urbanization is promoted, the natural and rural environment is preserved and private research institutes are located. A new urbanization area along the Tsukuba Express Line is also under development.

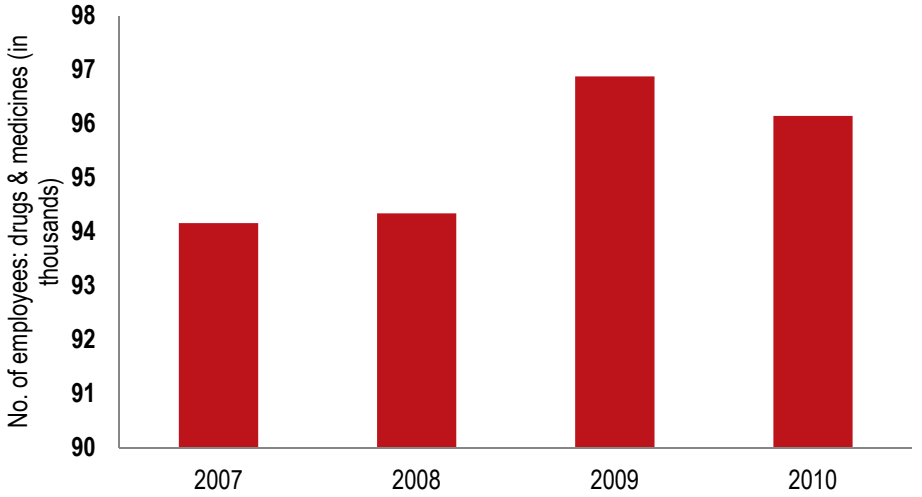
Beyond government initiatives, industry associations such as the Pharmaceutical Industry Forum (PI Forum) are active in trying to rev up R&D activities in Japan. Such initiatives are encouraging for domestic R&D hubs. The Kobe and Tsukuba science parks have fallen on hard times of late and have been struggling to attract occupiers as much of the R&D activity has moved offshore in recent years.

**Fiscal and political resources**

The Ministry of Health, Labor and Welfare (MHLW) and the Pharmaceuticals and Medical Devices Agency (PDMA) are the key regulators in Japan. In August 2012, a bill was submitted to create an independent inspection organization within the MHLW to evaluate pharmaceutical administration and monitor how safety policies relating to pharmaceutical products and medical devices are implemented in the country.

Over the past decades, the government adopted a series of measures aimed at developing Japan's pharmaceutical industry and enhancing its competitiveness. In recent years, Japan recognized the need for having a national strategy for the development of its biotechnology industry to meet increasing market demand, as well as produced Biotechnology Strategy Guidelines.

**Employment**




*Source: Japan Ministry of Economy, Trade and Industry*

## Highlights

### Japanese life sciences firms expand globally

Japanese firms have, in recent years, engaged in intense acquisition activity in Asia and globally, failing, however, to capitalize on their geographic proximity to China. Here are some of the most significant transactions by Japanese companies looking to expand their presence overseas.

- In August 2012, Nipro Pharma Corporation started building a JPY 19.7 billion ($250.0 million)[1] pharmaceutical plant on a site of 150,000 square meters in Vietnam-Singapore Industrial Park (VSIP) in Vietnam's northern port city of Haiphong. Scheduled for completion in April 2015, the factory will provide high-quality medicines and medical equipment for Japan, Europe and the United States, and is expected to bring in net revenue of JPY 200.0 billion ($2.5 billion)[1] by 2020.
- Fuji Pharma is taking over OLIC, Thailand's largest contract pharmaceutical manufacturer, to utilize it as a manufacturing and distribution base for Fuji Pharma products in Asia and globally, in line with the company's "Good to Great" medium- / long-term vision for 2015 to grow overseas.
- Bio-tech firm Chugai Pharmaceutical plans to invest JPY 12.6 billion ($160.0 million)[1] on antibody research in Singapore from 2012 to 2017, opening its JPY 94.7 million ($1.2 million)[1]-Chugai Pharmabody Research Institute, its second satellite research institute and Singapore's first corporate laboratory in antibody engineering.
- In April 2012, Eisai Pharmaceuticals opened its regional offices at Dubai Healthcare City to market oncology and neurology treatment in the Middle East and North Africa region.
- After its JPY 1.1 trillion ($14.0 billion)[1]-purchase of Nycomed (Switzerland) and its JPY 631.6 billion ($8.0 billion)[1]-purchase of Millennium (United States), Takeda Pharmaceutical Company agreed in April 2012 to buy URL Pharma (United States) for JPY 63.2 billion ($800 million),[1] plus potential further payments based on the company's performance. The deal will allow Takeda to increase its presence in the United States and contribute net sales of about JPY 43.4 billion ($550.0 million)[1] for 2012, thanks to URL Pharma's major product Colcrys, a treatment for gout.
- In March 2012, Asahi Kasei had acquired U.S. healthcare equipment maker Zoll Medical for JPY 173.3 billion ($2.2 billion).[1]
- In 2012, Dainippon Sumitomo Pharma purchased United States biotechnology company Boston Biomedical to gain access to its oncology innovative pipeline and use its drug discovery and development platform to expand their presence in cancer treatment globally.

[1] Six-month average conversion rate of 78.95 Japanese Yen (JPY) per U.S. dollar, as of October 2012.

Japan has made its industry regulations match with those in developed Western countries, facilitating not only Japanese players to develop in foreign markets, but also American and European counterparts to operate in its domestic market. In 2012, the government considered allowing consumers to purchase drugs and medical devices already accepted in the West, but still undergoing clinical trials in Japan. Efforts have also been made to speed up the approval process for Japanese patients to gain access to better treatment, so as to cut healthcare costs for its rapidly aging society.

Many manufacturers of drugs and medical devices maintain their headquarters in Tokyo or Osaka while locating manufacturing plants and R&D laboratories in regional cities. Several local authorities promote the development of medical care and welfare services and government-sponsored special zones include policies to develop specific regions to make industry more competitive in the global market. In 2011, International Strategic Comprehensive Special Zones were created where designated companies will receive favorable tax and regulations conditions.

- Tsukuba international special zone focuses on the development and application of boron neutron capture therapy.
- Keihin waterfront district life innovation international special zone facilitates fast approval for drugs and medical devices through international collaboration in clinical trials.
- Kansai innovation international special zone accelerates the application process through R&D. The Pharmaceutical Affairs Law (PAL), which regulates the manufacturing, marketing and distribution of pharmaceutical drugs and medical devices in Japan, makes it difficult for foreign manufacturers to set up base in Japan on their own. Japanese pharmaceutical companies with ties to foreign drug makers are accelerating their efforts to introduce new cancer drugs in the domestic market by simultaneously conducting clinical tests in Japan, the United States and Europe.

Another challenge for foreign pharmaceutical firms is that clinical tests often take longer in Japan as only large medical institutions in major cities are permitted to conduct them, forcing foreign companies to test and launch new drugs first in the United States and Europe rather than in Japan where product launches could be delayed by as much as three years. The MHLW is now revising the clinical testing process and plans to allow hospitals in smaller cities to conduct clinical tests as well.

In July 2012, the government approved a regulatory reform increasing the number of countries and products benefiting from the Japan–European Community Mutual Recognition Agreement (MRA), a framework that simplifies import procedures and provides for mutual acceptance of the results of Good Manufacturing Practice (GMP) inspections at pharmaceutical manufacturing facilities. The current agreement applies only to chemical pharmaceuticals. By the end of 2012, a revised plan will reduce the cost of trade for companies producing a broader range of medicinal products and allow for the omission of certain GMP inspection procedures.

One defining characteristic of the Japanese pharmaceutical market resides in the revision of drug prices every other year by NHI (National Health Insurance). Drug retail prices are fixed and controlled by the government, but wholesale prices depend on negotiations between manufacturers and wholesalers, and pharmacy margins depend on negotiations between wholesalers and pharmacies. After the 2010 NHI revision, many players in the supply chain suffered losses and had to compromise on profit margins.

## Outlook

Thanks to the regulatory reforms speeding up new drug launches, eased pricing policies and the aging population strengthening demand for drugs, sales in Japan have been growing fast at a time when other regions are suffering. With a 1.0 to 4.0 percent annual growth, pharmaceutical sales are expected to reach upward of JPY 8.3 trillion ($105.0 billion)[1] by 2016, according to IMS Health. At this date, Japan is likely to be overtaken by China and to rank as the third largest pharmaceutical market in the world, and the second in Asia Pacific.

Demand for pharmaceuticals in Japan will be driven by the country's growing elderly population. Estimates predict the elderly population to represent over 25.0 percent of the population by 2016 (the largest percentage in the region), thus it is expected to significantly impact the government's healthcare budget, ranking as the country with both the second highest total health expenditure and second largest per capita health spending in the region. This will not be enough to compound the lower single-digit CAGR of the domestic pharmaceutical market. Japanese companies are actively seeking growth by expanding into new markets in the Asia Pacific region, as well as globally.

[1] Six-month average conversion rate of 78.95 Japanese Yen (JPY) per U.S. dollar, as of October 2012.

# Kobe Biomedical Innovation Cluster (KBIC)

## Overview

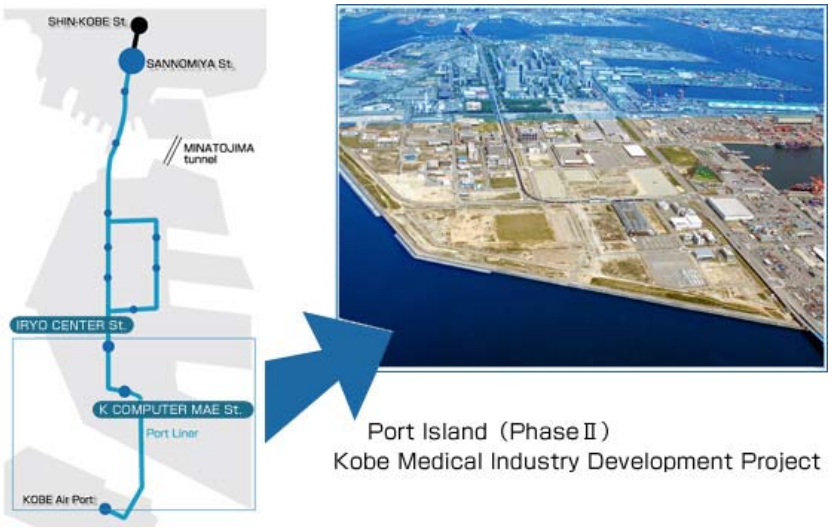
Kobe launched the Medical Industry Development Project in 1998, constructing a base of R&D activities for advanced medicine on the city's Port Island. The medical industry cluster is meant to facilitate interaction and collaboration between public institutions, academia and industry players.

At present, 11 core research facilities, such as the Institute of Biomedical Research and Innovation (IBRI), Riken Center for Developmental Biology (CDB) and Riken Molecular Imaging R&D Center, are operating in KBIC. New facilities are being added, including the Riken Next-generation Supercomputer R&D Center and new Kobe City General Hospital.

Over 200 world-class research facilities and private companies are engaged in translational research in regeneration medicine, in the pursuit of new scientific discovery for therapeutic agents and in the development of new medical instruments. The Kobe Medical Industry Development Project is regarded not only as a municipal enterprise for local development, but also as a national project for Japan.

## Outlook

KBIC has granted tax exemptions, allowance for some of initial investment and financial support to invite prospects. However, with KBIC belonging to the public sector, rents tend to be non-negotiable.



***KBIC is Japan's best example of an international medical zone where various incentives are provided to tenants.***

*Source: photos and map www.kobe-lsc.jp*

# Tsukuba Science City

## Overview

Tsukuba Science City is located in Ibaraki Prefecture, 50 kilometers from Akihabara in Tokyo and 40 kilometers from Narita International Airport; and it is easily accessible from Tokyo, due to a high-speed rail transportation system. Founded by the merger of three towns and a village, the purpose-built city was inspired by planned metropolises such as Brasilia with the goal to stimulate scientific discovery in an international environment.

Today, Tsukuba Science City offers one of the highest concentrations of cutting-edge research centers and high-tech companies in the world with an estimated 3.0 percent of the population holding doctoral degrees. Dozens of national research institutes and two universities grouped into five specialized zones (higher education and training, construction research, physical science and engineering research, biological and agricultural research and public facilities) are surrounded by hundreds of private research facilities hosting over 22,000 researchers of 131 nationalities.

The “Research and Education District” was designed and developed to combine research and educational organizations with residences and public facilities on an area of about 2,700 hectares in area. As a result of relocation and new establishment, Tsukuba Science City is home nearly a third of Japan’s public research institutions. The most prominent of these include the University of Tsukuba, the High Energy Accelerator Research Organization (KEK), the Electrotechnical Laboratory, the Mechanical Engineering Laboratory and the National Institute of Materials and Chemical Research.

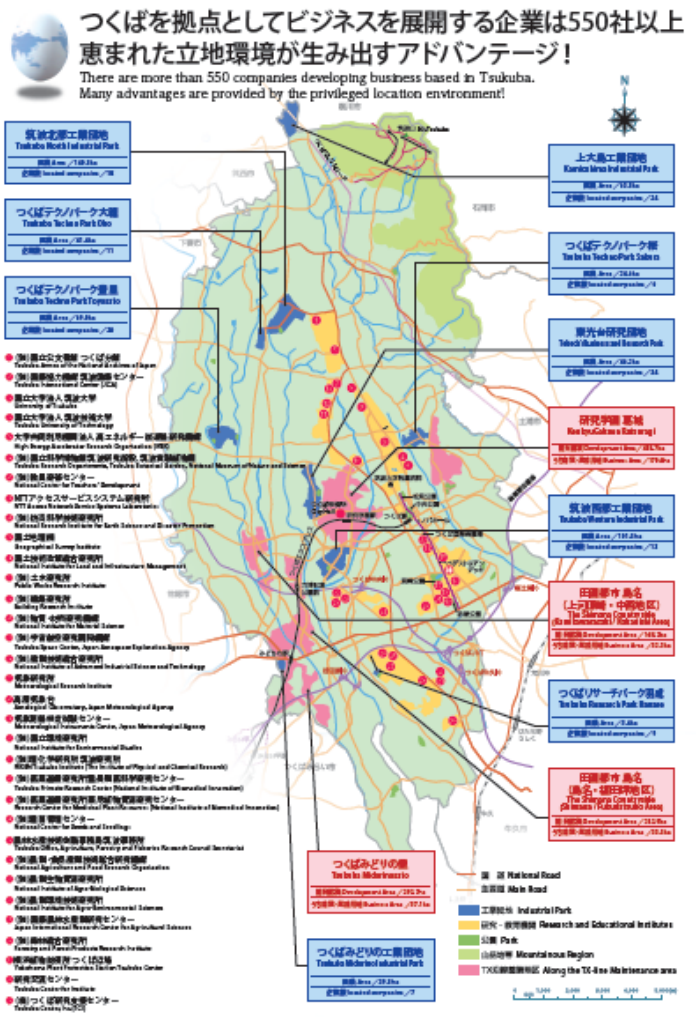
The “Surrounding Development District” covers about 25,700 hectares and is home to many private research institutes in its nine business and R&D industrial parks. Companies with facilities here include Astellas Pharma, Eisai, Kyouritsu , Ono Pharmaceutical, Tsukuba Research Laboratories and Takeda Pharmaceutical.

Aiming to become Japan's flagship science and technology hub, Tsukuba Science City has received nearly half of Japan's public R&D budget over the past several decades and has succeeded in being one of the world's key sites for public-private partnerships (PPP) in basic research in areas such as microbiology, next-generation cancer therapy and plant genetics. Tsukuba Center, Inc. (TCI) provides various rental laboratories and offices, promotes industry-academia-government collaboration and fosters the development of entrepreneurial ventures (more than 205 venture companies have had their start in Tsukuba).

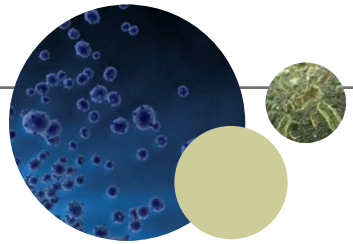
## Outlook

In 2011, the city was designated as one of the seven national “Comprehensive Special Zones for International Competitiveness Development,” strengthening its status as an industrial base and as a platform for science-and-technology based innovation. Leading projects include the establishment of a global nanotechnology research and education complex. Tsukuba Global Innovation Promotion Agency promotes Tsukuba’s International Strategic Zone to transform the city into an international hub of research institutes producing and raising global-scale projects. One of its challenges is to transition from pure or “seed” research to “needs” research that can be commercialized. Tsukuba is also applying for Strategic Global Innovation center status to secure benefits such as tax breaks for small and medium-sized businesses, infrastructure development and training for overseas personnel.

By 2030, the total population of Tsukuba is projected to exceed projections and reach 100,000 in the “Research and Education District” plus 250,000 in the “Surrounding Development District.”



Sources: map and photo from City of Tsukuba website



## *Stable political structures, strong intellectual property protection and favorable regulatory and tax policies make Singapore an attractive business location.*

### Global trends

The aftereffects of the recession, coupled with the European sovereign debt crisis, continue to plague business operations in the mature market clusters of North America and Western Europe, including those of life sciences companies of all sizes and maturity levels. Although most life sciences companies continue to enjoy higher profit margins than those of other industry segments, it has become markedly clear that the product development formula of the past no longer applies. As a result, greater emphasis is being placed on the next wave of drugs and treatments – those stemming from biological organisms. Additionally, companies are increasingly diversifying their portfolios to mitigate risk and help fund the lofty costs of innovation, adding generic brands, crop and animal science and even consumer products through mergers and acquisitions.

New product developments have become ever more costly and difficult to achieve. Drug makers are attempting to achieve greater breakthroughs with less funds than in years past. The need to increase a company's likelihood of developing a new treatment continues to steer conversations around location strategy. Although many companies maintain R&D in mature markets rich with people capital and renowned research universities, others are turning to emerging global clusters due to dedicated private and public funding.

### Singapore market overview

Overall pharmaceutical sales reached SGD 901.0 million (USD 725.6 million)[1] in 2011 in Singapore according to Business Monitor International. Positive factors such as high income levels (GDP per capita is the highest in Asia), a universal and affordable healthcare system, excellent ratios of doctors and hospital beds per capita are tempered by the limited population size as Singapore is one of the smallest markets in the region.

Despite the modest size of its domestic market, Singapore has the ambition of staying one step ahead of its geographic neighbors and of becoming the "biopolis of Asia." While India and China will flourish due to their immense markets, Singapore's mature business environment and established status as a distribution center make the island country a desirable launching pad into other regional markets. As a result, biomedical sciences (BMS) accounted for 6.0 percent of Singapore's GDP and BMS manufacturing output was more than SGD 23.0 billion ($18.4 billion)[1] in 2011.

Singapore has a few home-grown companies and has become a top destination for research and clinical research services. Leaders of Asia Pacific research and contract research companies continually identify Singapore as a destination of choice for their regional headquarters. Foreign pharmaceutical companies having R&D bases in Singapore include Abbott Labs, Cell Research Corp, GlaxoSmithKline, Novartis and Takeda.

A large number of multinational pharmaceutical corporations have also established the base of their Asia Pacific manufacturing operations in Singapore. With over 100 biomedical sciences firms, Singapore is home to manufacturing facilities of eight of the top 10 pharmaceutical companies and most of the top medical technology companies. Collectively, they have invested in dozens of commercial-scale manufacturing facilities in Singapore. Illustrating the shift toward the higher end of the value chain, former API or semiconductor facilities have been successfully converted into pharmaceutical facilities.

The segments receiving significant investments include the biologic manufacturing sector, with Baxter, GlaxoSmithKline, Lonza and Roche announcing over SGD 2.5 billion ($2.0 billion)[1] in capital expenditure to set up their biologic facilities. Neutroceuticals are also present in Singapore, in particular, with the presence of Mead Johnson Nutritionals.

With a disproportionately large volume of pharmaceutical trade flowing in and out of the island (compared with the size of the country), Singapore acts as a trading hub to connect Southeast Asia and the Western world and also a major re-exporter of pharmaceuticals. Retail medicaments and raw materials account for significant proportions of the trade surplus.

[1] Six-month average conversion rate of 1.25 Singapore Dollars (SGD) per U.S. dollar, as of October 2012.

### *Industry statistics*

**12.0** Researchers in science, per thousand total employment

Total patent applications, residents only **895**

**2.3%** Gross expenditure on R&D, as percent of GDP

*Sources: UNISCO Institute for Statistics, the World Bank*

Location-wise, life sciences activity in Singapore largely occurs in several dedicated parks. The largest research park, Biopolis, is located in one-north, Singapore's ongoing business park under development by JTC Corporation. Also developed by JTC Corporation, the Tuas Biomedical Park (TBP) is a 371-hectare biomedical manufacturing cluster located within the larger Tuas industrial zone in Singapore's western region.

Separately a specialized center, termed MedTech Hub, was launched in April 2012 to cater to medical technology sector. The first project, a multitenanted building called MedTech 1, offers cost savings by providing shared facilities such as sterilization services, specialized warehousing and logistics services to smaller manufacturers, suppliers and service provides in the biomedical science cluster.

Thanks to good connectivity with key Asian markets, secure infrastructure and efficient customs, Singapore presents a strategic home base for companies to tap into the region's fast-growing healthcare markets. Leading Third-Party Logistics (3PLs) providers have set up dedicated life sciences facilities in the city, and Singapore Airport Terminal Services also offers a temperature-controlled Coolport facility. Specialized logistics services parks developed to facilitate pharmaceutical companies' supply chain management and regional clinical trials coordination continue to be in demand.

## Industry framework

### Intellectual capacity

Over 16,000 individuals are employed in the industry, a highly skilled and reliable workforce that includes more than 6,000 researchers from across the globe. Aware that R&D is dependent on the presence of talent, the Singaporean government has shaped the local education system to develop graduates with skills for work in life sciences, promotes life sciences studies and adapts curricula to fit the industry's needs.

### Innovation capital

Two leading research universities are the source for a large share of innovation in Singapore. The National University of Singapore (NUS) has three centers of excellence relevant to the industry: Cancer Science Institute of Singapore, Mechanobiology Institute, Singapore and Singapore Centre on Environmental Life Sciences Engineering. Nanyang Technological University (NTU) offers additional centers, including the Biomedical Engineering Research Centre, the Centre for Biotechnology, the Centre for Chiral and Pharmaceutical Engineering, the Computer-integrated Medical Intervention Laboratory and the Physiological Mechanics Laboratory in addition to several interdisciplinary centers focused on nanotechnology. Both universities have expanded their research and industry-related graduate programs in recent years.

Government support for universities is provided via the National Research Foundation (NRF) and the Education Ministry. Aware that the development of a critical mass of human capital is crucial to the advancement of the domestic research capabilities, the NRF has funded several research centers of excellence, including the first two centers at NUS. More recently, it has developed a new Campus for Research Excellence and Technological Enterprise (CREATE) that hosts U.S. and European universities eager to establish presence in Asia, with the aim to be a talent magnet and innovation hub. The co-location of public institutions and private research companies in Singapore's largest research park, Biopolis, facilitates innovation support from the government.

### Fiscal and political resources

Known for a strong and focused industrial policy, the government is backing the pharmaceutical sector by offering attractive tax incentives, manpower training initiatives and financial backing to the healthcare industry. The incentives and grants offered by the government, in addition to the transparent and open business environment, have played a key role in attracting pharmaceutical giants to set up new R&D bases in Singapore.

The government continues its steadfast investments in growing R&D in Singapore. As part of the Research, Innovation and Enterprise (RIE) 2015 plan, SGD 16.1 billion ($12.9 billion)[1] has been earmarked, an increase of 20.0 percent over the previous plan and a commitment of 1.0 percent of GDP dedicated to research and innovation. Aiming to increase Singapore's gross expenditure on R&D (GERD) to 3.5 percent of GDP by 2015, the country is expecting a return on investment in terms of economic impact and commercialization of R&D.

The RIE sum allocated to biomedical R&D reaches SGD 3.7 billion ($3.0 billion)[1] over the next five years. The government has approved the establishment of Sector Specific Accelerators (SSA) to identify, invest and grow start-ups in strategic but nascent sectors, starting with the Biomedical Science Sector. With an initial focus on the Medical Technology (MedTech) subsector, SGD 40.0 million ($32.0 million)[1] has been set aside to pilot the SSA initiative via the Biomedical Science Accelerator (BSA).

To support the growth of the industry, the government has designated several boards and councils:

- Singapore's Economic Development Board (EDB). Its Biomedical Sciences Group (BMSG) promotes private sector manufacturing and R&D activities while Bio*One Capital functions as the biomedical investment arm of EDB.
- Singapore's Agency for Science, Technology and Research (A*Star). The Biomedical Research Council (BMRC) of A*Star funds and supports public research initiatives.
- Ministry of Health (MOH) – Its National Medical Research Council (NMRC) funds and supports public research initiatives, as well as awards medical research fellowships for the development of medical research manpower.
- Singapore's Biomedical Sciences Industry Partnership Office (BMS IPO).
- Singapore's National Research Foundation (NRF).

Many of the government councils work in close partnership. The BMRC works with the EDB's Biomedical Sciences Group and Bio*One Capital on the Singapore Biomedical Sciences (BMS) initiative. The BMS initiative seeks to develop the biomedical sciences sector into one of the country's economic pillars through a three-phase program running from 2000 through 2015. The

[1] Six-month average conversion rate of 1.25 Singapore Dollars (SGD) per U.S. dollar, as of October 2012.

overall emphasis for BMS Phase 3 (from 2011 to 2015) is the greater amalgamation of activities across the entire BMS community, including public and private sector performers, hospitals and government agencies.

Multiple local and international venture capital (VC) funds are managing billions of dollars worth of funds in Singapore, a substantial amount invested in biomedical industries. Funding programs are available for companies looking to establish manufacturing facilities or R&D centers. Government-affiliated funds such as the Economic Development Board (EDB) are offering investments or channeling money for seed capital, R&D and manpower development. Additionally, foreign direct investments (FDI) into the pharmaceutical industry continue to grow after briefly declining during the global financial crisis.

## Outlook

Espicom projects a high, single-digit 2012–2017 CAGR for the Singaporean pharmaceutical market, while the EDB aims to hit a biomedical sciences manufacturing output of SGD 31.3 billion ($25.0 billion)[1] by 2015, up from SGD 26.3 billion ($21.0 billion)[1] in 2010. By segment, local industry experts forecast the highly lucrative OTC market to grow by 11.0 percent to 15.0 percent a year, boosted by the country's rising elderly segment, and Espicom expects the biologic sector to grow on the back of massive investment by several large multinational companies setting up biologic facilities.

Singapore is already active among contract research and manufacturing sectors of the industry and hopes to increase penetration into high-tech aspects of research and innovation. The Economic Development Board encourages multinationals coming to Singapore to focus on the higher value-add parts of the business, and prefers to collaborate with the Indonesian and Malaysian government to locate facilities in Batam or Iskandar for manufacturing lower value-add drugs, such as generics. The government is increasing its investment in biomedical sciences research over the period 2011 to 2015.

Strong intellectual property protection laws have already supported growth in the industry. The country is home to several research start-up companies and has attracted investment by large biotech and pharmaceutical firms. Strong infrastructure, strong representation from the industry and government support is expected to help Singapore expand manufacturing and research aspects of the value chain.

[1] Six-month average conversion rate of 1.25 Singapore Dollars (SGD) per U.S. dollar, as of October 2012.

*Investment Highlight*

Abbott's nutritional powder manufacturing plant in Singapore, source: Abbott Singapore website

### Large investments in Singapore

- Completed in April 2008, Abbott's nutritional powder manufacturing plant in Tuas Biomedical Park 2 is the company's first major capital investment in Asia and its largest nutritional investment ever. The SGD 450.0 million ($360.0 million)[1] fully integrated facility produces powder nutritional products for local consumption and regional exports. Key unit operations include wet processing, evaporation, spray drying, blending and packaging in addition to extensive laboratory facilities and state-of-the-art process control and enterprise planning systems. Abbott operates other facilities in Singapore via Abbott Diabetes Care (design, development and manufacturing of pioneering blood glucose monitoring systems for both home and hospitals), Abbott Diagnostics and Abbott Medical Optics.
- In 2011, Merck announced an investment of SGD 312.5 million ($250.0 million)[1] over the next 10 years to improve its Tuas manufacturing facilities. With about 1,500 employees in Singapore, Merck will also add capability to its biotech operations to support new product launches and collaborate with local universities to enhance its local workforce's technical expertise. Since it established manufacturing operations in Singapore 1996, Merck's investments in the country have amounted to close to SGD 1.9 billion ($1.5 billion).[1]

# Biopolis

## Overview

Biopolis is part of a much larger planned development called "one-north," Singapore's ongoing business park under development by JTC Corporation. Created to provide space for private companies and public scientific or educational bodies to collaborate in biomedical research, Biopolis is adjacent to the National University of Singapore and the National University Hospital.

Phase I of Biopolis, a 185,800-square-meter, integrated biomedical research complex, was completed in 2003. Out of the seven buildings linked by sky bridges, five are designated for public institution use. Two thousand scientists work there. The 111,500-square-meter space allotted to laboratories includes 35,000 square meters occupied by public research institutes such as the Genome Institute of Singapore, the Bioinformatics Institute and the biomedical research institutes of the Agency for Science Technology and Research (A*Star) that oversees scientific efforts under Singapore's Ministry of Trade and Industry and hosts scientists of 50 nationalities.

Phase II, completed in 2006, added two buildings totaling about 40,000 square meters. In 2011, Phase III delivered two additional buildings, totaling some 42,000 square meters. Phase IV is entirely taken up by Procter & Gamble for their SGD 250.0 million ($200.0 million)[1] Innovation Centre, to be completed in 2013. The purpose-built facility will house 400 researchers collaborating with A*STAR on strategic upstream corporate research focusing on new innovations for consumers.

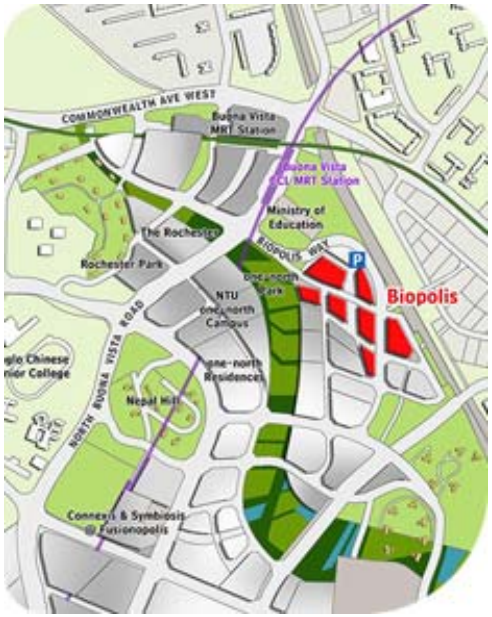
## Outlook

Phase V of Biopolis will be completed in 2013 and targets a Green Mark Gold Plus certification. Situated on a land area of 9,621.4 square meters, this phase is meant to improve lab design for clinical trial support and to cater to increased demand for biomedical research, with two towers providing a GFA of just under 47,000 square meters.

JTC Corporation's ambition is that, when fully developed, the Biopolis will anchor the development of the entire R&D value chain of life sciences in Singapore.

[1] Six-month average conversion rate of 1.25 Singapore Dollars (SGD) per U.S. dollar, as of October 2012.

*Source: www.jtc.gov/sg*




Biopolis site plan, *source: www.jtc.gov/sg*

***A key feature of Biopolis' Phase V biomedical research facility will be 1,000 square meters of new, ready-fitted laboratories called Shell-plus. Equipped with mechanical, ventilation and air conditioning system, finished vinyl flooring, basic laboratory furniture and ready-fitted fume hoods, the new laboratories will save biomedical SMEs and start-ups time and resources during their initial set-up phase.***

# Tuas Biomedical Park (TBP)

## Overview

Tuas Biomedical Park (TBP) is a 360-hectare stretch of ready-prepared and specifically zoned land set aside by the Singaporean government for pharmaceutical and biologics manufacturing, with an investment of SGD 44.0 million ($35.2 million)[1] and SGD 53.0 million ($42.4 million)[1] into TBP's two phases. Developed by JTC Corporation, TBP is located within the larger Tuas industrial zone in Singapore's western region. Strategically positioned to provide companies with access to skilled talent, research expertise and air and sea logistics, with the two industrial parks dedicated to manufacturing-related activities for pharmaceuticals, biopharmaceuticals, biologics, vaccine, medical devices and nutrition-related companies.

TBP offers "plug-and-play" opportunities, as well as build-to-suit opportunities for pharmaceutical manufacturers. Most of TBP 1 is occupied or reserved by leading, global biomedical companies such as Pfizer, GlaxoSmithKline, Novartis, Abbott, Roche, Merck Sharp & Dohme, Wyeth Nutritionals, Lonza and Genentech Singapore.

The 20 commercial-scale facilities house process development operations and manufacture active pharmaceutical ingredients (APIs) and novel medicines. Pfizer and MSD GmbH have partnered with Tuas Power to develop state-of-the-art tri-generation facilities. MedTech Hub launched a specialized center in April 2012. Its first multitenanted building, MedTech 1, is under construction and will offer cost savings through shared facilities such as sterilization services, specialized warehousing and logistics services to manufacturers, suppliers and service providers in the biomedical science cluster. Biosensors International, the first firm to set up at the hub, is leasing about 12,000 square meters of space to build a SGD 95.0 million ($76.0 million)[1] facility.

## Outlook

Demand for land at TBP is still active. JTC Corporation achieved a net allocation of prepared industrial land of 1.1 hectare and 18.3 hectare for first half of 2012 and the whole year of 2011, respectively. The nearby port facilities and the planned closer transport links with Malaysia provide seamless access to overseas markets, which value Singapore's products.

[1] Six-month average conversion rate of 1.25 Singapore Dollars (SGD) per U.S. dollar, as of October 2012.

Inside a TBP facility, *source: www.jtc.gov/sg*

TBP site plan, *source: www.jtc.gov/sg*

***A park catered for high-value biomedical manufacturing, TBP boasts of many firsts in Singapore as firms set up new, large-scale installations there. GSK Biologicals built the first bulk vaccine plant in Asia Pacific in 2009, and Genentech installed the first microbial-based biopharmaceutical manufacturing facility.***

# Appendix

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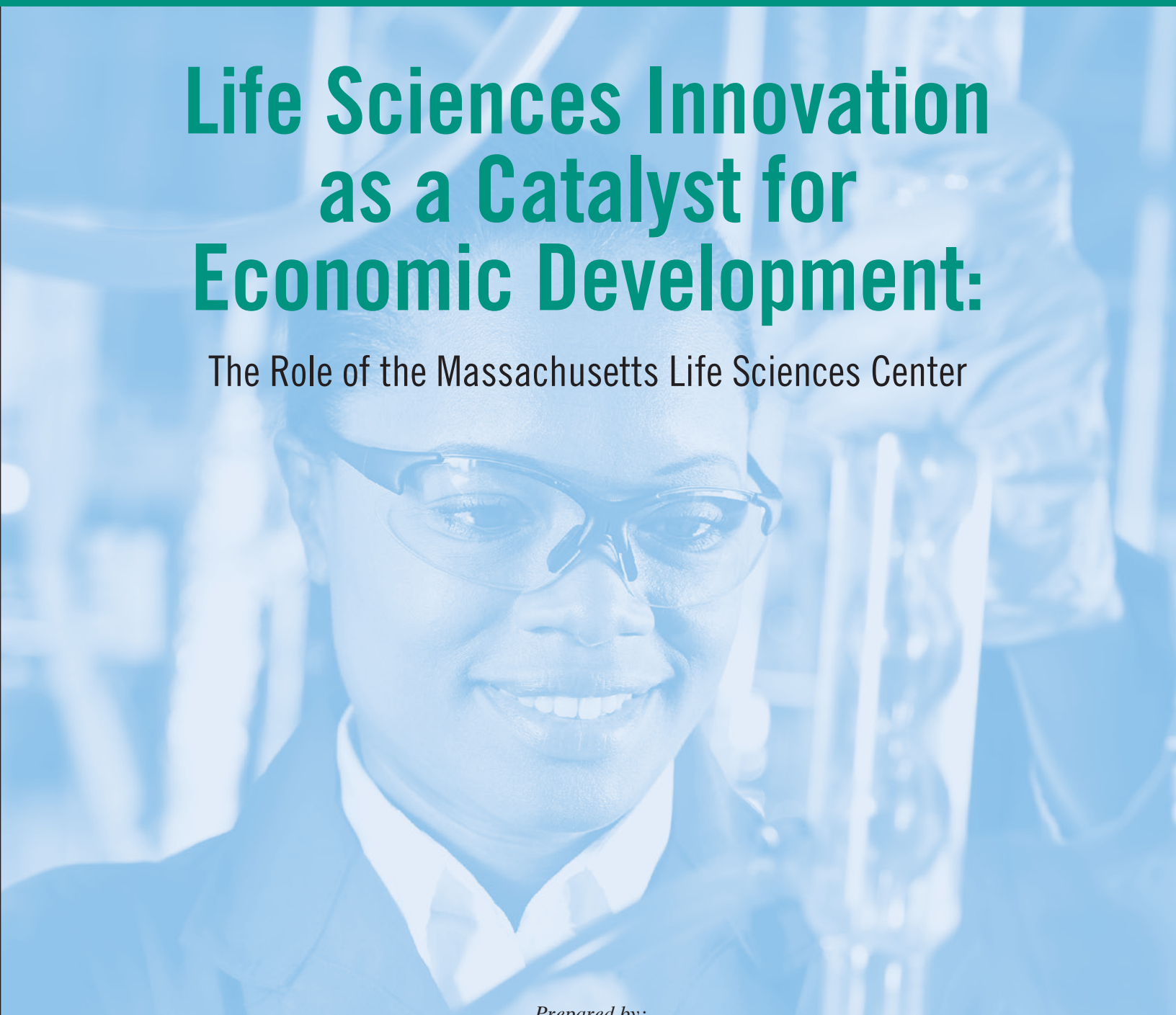
# Life Sciences Innovation as a Catalyst for Economic Development:

## The Role of the Massachusetts Life Sciences Center



*Prepared by:*

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**The Boston Foundation**

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## About the Authors

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# Life Sciences Innovation as a Catalyst for Economic Development:

## The Role of the Massachusetts Life Sciences Center

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# Preface

In 2003, a distinguished group of university leaders, educators and business representatives came together for a unique and unprecedented summit, spearheaded by Harvard Business School professor Michael Porter and hosted by the presidents of MIT and Harvard, Susan Hockfield and Drew Gilpin Faust. This was the same year those two universities played a major role in the international team that cracked the human genome.

The summit's purpose was to discuss the state's life sciences "super cluster," meaning all of the many sectors that are involved in the life sciences. Everyone attending agreed that strengthening the life sciences was not only smart and played to our state's strengths, it was crucial to our future global competitiveness. It could mean jobs for hundreds of thousands and billions added to the Massachusetts economy.

While the summit was stimulating, there was no established vehicle to build on the momentum that it generated. And so, in 2005, the Boston Foundation provided a grant of $125,000 to create the Massachusetts Life Sciences Collaborative. The Organizing Committee for the new group included the leaders of all of the Boston area's major universities, teaching hospitals, life-sciences companies and venture-capital firms.

In March of 2007, Governor Deval Patrick spoke at one of the Collaborative's meetings about the importance of the life sciences to the Commonwealth. He previewed an announcement he would make publicly later that year about the creation of a new Massachusetts Life Sciences Initiative, which represented a 10-year, $1 billion investment to enhance and strengthen the state's leadership in the life sciences.

The Boston Foundation was honored to play a major convening role in bringing together the stakeholders for those early discussions. And now we are proud to publish this first report on the Massachusetts Life Sciences Initiative and the work of the quasi-public agency charged with carrying out its mission.

We have published many reports researched by the lead author of this report, Barry Bluestone, Director of the Kitty and Michael Dukakis Center for Urban Affairs at Northeastern. Reports from the Dukakis Center are always thorough and compelling, but not all of them carry good news. This one does, especially when it comes to economic impact. The $56.6 million Massachusetts awarded in tax incentives to life sciences firms between 2009 and 2011 has created 2,500 jobs, which should generate more than $266 million in wages and salaries during the next five years. In fact, the Commonwealth's life sciences super cluster has risen to number one in the nation in terms of per capita employment, with close to 14,300 jobs for every one million residents.

These jobs are not just for workers with advanced degrees: at least one in five require no more than a two-year associate's degree and another 48 percent require just a bachelor's degree. For the Boston Foundation, this confirms our deep investment in supporting the full education pipeline and the importance of preparing college students for well-paying jobs in a field that will only grow.

Estimating the economic impact of this life sciences super cluster is within our grasp. Evaluating its broader value to society is daunting because of the almost limitless potential it has for improving the lives and well-being of people here in Massachusetts and around the world.

Paul S. Grogan
President & CEO

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# Executive Summary

This report provides an up-to-date, independent evaluation of the $1 billion, 10-year Massachusetts Life Sciences Initiative and the Massachusetts Life Sciences Center (MLSC) charged with the responsibility of carrying out its mission. The initiative was established in July 2008 by Governor Deval Patrick's Administration and the Legislature to encourage the growth of discovery and production in the life sciences, including biotechnology, pharmaceuticals, medical diagnostics, medical devices and bioinformatics in the Commonwealth. Based on the region's existing comparative advantage in life sciences research and development (R&D) emanating from the laboratories of its leading universities and medical institutions, this substantial infusion of public funds was undertaken with the ambitious goal of making this cluster of industry sectors the most successful in the world.

This evaluation comes at a propitious time, given the state of fiscal affairs in the Commonwealth and the nation. Virtually every unit of government is scrutinizing the use of each tax dollar to ensure that public revenue is being spent effectively and efficiently. Put simply, our goal in this evaluation was to gather as much data as possible to assess whether the Commonwealth's sizeable commitment of public resources is paying off in the form of a life sciences "super cluster" capable of attracting massive amounts of investment dollars, generating well-paying jobs for Massachusetts residents and yielding additional tax revenue for the Commonwealth.

## The Life Sciences Super Cluster and the MLSC

After it was created, the MLSC sought to develop as a key element of its strategy the creation of a collaborative "ecosystem" encompassing all aspects of the state's life sciences. It would do this by encouraging the development of a dense, highly connected community of scholars, entrepreneurs, industry leaders, venture capitalists and government officials who were all dedicated to the success of this sector. Unlike many narrowly focused state economic development initiatives, the Center has chosen to guide its investments with a broad range of strategic priorities geared to enhance all aspects of the life sciences cluster. These include:

- funding translational research that converts new discoveries into marketable products and services
- investing in promising new technologies
- ensuring worker skill acquisition that aligns with the needs of life sciences industries
- creating new infrastructure with shared resources to accelerate life sciences innovation
- building partnerships among segments of the local and international life sciences communities

To accomplish these goals, the Center relies on a portfolio of seven distinct programs. These include:

**Cooperative Research Grants** to support industry-sponsored research at universities in order to facilitate scientific discoveries that lead to medical applications. These grants match industry contributions dollar for dollar.

**Internship Challenge Program** to provide funds for interns working at start-up and smaller Massachusetts life sciences companies.

**New Investigator Grants** to spur innovative research and advance the careers of new investigators working on cutting-edge research at academic research centers in Massachusetts.

**Life Sciences Accelerator Loan Program** to make loans available to early-stage companies and help leverage additional sources of capital.

**Small Business Matching Grant (SBMG) Program** to provide matching support to firms on the verge of commercializing new technologies developed with Phase II or Post-Phase II federal Small Business Innovation Research (SBIR) awards or federal Small Business Technology Transfer (STTR) grants.

**Life Sciences Tax Incentive Program** to offer a combination of 10 competitively awarded tax incentives available to companies that meet specified hiring goals.

TABLE 1
**Distribution of MLSC Investments by Dollar Amount (June 2008–June 2012)**

| | |
|---|---|
| Capital Projects (12) | $186,950,000 |
| Company Grants and Accelerator Loans (31) | $22,907,000 |
| Academic Research Grants (35) | $23,346,344 |
| Tax Incentives (56) | $56,595,093 |
| Interns Funded for Workforce Development (884) | $6,903,164 |
| Equipment and Supply Grants for Schools (32) | $3,333,675 |
| Other Grants/Business Plan Competitions | $1,540,000 |
| **TOTAL** | $301,575,276 |

Source: Massachusetts Life Sciences Center, 2013

**Capital Projects Fund** to provide capital for equipment and supplies for high schools in Gateway Cities, vocational/technical schools, and community colleges; and for capital projects at academic/research institutions, business incubators, and other not-for-profit organizations.

Between 2008 and June 30, 2012, the Center directly invested or committed more than $300 million in state funds that have leveraged more than $1 billion in third-party investments by private businesses, the federal government and foundations, according to the MLSC *FY2012 Report*. **Table 1** provides a breakdown of these investments.

## Special Features of the Massachusetts Life Sciences Center

Our analysis revealed that, aside from its extraordinarily broad mandate, there are other factors that make the MLSC quite different from most government subsidy programs.

First, the MLSC operates under a Board of Directors that includes state government officials, but also industry CEOs, leaders from academia and medicine, bioscience researchers and others who have great knowledge of the life sciences.

Second, MLSC accelerator loans and other investments are reviewed by a panel of more than 200 specialists who advise the Center's Scientific Advisory Board (SAB), which itself is dominated by academic researchers, industry scientists, and private venture-capital experts who together can judge both the scientific and economic potential of an MLSC investment. Accelerator loans are also reviewed by private venture-capital experts who can assess the economic potential of recipient firms.

And third, the Center insists on accountability in terms of private sector investment matches. The Center also retains the power (and has utilized it) to "claw back" tax incentives if and when specific job creation goals are not reached by grant recipients.

We discovered from our interviews with life sciences executives, trade association leaders and members of the MSLC Scientific Advisory Board that the high level of professionalism associated with the Center's expert-based review process has resulted in MLSC investments that appear to have a high rate of return for the Commonwealth. We will return to this point, but must first touch upon a finding even more important than the measured rates of return to specific MLSC programs.

## New vs. Old Growth Theory

To properly assess the value of the Life Sciences Initiative and the MLSC, it is useful to place its activities in the context of economic growth theory. What is now known as the "old growth theory" suggests that economic prosperity springs from the accumulation of ever greater stocks of the fundamental ingredients of production: capital, labor and natural resources. Those countries that find ways of increasing investment in plant and equipment, adding to labor supply and extracting more natural resources are the ones that will become more affluent.

While not completely discounting this approach to growth, a "new growth theory" has evolved that places technological progress at the very epicenter of growth dynamics—even more important than capital, labor and resource inputs. Advances in technology and interdependencies between new ideas and new investment provide the basis for entire new industries and products that generate additional wealth and raise living standards.

Innovation-based growth is so powerful because it avoids the classic problem of diminishing returns on any given investment. With this type of growth, once the fixed cost of creating a new technology has been incurred, the formula can be used over and over again at little or no cost. As such, there can be increasing returns paying enormous dividends to society.

Moreover, the new innovation-based growth theory

posits a strong reciprocity among the rate of skill acquisition by workers, investments in new capital and new inventions. Thus, programs that combine incentives for innovation along with resources to augment human capital should fuel rapid economic growth more than anything else society can do to promote prosperity.

What is special about the Massachusetts Life Sciences Initiative is that it focuses explicitly on increasing the rate of innovation by encouraging more research and development (R&D) in the life sciences and helping small firms in this super cluster convert basic research into marketable products and services. New growth theory posits that this activity is the very fountain of economic growth.

## Has the MLSC Been Successful?

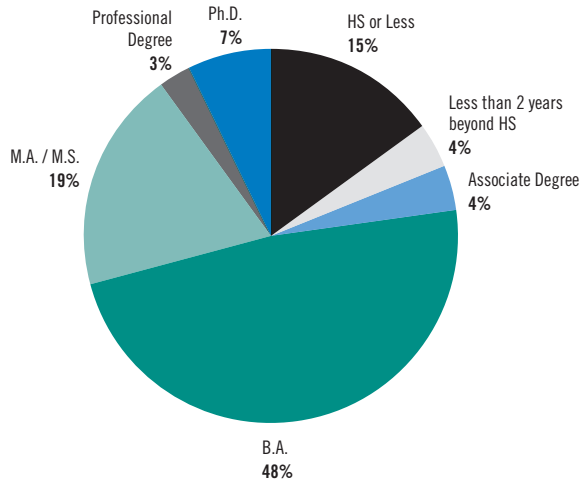
Unfortunately, keeping score on the success of innovation is difficult. Instead of a more-or-less certain return to a given infusion of capital under the old growth theory, under the new growth theory, innovation tends to deliver stronger long-term growth but it is "lumpy, discontinuous, and nonlinear." There can be a long gap between the time a new innovation is first incorporated into production and the time that it pays off in terms of increased productivity, output and jobs. In the short term, it can be discouraging, as investments in fundamental innovation usually have little immediate payoff. It will take decades to realize the full benefits to humanity and the economy from the advances now being made in drug discovery, medical diagnostics and medical devices.

What we can do is measure the short-term direct benefits of MLSC investments and consider the views of experts as to whether the Center has indeed played a critical role in creating a life sciences "ecosystem" that attracts investment and generates jobs in this sector.

### Short-Term Benefits

As for the short-term benefits, we conducted a cost-benefit analysis of the Center's tax incentive program. According to our analysis based on MLSC data, the total value of tax incentives outstanding to Massachusetts life sciences firms as of June 30, 2012 was $56.6 million. Our best estimate is that a little over 2,500 jobs were created as a result of these incentives. Given the average $105,000 salary of these jobs, we predict they will generate more than $266 million in wages and salaries during the next five years. If our analysis proves correct, these workers will pay more than $93 million in state personal income and sales taxes during that period. As such, assuming all of these jobs were directly related to the tax incentives and that these jobs last at least five years, every dollar of tax incentive will repay $1.66 to state coffers, as **Table 2** reveals. This is an outstanding rate of return.

FIGURE 1
**Education Distribution of New Hires by 2010 MLSC Tax Incentive Awardees**




Source: Dukakis Center for Urban and Regional Policy

What is more, our analysis suggests that these jobs will go to a broad array of workers, not just those with advanced degrees. As **Figure 1** reveals, more than one in five jobs in life sciences firms require no more than a two-year associate's degree and nearly another half (48%) require no more than a bachelor's degree. Thus, the short-term benefits of MLSC tax incentives seem to have heavily outweighed the costs and the job benefits are broadly shared.

## The Unique Growth Pattern of Regional Life Sciences Clusters

The most important benefits stemming from MLSC activities, however, will come in the future. This is due to the unique growth pattern of highly innovative sectors like the life sciences. The regional concentration of life-sciences companies happens in a very different manner than in other industries. In the case of traditional industrial sectors such as auto, aircraft engine, financial services and the like,

TABLE 2

## Economic Return on the MLSC Tax Incentive Program

| | Program Year 2009 | Program Year 2010 | Program Year 2011 | 3 Years of Incentives |
|---|---|---|---|---|
| Total Value of MLSC Tax Incentives ($) Outstanding | $15,245,500 | $20,672,638 | $20,340,884 | $56,259,022 |
| Net New Jobs Created | 901 | 721 | 915 | 2,537 |
| Tax Incentive per Job ($) | | | | $22,175 |
| Annual Tax Incentive per 5-year job ($) | | | | $4,435 |
| Average Salary per Job ($) | | | | $105,037 |
| Total Salaries Generated per Year ($) | | | | $266,479,399 |
| State Income Tax Revenue per Job per year ($) | | | | $4,937 |
| Total State Income Tax per year ($) | | | | $12,524,532 |
| Average Sales Tax per Job ($) | | | | $2,404 |
| Total State Sale Tax per year ($) | | | | $6,099,447 |
| Total Income+Sales Taxes per year ($) | | | | $18,623,979 |
| Average Income+Sales Tax/Job per year | | | | $7,341 |
| Total Income+Sales Taxes per 5-year Job | | | | $36,705 |
| Total Income+Sales Taxes over 5 years | | | | **$93,120,585** |
| **Tax Revenue/Incentive Ratio over 5 years** | | | | **1.66** |
| | **Pharma** | **Medical Devices** | **Scientific Research** | **Total** |
| Jobs | 1,843 | 481 | 213 | 2,537 |
| Average Salary ($) | $115,222 | $66,913 | $103,009 | $105,037 |
| Total Salary ($) | $212,353,256 | $32,185,280 | $21,940,863 | $266,479,399 |
| Share of Salary | 0.7969 | 0.1208 | 0.0823 | 1.0000 |
| State Income Tax By Sector ($) | $9,980,603 | $1,512,708 | $1,031,221 | $12,524,532 |
| Sales Tax by Sector ($) | $4,860,554 | $736,689 | $502,204 | $6,099,447 |

Source: Dukakis Center for Urban and Regional Policy

a region becomes dominant in a particular cluster once a large anchor enterprise or a small number of them establish operations in that locale. Once the anchor enterprise is established, an array of smaller firms is attracted to that region to serve as part of the supply chain for the large anchor enterprise(s). Essentially, the small firms in the industry are dependent on the large ones.

For the life sciences and other highly innovative sectors, the reverse is true. The large companies that depend on the development of breakthrough innovations and sophisticated medical devices prosper by being near a concentration of small start-up firms. Even the largest of the life sciences companies, with substantial research budgets, do not have the resources to generate more than a handful of breakthroughs in the biosciences, genomics and similar fields. These big firms grow and prosper by carefully monitoring the scientific discoveries under way in university research laboratories and in the translational research carried out by small start-ups.

Those few start-ups that develop potential blockbuster drugs or devices become prime targets for acquisition by the larger firms. The secret to success in the acquisition process is being where the small firms are located. This permits the large companies to closely monitor the progress of smaller firms and buy the most promising ones before "Big Pharma" competitors or other medical device manufacturers can make a bid. To use a metaphor from nature, the large, globally important life sciences firms want to feed in the waters where the minnows are swimming.

Because Massachusetts has so many small life sciences firms, nine of the world's ten major drug companies have now set up shop in the Commonwealth. They are

investing billions in plant and equipment and creating thousands of additional jobs. These include Pfizer, Novartis, Johnson & Johnson, GlaxoSmithKline, Sanofi (which absorbed Genzyme), AstraZeneca, Abbott Laboratories, Merck and Bristol-Myers Squibb.

And here is the key to understanding the central role of the MLSC: While the large firms can easily exist without the MLSC's direct investments, the small life-sciences ventures need the Center to provide them with accelerator loans, research and development funds, and interns who can help them translate their ideas into commercially viable products. While the private venture capital market may provide some funds for this purpose, venture capitalists often demand a quicker return than can be obtained from this sector, which often has long lag times between initial research, proof of concept and a final product approved by the U.S. Food and Drug Administration.

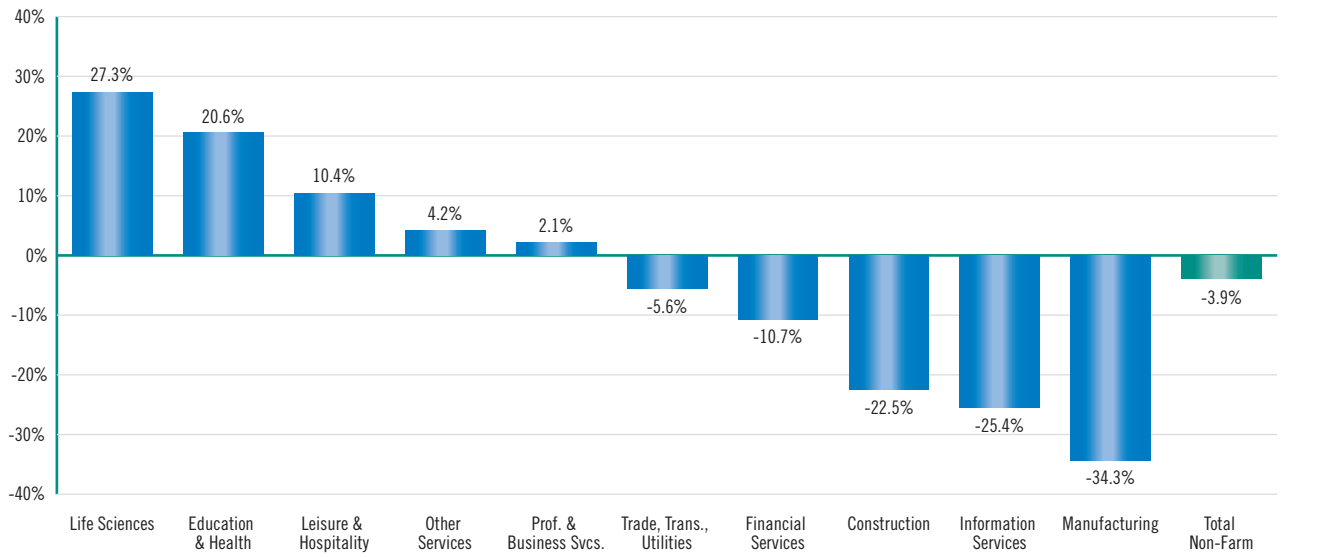
In this environment, the MLSC has become an important investment partner for smaller life sciences firms that grow out of local research universities and medical centers. By providing funds for translational research and development, the MLSC can help keep these growing companies in the Commonwealth instead of losing them to investment funds in other regions. To revert to metaphor again, it's because these minnows stay here that Big Pharma has come to swim in this pond. In addition, Big Pharma benefits from the Center's investments in workforce development, shared infrastructure resources and cooperative research projects between industry and academia. The result has been extraordinary output and employment growth.

## The Massachusetts Life Sciences: A Record of Output and Employment Growth

The numbers are, indeed, impressive. As of 2012, according to the Massachusetts Biotechnology Council (MassBio), 1,198 life sciences companies were operating in New England and employing 103,006 workers. More than half of these firms are located in Massachusetts. Of all the Massachusetts firms listed in the 2012 MassBio directory, about half (514) are medical device companies; 232 are drug development firms; 147 are contract research and manufacturing enterprises and 146 produce research products and instrumentation for the life sciences.

The rapid growth in employment in the life sciences in Massachusetts provides a strong indication of how rapidly this sector is expanding. As **Figure 2** reveals, the life sciences far outpaced all other industry sectors between 2001 and 2011.

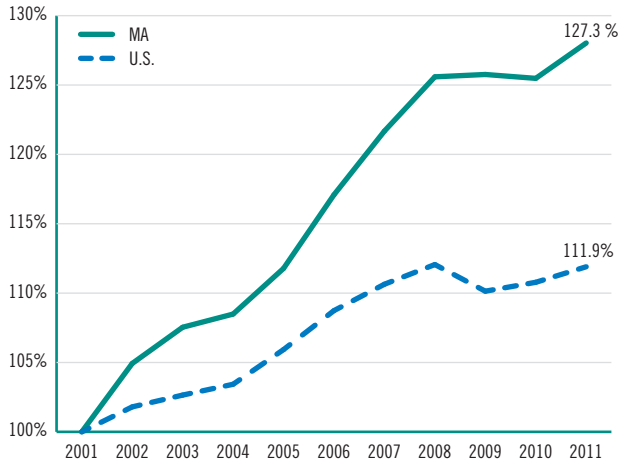
FIGURE 2
**Massachusetts Employment Growth by Industry Sector 2001–2011**




Source: BLS, Author's Analysis

FIGURE 3

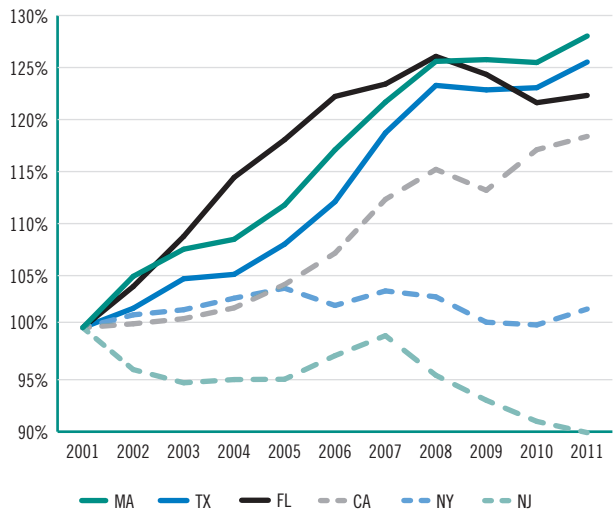
### Employment in Life Sciences Indexed to 2001, Massachusetts vs. the U.S.




Source: Author's Analysis from BLS data

FIGURE 4

### Employment in Life Sciences Indexed to 2001, Massachusetts vs. Big Competitor States




Source: Author's Analysis from U.S. Bureau of Labor Statistics (BLS) data

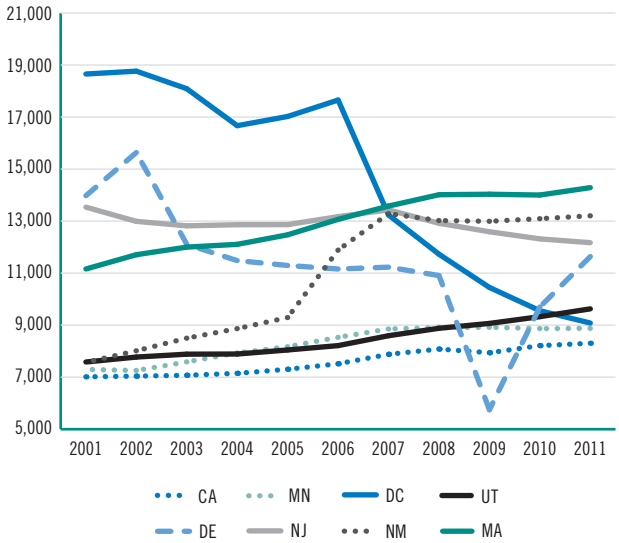
Even more impressive is the Boston-area super cluster's performance relative to the United States as a whole and to other states vying for supremacy in this rapidly evolving cluster of industries. The Commonwealth has indeed overtaken the rest of the nation in terms of employment growth in the life sciences, fulfilling an initial goal of the MLSC. **Figure 3** reveals the trend in life sciences employment in Massachusetts compared to that of the United States as a whole between 2001 and 2011. During this period, Massachusetts life sciences employment growth outperformed the nation by a factor of better than 2-to-1—growing by 27.3 percent vs. 11.9 percent for the nation.

The Commonwealth's main competitors in the life sciences are California, New Jersey, New York, Florida and Texas. But as **Figure 4** demonstrates, after 2008, the Commonwealth overtook all of these states in terms of the 2001-2011 employment growth rate.

Moreover, when we control for population size, Massachusetts is the clear winner for the entire life sciences cluster of industries. In **Figure 5**, we have controlled for the size of population of each state by measuring the number of life sciences jobs per 1 million residents. By 2011, given its rapid growth rate, the Massachusetts cluster had risen to #1 in terms of per-capita life sciences employment. With nearly 14,300 life sciences jobs for every 1 million residents, Massachusetts eclipsed all other states on this measure.

FIGURE 5

### Life Sciences Jobs per 1 Million 2010 Population Top 8 States in 2011, by Year




Source: Author's Analysis from BLS data

With this growth dynamic at work, Massachusetts appears well positioned to continue to attract new investment in the life sciences super cluster. In a 2011 analysis of the established life sciences clusters worldwide, the commercial developer Jones Lang LaSalle concluded that Boston had become the #1 region for the life sciences. The report noted the Boston area's concentration of high-tech research and hospital/medical employment, its many science and engineering graduate students, its plentiful funding from the National Institutes of Health and venture capitalists, its investment in R&D as a percentage of state GDP and its research facilities. Boston had a composite score of 7, ranking it #1 overall. New York/New Jersey was #2 with a composite score of 24, followed by the Bay Area and Los Angeles in California, each with a score of 25. Boston remained #1 in the developer's 2012 report, while San Diego, the San Francisco Bay area, Raleigh-Durham, N.C., and Philadelphia overtook New York/New Jersey and Los Angeles.

## Why Has the MLSC Been So Successful at Building the Life Sciences Ecosystem?

According to our interviews, the Center's successful record of investments in the life sciences is grounded in its reliance on a Scientific Advisory Board (SAB) along with a large panel of experts to guide the Center's Board of Directors in determining which firms show the greatest promise. This approach to distributing public funds has created credibility within the super cluster and its ecosystem. Over and over again, we heard adjectives like "rigorous" and "diligent" when our informants described the processes MLSC uses in selecting awardees and providing a platform for collaboration.

The interviews we carried out also suggested that the Center itself is being run quite effectively and efficiently and in a highly professional manner. Virtually all of our informants praised the management team and expressed special appreciation for the leadership's refusal to permit political considerations to trump scientific merit. Because the Scientific Advisory Board (SAB) selects awardees, "There is not an ounce of boondoggle in this agency," one informant told us. Another observed that the MLSC has "lots of moving parts" and all of them are working well. Several of the interviewees observed that the Center remains responsive to industry needs, meets its deadlines and stays focused on its mission. In its report on creating fiscally sound state tax incentives, the Pew Center on the States singled out the Massachusetts Life Sciences Tax Incentive Program for its focus on annual cost controls and its reliance on scientific merit in making awards.

Still another informant noted that the MLSC is successful because its leadership is committed to working "at the speed of business" and therefore has become a valued partner in the expansion of the industry.

## Conclusions

All of our research suggests that the state will benefit from fully funding the remaining five years of the initiative in order to maintain the lead the life sciences super cluster has established in the Commonwealth. This is particularly important as other states ramp up their investments in hopes of creating their own life sciences ecosystems to entice the small and large firms Massachusetts has successfully attracted. California, Maryland, New Jersey, New York, Minnesota and Florida are not resting on their laurels, but continue to spend state funds on their own life sciences industries.

Over time, it should be possible for the Center to reach out to the private sector to help fund more of its initiatives, as it has done with the newly established Massachusetts Neuroscience Consortium. This consortium, established in September 2012, combines the efforts of the MLSC with seven global biopharmaceutical companies to jointly fund pre-clinical neuroscience research at Massachusetts academic and research institutions. Based on this model and with the plethora of larger, profitable firms coming to the state to expand their operations, one could imagine the Center funding more of its internships with private funds and having for-profit companies contribute to other programs (STEM: science, technology, engineering and math education, for example), allowing the Center to focus even more of its resources on accelerator loans and tax incentives for firms undertaking translational research.

We should also note that the success of the MLSC has lessons for other quasi-public entities in the Commonwealth. We can mention five of them here:

1. Long-term success in the use of tax incentives and business loans is most likely to occur when funds are focused on a cluster of firms and a set of technologies in a given industry, helping to create an industrial ecosystem which can attract new companies to the state.

2. The use of expert panels to determine the awarding of loans assures that these funds will be well utilized. "Claw-back" provisions protect the taxpayers by requiring firms to repay funds advanced by the Commonwealth if they fail to meet hiring goals.
3. A focus on encouraging firms in their early stage innovation activity is central to promoting economic growth and prosperity.
4. Helping fund workforce development efforts for critical industries as part of the mandate of the quasi-public entity helps ensure a pipeline of skilled workers for the industry and this itself helps attract new firms to the region.
5. Taking a "portfolio" approach to the entire range of activities in the life sciences—from investments in small innovative firms to helping train the future workforce to underwriting infrastructure—helps sustain the "ecosystem," undergirding a virtuous cycle of discovery, innovation, investment, and employment opportunity.

In the end, we applaud the Governor and the Legislature for their foresight in creating the Massachusetts Life Sciences Center and the $1 billion Life Sciences Initiative and we tip our hat to the MLSC for carrying out its public responsibilities in a most effective and efficient manner. The programs in place are fulfilling the goals set out in the original legislation and the Center's leadership has ensured that these programs work to the full benefit of the Commonwealth and its residents.

# Introduction

The Massachusetts Life Sciences Initiative, conceived by Governor Deval Patrick's Administration and passed into law by the Massachusetts Legislature in July 2008, is a bold 10-year, $1 billion investment in the future of the state's economy. Based on the region's existing comparative advantage in the life sciences emanating from the laboratories of its leading universities and medical institutions, this substantial infusion of public funds was squarely aimed at making this cluster of industry sectors—including biotechnology, pharmaceuticals, medical diagnostics, medical devices, and bioinformatics—the most successful in the world. The Massachusetts Life Sciences Center (MLSC), founded two years earlier, was charged with the responsibility of implementing this bold experiment in public-private sector collaboration. If effective, the initiative was expected to boost investment and jobs in this evolving industrial sector, generating increased household income and tax revenue for the state.

In 2012, at the near halfway point of that 10-year initiative, the Dukakis Center for Urban and Regional Policy at Northeastern University was invited by the MLSC to measure the progress of the life sciences sector in Massachusetts and to carry out an evaluation of the Center's activities. We agreed to conduct such a study, but only under the condition that we would have full access to MLSC records, that our investigation would not be censored in any way by the MLSC staff, and that the staff of the Dukakis Center would have absolute control over the content of the final evaluation report. As a result, this report is being published by the Boston Foundation as part of its *Understanding Boston* series.

For the past year, Barry Bluestone, Director, and Alan Clayton-Matthews, Senior Research Associate at the Northeastern center, have carried out this evaluation. Both of us are economists who have extensive experience in industry studies and in program evaluation. Neither of us, however, was an expert on the life sciences sector when this evaluation project was first launched.

In the course of this research, we immersed ourselves in literature about the components of the life sciences industry cluster and about the role of public investment in innovation and economic growth. We analyzed existing employment data on each of the life sciences industries in the state; reviewed all of the annual reports of the MLSC; attended meetings of the MLSC Board of Directors where decisions over tax incentives and awards were made; and conducted lengthy interviews with leading executives of life sciences companies located in the state, industry trade association leaders, and members of the MLSC Scientific Advisory Board. This report is based on all of the data gathered over the year.

We began this research fully agnostic about what we might ultimately find, given the checkered record across the country of state industrial policy aimed at assisting other industries. But what we have found, based on our research, is that the Commonwealth's life sciences initiative is meeting, if not exceeding, the goals first established in 2008 by the Governor and the Legislature. Moreover, our interviews with key informants led us to the conclusion that the Massachusetts Life Sciences Center is executing its responsibilities in an effective, efficient, and professional manner. The initiative and the MLSC has performed exceptionally well in creating an *ecosystem* within which the cluster has prospered.

Moreover, we have concluded that the Center's mission, administration, and performance provide important lessons that can be applied to other state agencies charged with encouraging economic development.

This research could not have been carried out without the assistance of the staff of the MLSC and the many industry executives and experts who provided us with data and candid answers to our probing questions. We thank them all for their time and the information they afforded us.

CHAPTER ONE

# About the Massachusetts Life Sciences Center

In June 2006, the Massachusetts Legislature created a new quasi-public agency, the Massachusetts Life Sciences Center (MLSC), to promote the life sciences within the Commonwealth. It was tasked with "investing in life sciences research and economic development . . . by making financial investments in public and private institutions."[1] Its mandate was broad: to encourage basic research, development, and commercialization in the biosciences; ensure the preparation of a skilled workforce to meet the needs of the state's bioscience industry cluster, and build stronger collaboration between the sectors of the local and international life sciences community.[2]

A year later, in May 2007, Governor Deval Patrick revealed an ambitious plan for a 10-year, $1 billion public initiative to enhance the Commonwealth's existing competitive advantage in this rapidly evolving and critically important sector of the U.S. economy. This would provide the funding for a major expansion in the activities of the Life Sciences Center. In June 2008, the legislature enacted the Governor's Massachusetts Life Sciences Initiative with the aspiration of building on the existing strengths of the state's research universities, its world-renowned health care sector, and its emerging private sector life sciences firms to promote the Commonwealth as the foremost center for the life sciences in the world.

*With such a large commitment of state resources, how close has the Center come to meeting this goal? Has it helped attract life sciences companies to the Commonwealth, boosted R&D in the private life sciences arena, created job opportunities for Massachusetts workers and increased the state's revenue base by boosting employment, household income, and corporate profits?*

This analysis of the MLSC comes at a propitious time. Massachusetts, along with most of its cities and towns—not to mention the nation as a whole—faces growing fiscal constraints. The economic recession that officially began in late 2007 and officially ended in 2009 has given way to an extended period of sluggish economic growth. This has diminished tax revenue just when the swelling cost of health care and public pensions is generating structural deficits.[3] Without additional tax revenue from more vigorous growth, these potential deficits will require either raising taxes or cutting public services, or both.

In this new economic environment, virtually every unit of government is being forced to husband its resources and scrutinize its spending to assure that every tax dollar is spent effectively and efficiently. As such, it is not surprising that the nation, the Commonwealth, and most of its municipalities are considering ways to cut "unnecessary" or "wasteful" spending. At the same time, they want to preserve essential public programs that meet critical social needs and improve the targeting of incentives to the private sector to accelerate economic growth.

A prime target in this new era of public scrutiny is the extensive set of "subsidies" and "tax expenditures" that governments have traditionally used to encourage specific types of consumption or investment. Every tax dollar that a government agency transfers to a private business or individual in the form of a *subsidy* means a dollar less that can be used in the short-term for other purposes. Every dollar that a business or individual saves on its taxes is an "uncollected" dollar—a *tax expenditure*—that could have been used to pay for one or another public service.[4] Because of the short-run "opportunity costs" attached to every dollar spent, there is a growing demand to ensure that public dollars are not being wasted on programs that have little payoff. Each program must be judged on whether the *long-term* gain from issuing a tax incentive, government grant, loan guarantee, or subsidy outweighs the *short-term* cost to the treasury.

Adding to the demand for more accountability has been a recent series of high-profile cases of "failed" government incentive programs. Solyndra, a manufacturer of solar photovoltaic systems, became the poster child for "misspent" federal funds during the last presidential campaign when it filed for bankruptcy after receiving

$535 million in U.S. Energy Department loan guarantees.[5] The same was true when A123, a manufacturer of lithium ion batteries for electric cars, went bankrupt after receiving a $130 million federal grant to build a plant in Michigan. It was, according to a series of *Washington Post* reports, the fifth clean-energy firm the current Washington administration subsidized with loans or grants that filed for bankruptcy protection. During the campaign, Republicans claimed both Solyndra and A123 were prime examples of "cronyism" in President Obama's stimulus program.[6]

Closer to home was the failure of Curt Shilling's 38 Studios video-game firm. It closed its doors and laid off all of its employees after Rhode Island lured it from Massachusetts with a $75 million loan guarantee. This case raised anew an old question. Under what circumstances should states use tax abatements, subsidies, and other inducements to encourage investment and create jobs in the private sector?[7]

As the Massachusetts Life Sciences Initiative approaches the halfway mark in its 10-year legislative life, it is altogether appropriate that this report attempt to ascertain whether, and to what extent, the Massachusetts Life Sciences Initiative has already produced tangible positive gains for the Commonwealth, and whether maintaining the initiative will likely produce even greater long-term benefits for the state's residents and taxpayers.

For the purposes of this report, we define the Life Sciences cluster as consisting of sixteen (16) specific 6-digit NAICS industry sectors as shown in **Table 1**.[8] These include two research and development industries, two laboratory industries, two medical distribution

TABLE 1
**Life Sciences Sectors**

| Group | NAICS | Title |
|---|---|---|
| 1 | 325411 | Medicinal and Botanical Manufacturing |
| 1 | 325412 | Pharmaceutical Preparation Manufacturing |
| 1 | 325413 | In-Vitro Diagnostic Substance Manufacturing |
| 1 | 325414 | Biological Product (except Diagnostic) Manufacturing |
| | | |
| 2 | 334510 | Electromedical and Electrotherapeutic Apparatus Manufacturing |
| 2 | 334516 | Analytical Laboratory Instrument Manufacturing |
| 2 | 334517 | Irradiation Apparatus Manufacturing |
| | | |
| 3 | 339112 | Surgical and Medical Instrument Manufacturing |
| 3 | 339113 | Surgical Appliance and Supplies Manufacturing |
| 3 | 339114 | Dental Equipment and Supplies Manufacturing |
| | | |
| 4 | 423450 | Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers |
| 4 | 424210 | Drugs and Druggists' Sundries Merchant Wholesalers |
| | | |
| 5 | 541711 | Research and Development in Biotechnology |
| 5 | 541712 | Research and Development in Physical, Engineering, and Life Sciences (except Biotechnology) |
| | | |
| 6 | 541380 | Testing Laboratories |
| 6 | 621511 | Medical Laboratories |

Source: Battelle and the Biotechnology Industry Organization (June 2012)

sectors, and ten different manufacturing industries.[9] The cluster also includes the life sciences departments in universities and medical institutions in the Commonwealth.[10]

As of 2012, according to the Massachusetts Biotechnology Council (MassBio), there were 1,198 life sciences companies operating in New England employing 103,006 workers, the vast majority of these firms located in Massachusetts. More than one-third of these New England firms were founded after 2004 and 80 percent are relatively small with sales under $100 million a year. More than two out of five of these firms (43%) have annual sales of less than $5 million. Of all the Massachusetts firms listed in the 2012 MassBio directory, about half (514) are medical device companies; 232 are drug development firms; 147 are contract research and manufacturing enterprises; and 146 produce research products and instrumentation for the life sciences.[11]

CHAPTER TWO

# The Size and Scope of Public Tax Expenditures and Public Subsidies

To begin our assessment, it is useful to put the Commonwealth's $1 billion investment in the life sciences into perspective. According to the Congressional Research Service, at the federal level there are over 200 separate tax expenditures which taken altogether are projected to cost the U.S. Treasury more than $1.1 trillion in FY2014.[12] The bulk of these take the form of exemptions, deductions, and exclusions from the personal income tax such as the mortgage interest deduction. These tax provisions are intended to encourage such "virtuous" behavior as home ownership, charitable contributions, and family saving.[13]

While paling in comparison to these personal tax expenditures, federal corporate subsidies cost the Treasury almost $100 billion a year, according to research conducted by the Cato Institute.[14] A full quarter of these go to farmers in the form of agricultural subsidies and crop insurance, but other subsidies underwrite applied research and development under way at defense contractors, energy companies, housing developers, airlines, AMTRAK, universities and research labs, the National Institutes of Health, NASA, and small businesses.[15] In searching for ways in 2013 to cut federal spending in order to reduce federal deficits, one can be certain that some, if not many, of these tax expenditures and subsidies will be reviewed for possible modification or elimination.

States and municipalities have also provided the private sector with billions in tax expenditures and subsidies. In a recent series of articles, a trio of *New York Times* investigative reporters found that across the nation, states, counties, and cities dole out over $80 billion in "business incentives" each year.[16] The key industries receiving such tax preferences and subsidies are manufacturing; agriculture; the oil, gas, and mining industries; and the film industry. Technology companies like Twitter and Facebook, according to the *Times* report, are not far behind.

The *Times* analysts collected data on all 50 states. In their review of Massachusetts, they found 48 state programs that provide nearly 1,500 grants or incentive packages to specific companies. The total annual cost to state and municipal governments for these programs was reported to be at least $2.26 billion, equal to seven percent of the state budget or $345 per capita. Of this total, more than a third ($786 million) take the form of corporation income tax credits, rebates, or reductions. Another $130 million is paid out by the state treasury in the form of cash grants, loans, or loan guarantees.

The *Times* reporters listed a group of 94 Massachusetts companies that received nearly $165 million in grants, tax incentives, and subsidies between 1994 and 2011. Of this total, 26 were life sciences companies accounting for $48.7 million or nearly 30 percent of the total. Among the companies receiving these funds were Vertex Pharmaceuticals, Organogenesis, Shire Human Genetics Therapies, Sanofi, and Cubist Pharmaceuticals. The company receiving the largest state subsidy, however, was Liberty Mutual, an insurance company. Between 2006 and 2009 alone, the Massachusetts Film Office doled out nearly $150 million in tax credits to film companies.[17]

States like Alaska, West Virginia, Texas, and Michigan spend two to three times as much per capita as Massachusetts on such business incentives, but other states including New Hampshire ($30), North Carolina ($69), California ($112), South Carolina ($194), New York ($210), Florida ($212), Oregon ($226), Connecticut ($241), and Ohio ($281) spend less.

Obviously, in a time of tight fiscal budgets, such expenditures of tax revenue need to be carefully evaluated as elements of what is known as "industrial policy"—government support of private business.

*To assure that this assessment of the Massachusetts Life Sciences Center is placed in proper context, we need to begin by considering the ways in which government can encourage private sector economic development in an efficient and effective way. In doing this, we need to pay particular attention to understanding the role of government-induced innovation in spurring economic growth.*This foray into these theoretical issues will provide us with guidance as to what types of government tax expenditures and subsidies are more likely to yield positive benefits for society and thereby help us to assess the value of the MLSC.

CHAPTER THREE

# Industrial Policy: Pros and Cons

For decades, economists have debated the role of government in the promotion of private industry. At various times in our history, the federal government has helped to establish industries that went on to be central to our economy. The growth of the nation's aircraft industry was aided by the U.S. Post Office, which subsidized airlines with lucrative air-mail contracts in the early days of air travel. In the aftermath of Sputnik, the federal government invested billions of research dollars into perfecting solid state guidance systems and software for rockets and missiles, helping to create what today is our high-tech universe of cell phones, the Internet, iPads, GPS devices, and a dizzying array of gadgets based on the integrated circuit and the software that runs them.

Yet, as a recent Center for Economic and Policy Research working paper put it, "For the past generation, the dominant view among economists was that giving businesses a free hand—that is, little regulation and low taxes—was the most important contribution governments could make to encourage productive investments. The corollary to this view was that, as much as possible, overall investments in the economy should be undertaken by the private sector, as opposed to any sort of government entity."[18]

The argument *against* a public "industrial policy" is that governments are not capable of "picking winners" and therefore too often waste tax dollars. The conservative Cato Institute claims that government subsidies inevitably distort economic activity and "create even larger failures than might have existed in the marketplace."[19] By aiding some businesses, others are placed at a disadvantage either by reason of having to pay higher taxes or having to compete with subsidized firms. Hence, diverting resources from businesses preferred by the market to those preferred by policy makers leads to losses for the overall economy."[20]

The argument *for* public investment in the private sector is that rather than "crowding out" private capital, public investments actually "crowd in" private investment and can be used to "incubate new technologies and help private businesses bring these innovations to the stage where they can be effective in the marketplace."[21] In brief, well-placed public funds in the private sector can yield large long-term gains at relatively modest short-term cost.

But what makes for "well-placed" public funds? A good part of the answer lies in whether the funds contribute significantly to a growing economy and increasing numbers of jobs.

## New vs. Old Growth Theory

In economics, there are two fundamentally different views about what contributes most to growth. What is now known as the "old growth theory" suggested that economic prosperity emanates from the accumulation of ever greater stocks of the fundamental ingredients of production: capital, labor, and natural resources. Those countries that find ways of increasing investment in plant and equipment, adding to labor supply, and extracting more natural resources are the ones that will become more affluent. Just consider the United States or Saudi Arabia versus poor countries in Africa or Southeast Asia. Clearly, without capital, labor, and natural resources, output cannot be produced.

While not completely discounting this approach to growth, a "new growth theory" has evolved that "places technological progress at the very epicenter of growth dynamics, rather than capital investment per se."[22] Advances in technology and interdependencies between new ideas and new investment provide the basis for entire new industries and products that create new wealth and raise living standards. "In the new model, technology provides the engine for sustained growth in the face of the diminishing productivity associated with additions to the stock of physical and human capital."[23]

In addition to avoiding diminishing returns, innovation-based growth has an additional salutary feature relative to other ingredients in the growth equation: Once the fixed cost of creating a technology has been incurred,

the formula can be used over and over again at little or no cost. Indeed, this *spillover* property is taken to be the defining characteristic of technology. As Paul Romer, one of the founders of new growth theory puts it, "The idea behind the transistor, the principles behind internal combustion, the organizational structure of the modern corporation, the concepts of double-entry bookkeeping—all these pieces of information and many more like them have the property that it is technologically possible for everybody and every firm to make use of them at the same time without additional costs."[24] As such, instead of diminishing returns to investment, there can be increasing returns.

Moreover, the new growth theory posits a strong reciprocity between the rate of skill acquisition among workers and the growth dividend society obtains from new capital and new inventions. *Thus, programs that combine incentives for innovation along with resources to augment human capital should, according to this theory, fuel rapid economic growth more than anything else society can do to promote prosperity.*

But here is the rub. Keeping score on the success of innovation is difficult. Instead of a more or less certain return to a given infusion of capital under the old growth theory, innovation under the new growth theory tends to deliver faster and stronger long-term growth, but it is "lumpy, discontinuous, and nonlinear."[25] There can be long lags between the time a new innovation is first incorporated into production and the time that it pays off in terms of increased productivity, output, and jobs. The introduction of the steam engine in the mid-18th century did not pay off in terms of improved productivity until the early 19th century.[26] In the short term, it can be discouraging, as investments in fundamental innovation usually have little immediate payoff.

To be productive, innovation needs to be perfected and diffused, and this takes time. According to a study of 265 major and minor innovations over the past couple of centuries, it took a typical new innovation forty-one years, on average, to move from the 10 percent to the 90 percent diffusion level.[27] The diesel locomotive, for example, was clearly superior to the steam locomotive, yet twenty years after the first diesel was introduced in 1925, there were still nearly ten steam locomotives in service for every diesel-powered engine. The first integrated computer circuits were introduced in the 1960s, but it was not until the 1990s that the full productivity premium of the computer generation was finally realized.[28] It will take decades to realize the full benefits to humanity and the economy from the advances now being made in drug discovery, medical diagnostics, and medical devices.

Unfortunately, in an era of intense concern over short-term deficits, it is often hard to marshall the patience needed to invest sufficiently in technological innovation or the firms that create it. As a corollary, investments made today in research and development (R&D) are often risky propositions from the perspective of the short-term balance sheet. Yet without massive infusions in R&D, continuous breakthrough innovation cannot occur. Nowhere is this truer than in the life sciences.

## Public Investment in R&D

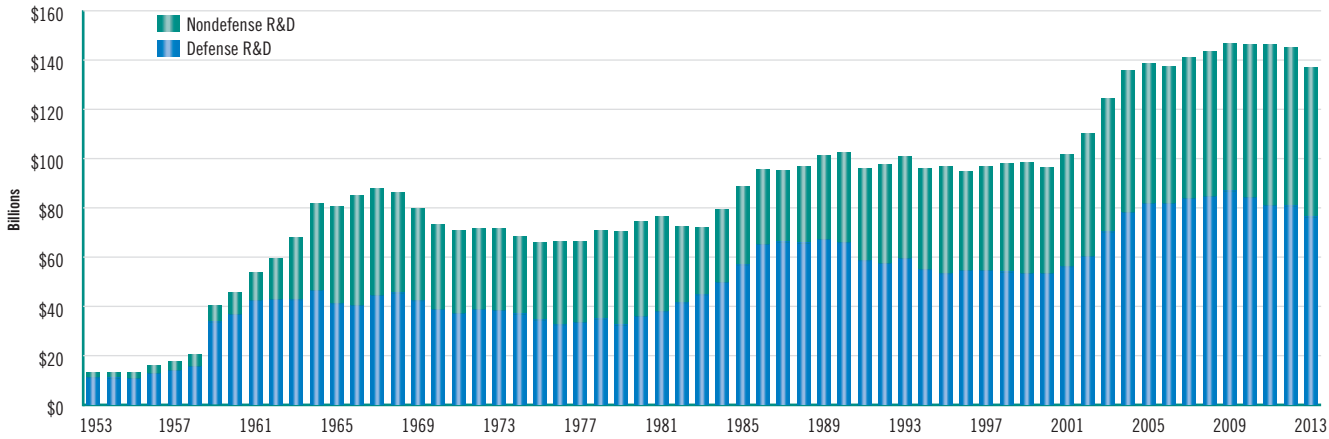
Worldwide, no country spends more than the United States on R&D, and this investment has played an important role in the nation's economic development, at least since World War II.[29] According to the Battelle Institute, total R&D spending in the U.S. reached $436 billion in 2012, of which about 29 percent ($126 billion) was supplied by the federal government while 64 percent ($280 billion) was provided by private industry. The remainder came from foundations and other non-profits ($14.5 billion), university-owned funds ($12.3 billion), and a tiny amount from state and local governments ($3.8 billion).[30]

Despite its smaller share of overall R&D funding relative to the private sector, the importance of the federal government in spurring innovation should not be underestimated. Without government investment, it is likely that private firms would underinvest in R&D, particularly basic research. The reason is that the social rate of return to investment in basic research often exceeds the private rate. Unlike investments in tangible capital such as machinery, the ideas flowing from R&D are, in the words of economists, "nonrival" and not fully "appropriable." *Nonrival* means that my learning of a new innovation does not prevent you from using it. When returns are not fully *appropriable*, the original innovator cannot gain all the profit that flows from the eventual application, especially the commercialization, of the new process or product.[31] In this case, firms will often wait for others to do the innovating. As Federal Reserve Bank Chair-

FIGURE 1

**Federal Spending on Defense and Nondefense R&D**

Outlays for the conduct of R&D, FY 1953–2013, billions of constant FY 2012 dollars




Source: American Association for the Advancement of Science

man Ben Bernanke recently reminded an audience at a Washington, D.C. conference, "James Watson and Francis Crick received a minute fraction of the economic benefits that have followed from their discovery of the structure of DNA."[32] Without government-sponsored basic research, society loses out on innovation.

Public sector R&D also encourages private sector R&D spending. Research reveals that there is a strong positive correlation between the trajectory of private R&D spending in a given year following public expenditures a year earlier.[33]

## The Trend in Federal R&D Spending

Given (1) the importance of innovation as the prime driver of economic prosperity, (2) the role of R&D in promoting innovation, and (3) the fact that without public funding of R&D total research investment would be suboptimal because of the inability of private investors to fully appropriate its monetary benefit, how much has the federal government invested in this vital factor?

As **Figure 1** reveals, federal spending on defense and nondefense R&D (in inflation-adjusted FY2012 dollars) rose sharply between 1953 and 1965 from less than $15 billion to more than $80 billion before dipping back to just over $60 billion in 1976. Spending was back to more than $100 billion by 1989 and remained flat through 2001. It rose sharply after that, increasing to over $140 billion by 2009. In FY 2013, under pressure to reduce federal spending, total federal R&D spending once again declined.[34]

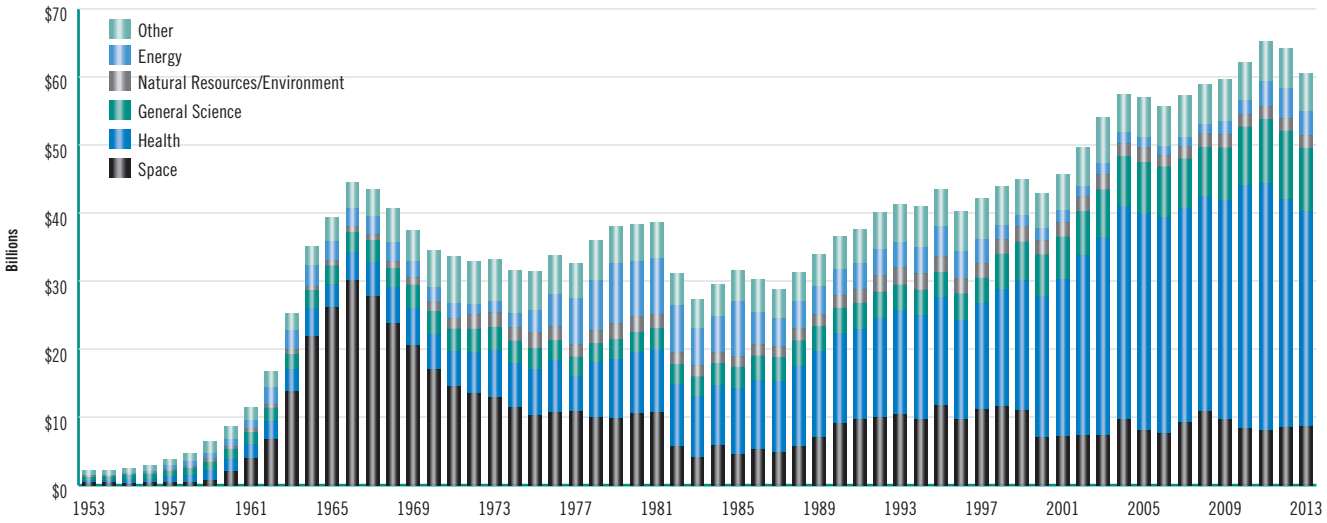
As **Figure 2** demonstrates, virtually *all* of this growth in non-defense federal R&D spending has been in the health field, mainly through the National Institutes of Health. While federally sponsored health research only accounted for about seven percent of total non-defense federal R&D spending in 1965, by 2013 it accounted for more than half (52%). Much of this basic public investment is going into the life sciences, and of all fifty states, Massachusetts trails only California in NIH funding. In 2011, California institutions received $3.5 billion in NIH funding; those in Massachusetts received $2.5 billion.[35] Yet, on a per capita basis, the Commonwealth swamps all other states in NIH funding, obtaining four times as much as the Golden State.

This growth in federally sponsored R&D seems impressive, but as a share of the nation's Gross Domestic Product (GDP), the federal government's role is roughly half of what it was in the early 1960s (**see Figure 3**). Spending rose rapidly in the 1950s and 1960s, surpassing 1.9 percent of GDP in 1964, up from just 0.7 percent in the early 1950s.[36] Much of this was in direct response to the Soviet Union's launching of Sputnik and President John F. Kennedy's goal of sending a man to the moon before 1970. After reaching its nadir of just 0.67 percent in 2000, it has slowly climbed back to 0.85 percent today.[37]

FIGURE 2

**Trends in Nondefense R&D by Function, FY 1953–2013**

Outlays for the conduct of R&D, billions of constant FY 2012 dollars




Source: American Association for the Advancement of Science

As we have seen, new growth theory suggests that our nation's prosperity is intimately tied to the rate of innovative activity. If innovation slows down, growth will suffer. Hence, the big question is whether the United States can maintain its rate of innovation activity into the future and thereby sustain economic prosperity and full employment.

## The Role of R&D Investment at the State Level

As noted above, states have historically played a minor role in funding research and development. Their $3.8 billion spent in FY2012 amounted to less than 1 percent of total spending on R&D and no more than 3 percent of government-sponsored R&D. Indeed, given that the full benefits from basic research cannot be easily appropriated by the funder, it might seem foolish that an individual state would spend its own revenue on investments that can be appropriated by entities in other states.

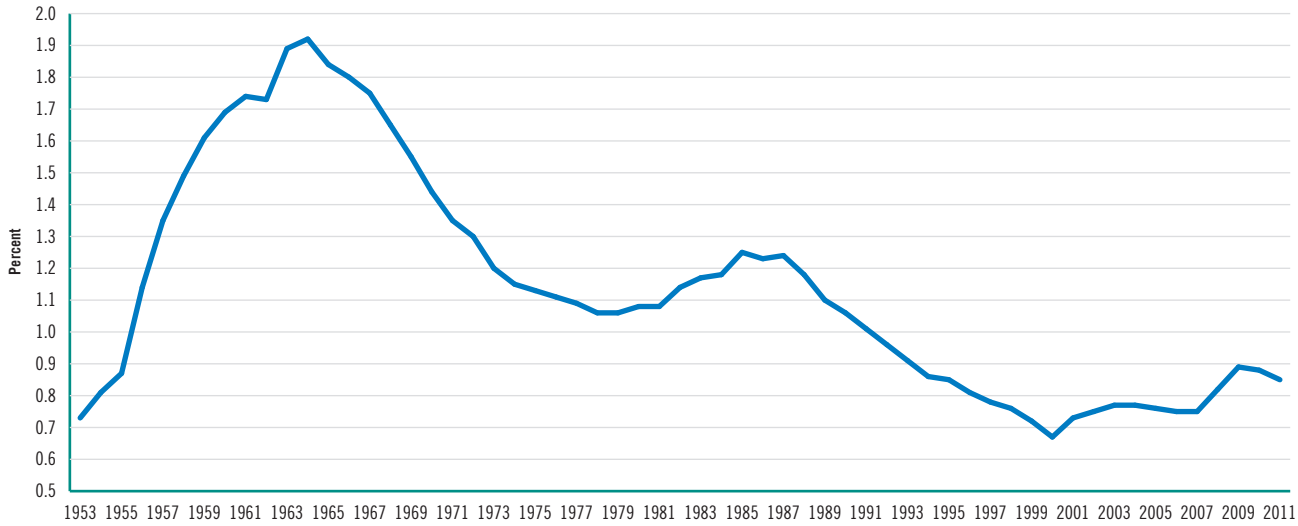
*So why should a state invest anything in R&D?*

Invested in the appropriate industries, public funds can help encourage the growth of an industrial cluster in a given region that, once incubated, can maintain a self-sustaining locational advantage that provides a magnet for new private investment in the region's cluster. Such locational advantages are called *agglomeration economies* and refer to the benefits, savings, or cost reductions resulting from the clustering of economic activities.[38] The clustering of such industries can give rise to an "industrial climate" or "ecosystem" that is self-perpetuating as the result of a regional congregation of specialized facilities, labor pools, education and training institutions, and specialized legal, accounting, and financial services.

Such agglomeration economies explain the economic success of most metropolitan areas. In New York City, for example, the cluster of financial industries and advertising is responsible for much of the growth in wealth. The birth of the early auto industry in and around Detroit in the early part of the 20th century would ultimately allow Detroit to take advantage of agglomeration economies and blossom into the world's "Motor City" by the end of World War II. By 1949, the median family income of Detroiters was higher than that of any other city in America except Chicago (whose residents enjoyed a 1949 median family income exactly one dollar higher), and 29 percent above the national figure.[39] Chicago's prosperity was built on being the transportation hub for America. Seattle became the center for jet aircraft production.

In the postwar period, the most successful new indus-

FIGURE 3
**Federal Spending on R&D as Percent of GDP**
**FY1953–FY2012**




Source: National Science Foundation "Science and Engineering Indicators 2012"

trial cluster was built in Silicon Valley in and around Palo Alto, California. Beginning in 1939 with the founding of Hewlett-Packard— the brainchild of two Stanford graduate students—the valley would attract a host of firms that would ultimately build the modern computer industry and make this region one of the wealthiest in the world.[40]

In the case of Detroit, local, state, and the federal governments essentially subsidized the auto industry through the public provision of streets, roads, and highways. Chicago's prosperity was underwritten by public subsidies to the railroads. Seattle's aircraft industry has benefited not only from the early airmail contracts but from massive defense spending that provided most of the resources needed to develop both military and then commercial jet airframes and jet engines.[41] While private venture capital has played a major role in the success of Silicon Valley, the federal government has played a significant role as well. From less than $10 million in 1960, federal research funding of computer science climbed to almost $1 billion by 1995, while the U.S. expenditure on research in electrical engineering (which includes semiconductor and communications technologies) has fluctuated between $800 million and $1 billion since the 1970s. According to the National Research Council, such funding "has constituted a significant fraction of all research funds in the computing field, particularly underwriting academic research. Federal support has constituted roughly 70 percent of total university research funding in computer science and electrical engineering since 1976."[42]

*The lesson is that the prosperity of many metropolitan areas has been stimulated in large measure by public investments in particular industry clusters. Given an early start in an industry, public funds can help build the agglomeration economies that in turn cement a single region's leadership in that industry nationally and globally. The Massachusetts Life Sciences Center was established precisely to this end. How successful has it been?*

CHAPTER FOUR

# The Emergence of the Massachusetts Biotechnology Super Cluster

In 2010, four scholars at the Massachusetts Institute of Technology (MIT) developed a schematic to explore the complement of elements needed to produce a successful American biotechnology cluster.[43] This schematic is summed up in **Table 2**. The schematic includes three innovation stages and four critical factors. Based on this matrix, the team was able to describe all of the aspects of what they called the Massachusetts Biotechnology Super Cluster.

A thriving science-based cluster must take basic research and transition it into commercial products and services. To do this requires funding, skilled labor, a legal framework that protects intellectual property (IP), and a diverse set of industries that includes both new innovative firms as well as established ones. As the authors suggest, "inadequacies in any area can threaten the cluster."[44]

As a whole, the U.S. biotechnology cluster benefits from access to both public and private sources of funding. These include, on the public side, NIH, the Department of Defense (DOD), Small Business Innovation Rewards (SBIR) to support basic research; foundation support from private nonprofits; and, on the for-profit side, angel and venture capital (VC) investors who provide funds for translating basic research into new products and services. The cluster is also supported by public and private customers for its end products, which at times are subsidized through tax expenditures and subsidies.

The talent pool for this sector ranges from creators and craftspeople who play the role of principal investigators on research grants and contracts, entrepreneurs who form new firms to commercialize the output of the sector and workers who range from those with just a high school diploma to those with Ph.Ds.

To be successful, the cluster must also enjoy a legal system that protects intellectual property through patents and licenses and IP enforcement in the courts.

Long-term success for the cluster also requires a diverse set of "tradable agglomerating" companies comprised of new innovative enterprises that can power future

TABLE 2
**The Prototypical American Biotechnology Cluster**

| Critical Factors | | Innovation Stages | | |
|---|---|---|---|---|
| | | Basic Research | Translation | Commercialization |
| Funding | Public | NIH | DOD, SBIR | Payers, Tax Policy |
| | Private | Foundations | Angel, VC, Industry | Customers |
| Talent | Creators | PIs | Entrepreneurs | Senior Execs |
| | Craftspeople | Grad Students | BA/MS/PhD | HS - PhD |
| Laws & Norms | Intellectual Property | Bayh-Dole | Patentability & Scope | IP Enforcement |
| | Experimentation | New Field Encouragement | Independence Over Security | Reinvention |
| Diversity | Tradable Agglomerating | Stem Cells | RNA, Interventional Imaging | Biologics |
| | Tradable Converging | Bio-processing | Molecular Diagnostics | Biomanufacturing |
| | Local Sustaining | Medical Centers | Science Parks | |

Source: Trusheim, Berndt, Murray, and Stern, 2010

growth through the development of breakthrough products, "tradable converging" firms which remain globally competitive in existing products, and a set of local entities including medical centers and science parks that provide local services to the cluster.

A good deal of this requires a collaborative form of industrial policy with both the federal and state government playing major roles in the emergence of the cluster. In the 1950s, the federal government continued its funding of R&D in the biosciences as part of its Cold War strategy. The VC model was invented and the first high-tech firms founded. In the 1970s, the federal government declared a "War on Cancer" with NIH funding, while the first recombinant DNA experiments were undertaken in university laboratories and private research firms.

In 1980, the Bayh-Dole Act was adopted, giving universities IP ownership of the output from federally funded research while the first recombinant DNA products hit the market. In the Commonwealth, the Massachusetts Biotechnology Council was created in 1985, one of the first in the nation. In the 1990s, the first genomics companies were founded, led initially by Millennium Pharmaceuticals (established by a former Genentech executive).

Much of this early work came to fruition in the first decade of the 21st Century. During this period, the human genome was sequenced and the George W. Bush administration committed itself to doubling the NIH budget.

Here in the Commonwealth, a final piece of the cluster puzzle was put in place with the founding of the MLSC, followed by the state's funding of the Life Sciences Initiative to help cement the region's lead in this important cluster and maintain that lead into the future. With all of the other parts of the matrix in place in Massachusetts, the state became a magnet for Big Pharma.

By the end of the first decade of the 21st Century, Massachusetts was home to 9 of the top 10 major drug companies in America, surpassing New Jersey. Pfizer, Novartis, GlaxoSmithKline, Genzyme's successor Sanofi, AstraZeneca, Abbot Laboratories, Merck and Bristol-Myers Squibb had all committed to operations in the Bay State. The largest of these big firms, in order of employment, are Genzyme (Sanofi), Pfizer, Biogen Idec, Novartis, Shire, Thermo Fisher Scientific, EMD Millipore, Vertex, Parexel International, and Hologic.[45] Only the Swiss pharmaceutical giant, Roche—the world's third-largest biopharma firm—has not moved into Massachusetts.[46]

According to a separate comprehensive analysis of the global life sciences cluster completed in 2011, the commercial developer Jones Lang LaSalle concluded that Boston had become the #1 region for the biosciences based on its concentration of high tech research and hospital/medical employment, its number of scientific and engineering graduate students, its level of NIH and venture-capital funding, its investment in R&D as a percentage of state GDP, and its thousands of square feet of academic and research institute facilities. Boston had a composite score of 7 ranking it #1 overall. New York/New Jersey was #2 with a composite score of 24, followed by the Bay Area and Los Angeles each with a score of 25.[47]

CHAPTER FIVE

# The Massachusetts Life Sciences Center

What role does the MLSC play in the MIT schematic? Beginning with its creation, the MLSC took as its strategic mission the role of pulling together all of the parts of the matrix into a life sciences ecosystem, creating a dense, highly connected community of scholars, entrepreneurs, industry leaders, venture capitalists, and government officials dedicated to the success of the life sciences super cluster in the Commonwealth. Unlike many state economic development initiatives, the Center has a broad range of strategic priorities geared to enhance all aspects of the life sciences cluster. These include:

- funding translational research—research that converts basic research into marketable products and services
- investing in promising new technologies
- ensuring worker skill acquisition that aligns with the needs of the life sciences industries
- creating new infrastructure from shared resources that accelerates innovation
- building partnerships between sectors of the local and international life sciences communities

To accomplish these goals, the Center relies on a portfolio of seven distinct programs.[48] These include:

**Cooperative Research Grants**—Supports industry-sponsored research at universities and facilitates scientific discoveries that lead to medical applications. These grants of $250,000 per year for up to two years match industry contributions dollar for dollar.

**Internship Challenge Program**—Provides up to $7,200 in funds for interns working at Massachusetts companies with fewer than 100 employees and fewer than 250 globally.

**New Investigator Grants**—Spurs innovative research and advances the careers of new investigators who are working on cutting-edge research at Massachusetts academic research centers with grants of $100,000 per year for up to three years.

**Life Sciences Accelerator Program**—Provides financing of up to $1 million for early-stage companies to help leverage additional sources of capital.

**Small Business Matching Grant (SBMG) Program**—Provides matching support capped at $500,000 per company to firms on the verge of commercializing new technologies developed using Phase II or Post-Phase II Small Business Innovation Research (SBIR) awards or Small Business Technology Transfer (STTR) grants from the federal government.

**Life Sciences Tax-Incentive Program**—Issues a combination of 10 competitively awarded tax incentives available to companies that meet specified hiring goals. These include:

- A refundable 10% investment tax credit[49]
- A refundable in-state research tax credit
- A refundable job creation tax credit (50+ jobs)
- A refundable FDA user fee credit
- Extension of net operating losses to 15 years
- Deduction of orphan drug clinical testing
- Elimination of the sales factor throwback provision
- Special sales tax exemption
- Life sciences research credit for out-of-state costs
- Construction sales tax exemption

**Capital Projects Fund**—Provides capital for equipment and supplies for high schools in Gateway Cities, vocational/technical schools, and community colleges; and for capital projects in academic/research institutions, business incubators, and other not-for-profit organizations in the Commonwealth.

Between 2008 and June 30, 2012, the Center had directly invested or committed over $300 million that has leveraged more than $1 billion in third-party investment, according to the MLSC's report for fiscal year 2012. If none of that investment would have been made in Massachusetts in the absence of the MLSC commit-

ments, each dollar of taxpayer money spent by the Center resulted in the attraction of $3.40 in additional, outside investment creating a public-private investment fund of more than $1.3 billion.[50]

There are four factors that make the MLSC quite different from most government subsidy programs:

- Instead of simply providing tax benefits to a few private firms to lure them to the Commonwealth, the MLSC has a portfolio of investment tools that include direct investments in life sciences companies; grants to academic organizations and medical centers and grants for "shovel ready" public and non-profit sector capital projects that help influence the location decisions of life sciences companies.
- The MLSC operates under a Board of Directors that includes state government officials, industry CEOs, leaders from academia and medicine, bioscience researchers and others who have great knowledge of the life sciences.
- Investments are reviewed by a panel of more than 200 experts who send their recommendations to the Center's Scientific Advisory Board, which itself is dominated by academic researchers, industry scientists and private venture capital experts who together can judge the scientific and economic potential of an MLSC investment.
- The Center insists on accountability in terms of private sector investment matches and specific job creation goals and retains the power to "claw back" tax incentives and other investments when these goals are not reached by grant recipients.[51]

In the four-year period between June 2008 and June 2012, the Center invested nearly $190 million in 12 capital projects, provided 31 company grants and loans worth nearly $23 million, issued 35 academic research grants with a value in excess of $23 million and 56 tax incentives (still outstanding) valued at close to $57 million, invested $7 million to fund 884 interns as part of the Center's mission to help develop the life sciences workforce, provided more than $3.3 million in equipment and supply grants to schools and spent $1.5 million on other grants including the funding of business plan competitions. As of June 30, 2012 the Center was managing a portfolio of approximately 200 grants, loans, and tax incentives.[52]

Examples of *infrastructure activity* as listed in MLSC's FY2012 report include:

- $5 million in support of the construction of the Joslin Center's Translational Center for the Cure of Diabetes
- $10 million to the Dana Farber Cancer Institute to support the expansion of its $20 million Molecular Cancer Imaging Facility
- $5 million to the Boston Museum of Science for the construction of its "Hall of Human Life," which helped leverage $11 million in private financing
- $14.6 million to the University of Massachusetts Dartmouth to build its new Massachusetts Biomanufacturing Center in Fall River
- $10 million to UMass Lowell to equip laboratories within its new Emerging Technologies and Innovation Center
- $14.3 million to help build the Framingham Wastewater and Pumping Station that will allow bioscience firms to operate in that community

Examples of accelerator loans awarded in FY2012 to provide working capital to early stage life sciences companies include:

- $750,000 to Allurion of Wellesley for developing a novel medical device for inducing weight loss in obese patients
- $750,000 to Alcyone Lifesciences, Inc. for the development of a micro-catheter for treating neurological conditions
- $245,000 to Strohl Medical for the creation of a medical device for accelerating the treatment of stroke victims

Subsequent to receiving accelerator loans, early stage firm recipients have raised more than $100 million in either private or public funding to grow their firms or in acquisition proceeds. Already six firms that have received accelerator loans have paid them off early, permitting the MLSC to construct a revolving fund, thus expanding the resources the Center has for this purpose.

In addition to the accelerator loans, the MLSC has begun a Small Business Matching Grant Program (SBMG), which complements funds received by firms from NIH, the National Science Foundation (NSF), and DOD. In 2012, the Center awarded a $500,000 grant to Firefly BioWorks, Inc. of Cambridge after full review by the

MLSC Scientific Advisory Board. The company has already been able to launch its first commercially viable product for help in diagnosing cancer, neurological disorders, and other diseases.

Examples of matching grants for academic research include:

- $5.1 million in grants to early career investigators working in research institutions within the Commonwealth which have in turn helped generate over $13 million in federal government, foundation, and private company research grants
- $4.8 million in cooperative research grants (between 2008 and 2011) to encourage industry-sponsored research at Massachusetts institutions, resulting in more than $8.6 million in research grants from other sources

Examples of the $20.6 million in 2011 program tax incentives to 26 life sciences companies include $3 million to Shire HGT, Inc.; $2.45 million to Vertex; $2.3 million to AVEO Pharmaceuticals; and $1.84 million to Biogen Idec MA, Inc. Smaller tax incentives of less than $500,000 went to such firms as Blueprint Medicines Corporation in Cambridge and T2 Biosystems, Inc. in Lexington. Under the Life Sciences Act, the Department of Revenue has the authority to "claw back" incentives from companies that the Center determines have not met the minimum job creation thresholds in their tax-incentive agreements.

In addition, the MLSC Internship Challenge Program has placed more than 1,000 interns in more than 290 companies across the state where host companies provide dedicated mentors to help expand the pool of prospective life sciences workers for the future. Those college students receiving MLSC internships are majoring in biology, engineering, chemistry, business, computer science and physics and end up interning in companies that produce medical devices, pharmaceutical products, diagnostic services, and biotechnology research. In FY2012, the Center also awarded $180,000 to four programs to encourage science, technology, engineering and math (STEM) education, especially for women and minorities.

**Table 3** provides a summary of the investments made by the MLSC between June 2008, when the Life Sciences Initiative funding first became available, and June 2012.

TABLE 3

**Distribution of MLSC Investments by Dollar Amount June 2008–June 2012**

| | |
|---|---|
| Capital Projects (12) | $186,950,000 |
| Company Grants and Accelerator Loans (31) | $22,907,000 |
| Academic Research Grants (35) | $23,346,344 |
| Tax Incentives (56) | $56,595,093 |
| Interns Funded for Workforce Development (884) | $6,903,164 |
| Equipment and Supply Grants or Schools (32) | $3,333,675 |
| Other Grants/Business Plan Competitions | $1,540,000 |
| **Total** | **$301,575,276** |

Source: Massachusetts Life Sciences Center, 2013

This comprehensive approach to an entire industry cluster differs significantly from other federal, state, and local incentive programs that target a single company or, at best, a single industry.

We can now ask: "*Has this approach, and the investments made through the MLSC, paid off?*"

We begin to answer this question by tracking output and employment in the life sciences cluster and consider the results in terms of the creation of the Center in 2006.

But given what we have learned about the role of innovation in spurring economic growth, we can ask a more fundamental question. "Has the creation of the Center and the Life Sciences Initiative paid off in terms of nurturing a rich 'ecosystem' within which the entire life sciences super cluster can flourish now and in the future, providing a platform for further growth in economic opportunity for Massachusetts residents?"

CHAPTER SIX

# Output and Employment in the Massachusetts Life Sciences Super Cluster

The life sciences super cluster began to benefit the Commonwealth by the middle of the last decade, even before the MLSC was established. By 2006, publicly traded companies in Massachusetts were already generating $30 billion in sales, an increase of nearly 50 percent in just four years. With $7.5 billion in exports, the Massachusetts life sciences sector accounted for 30 percent of total state exports.[53] Between 2001 and 2006, employment in Massachusetts life sciences industries increased by 13,000—more than 16 percent. The life sciences were generating jobs during a period when total non-farm employment in Massachusetts was actually *declining* by 2.8 percent. While total employment in the life sciences in 2006 accounted for just 26 out of every 1,000 jobs in the state, this sector was growing faster than any other, including education and health services (See **Figure 4**).

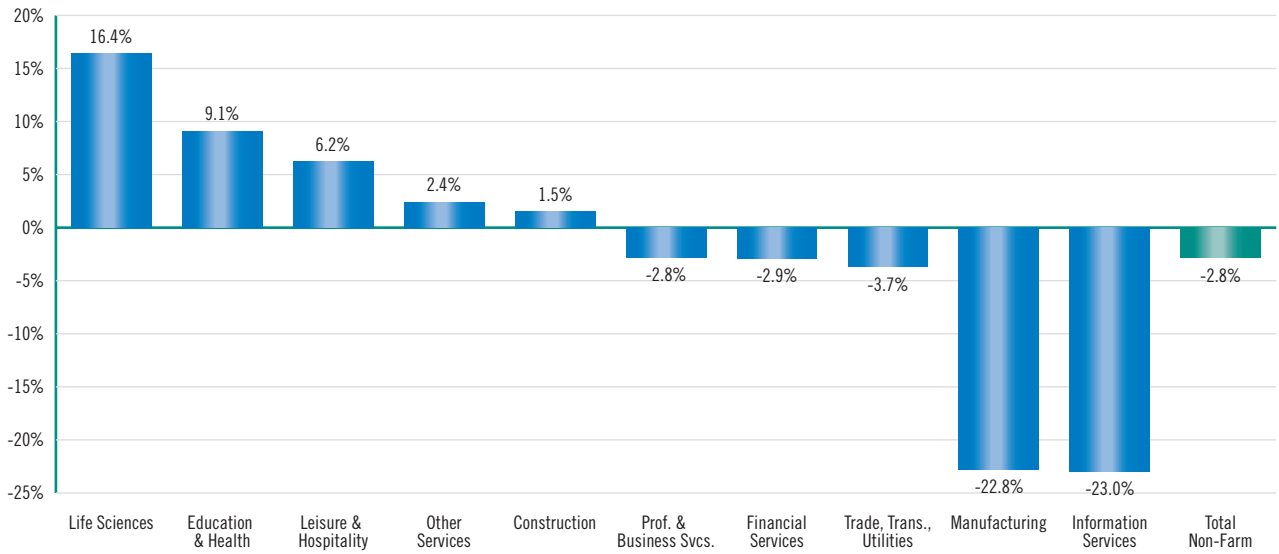
As **Figure 5** reveals, the life sciences cluster continued to generate jobs between 2006 and 2011, but not quite as rapidly as during the previous five years. However, it was still faster than every other sector save education and health services. The national recession that began at the end of 2007 weighed on the life sciences sector, as it did most other industries. Life sciences remained a small sector in terms of overall non-farm state employment, but given its faster growth, accounted for nearly 30 jobs out of every 1,000 in the Commonwealth by 2011.

Taking the entire decade (2001–2011) as a whole, the life sciences far outpaced all other industry sectors in terms of its employment growth rate as shown in **Figure 6**.

*Within* the cluster, however, the growth in employment has varied greatly across individual industry segments as shown in **Table 4**. During the entire period between 2001 and 2011, employment in research, testing, and medical laboratories increased by more than 50 percent, nearly twice as fast as the life sciences cluster as a whole (and 2½ times as fast as education and health services). Yet the production of medical devices—the

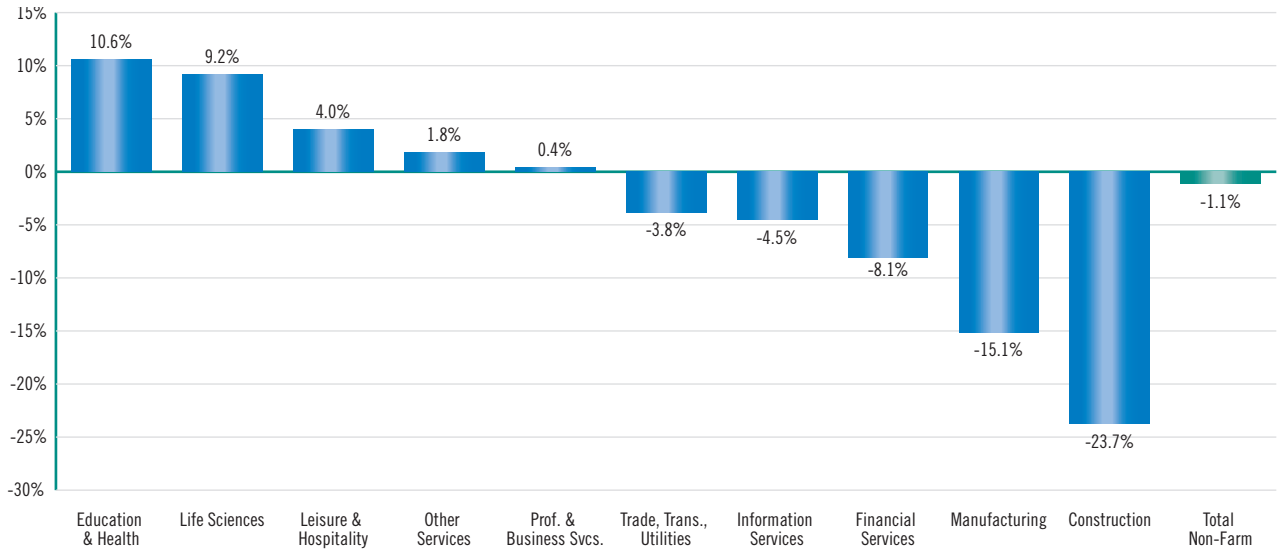
FIGURE 4

**Massachusetts Employment Growth by Industry Sector 2001–2006**



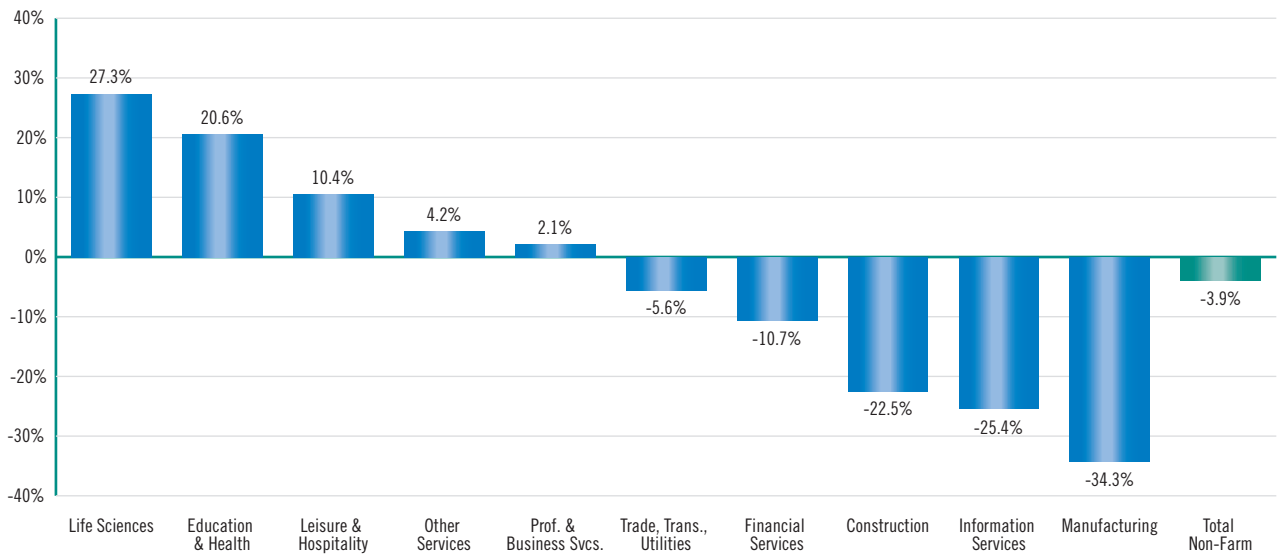

Source: Bureau of Labor Statistics, Author's Analysis

FIGURE 5
**Masssachusetts Employment Growth by Industry Sector 2006–2011**




Source: Bureau of Labor Statistics, Author's Analysis

FIGURE 6
**Massachusetts Employment Growth by Industry Sector 2001–2011**




Source: Bureau of Labor Statistics, Author's Analysis

key *manufacturing* segment of the life sciences cluster —remained nearly constant over this period, increasing by just 0.2 percent.

What is notable, however, is that the employment growth rate actually *increased* in the second period (2006–2011) for both the pharmaceutical industry and

TABLE 4
**Employment Change by Life Sciences Cluster Segment**

| | 2001 | 2006 | 2011 | % Δ2001–2006 | % Δ2006–2011 | % Δ2001–2011 |
|---|---|---|---|---|---|---|
| Drugs & Pharma | 7,794 | 7,944 | 8,537 | 1.9% | 7.5% | 9.5% |
| Medical Devices & Equipment | 22,835 | 21,645 | 22,882 | –5.2% | 5.7% | 0.2% |
| Research, Testing, & Medical Labs | 34,849 | 47,072 | 52,819 | 35.1% | 12.2% | 51.6% |
| Bioscience-Related Distribution | 9,607 | 10,877 | 11,377 | 13.2% | 4.6% | 18.4% |
| **Total** | **75,085** | **87,538** | **95,615** | **16.6%** | **9.2%** | **27.3%** |

Source: Bureau of Labor Statistics, Author's Analysis

medical device manufacturing, despite recession conditions nationally and regionally. Indeed, all four sectors in **Table 4** exhibited increased employment during this difficult economic period.

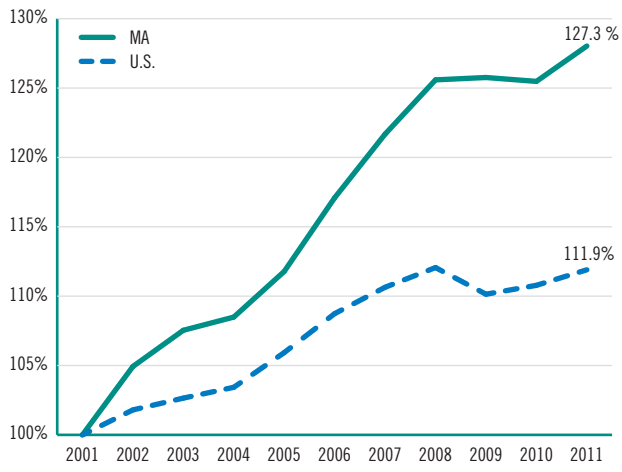
## Life Sciences Employment Trends: Massachusetts vs. the United States

The capacity of the Commonwealth's life sciences to create jobs at a faster pace during the past decade than all other major Massachusetts industries is one indicator of the successful development of this sector. Even more important is how the state's life sciences have performed relative to the country as a whole and other states vying for supremacy in this rapidly evolving cluster of industries. The data we have gathered on employment trends reveal that the Commonwealth has indeed overtaken the rest of the nation in terms of employment growth in the life sciences, fulfilling the initial goal of the MLSC.

**Figure 7** reveals the trend in life sciences employment in Massachusetts compared to that of the nation as a whole between 2001 and 2011. During this period, Massachusetts life sciences employment growth outperformed the nation by a factor of better than 2-to-1—growing by 27.3 percent vs. 11.9 percent for the nation.

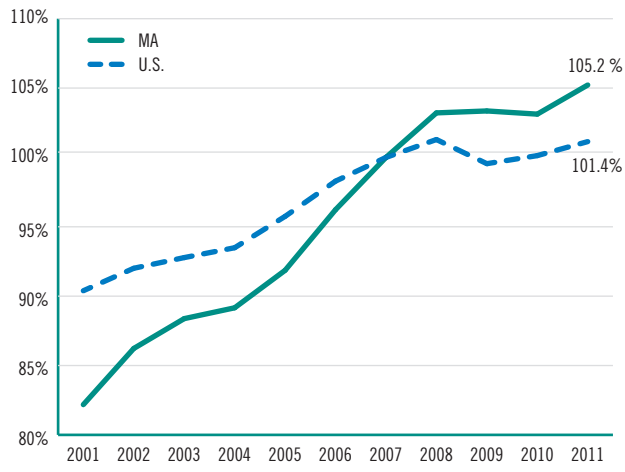
**Figure 8**, which indexes employment growth to 2007, reveals how the Commonwealth's life sciences cluster grew at a faster clip than the nation's, surpassing the nation and now remaining firmly ahead of it in terms of employment growth.

FIGURE 7
**Employment in Life Sciences Indexed to 2001, Massachusetts vs. the U.S.**




Source: Author's Analysis from BLS data

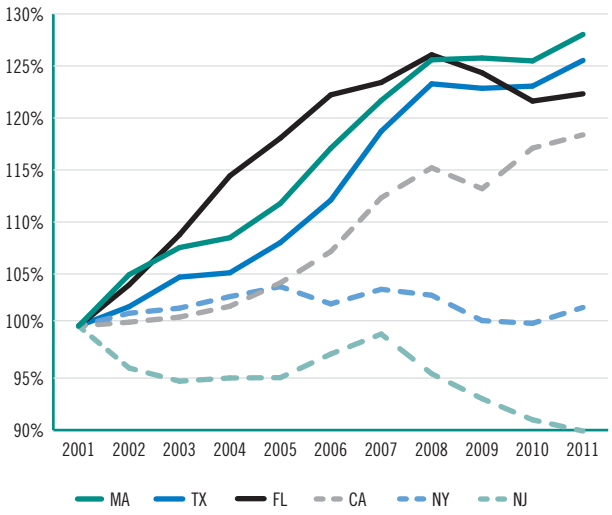
FIGURE 8
**Employment in Life Sciences Indexed to 2007, Massachusetts vs. the U.S.**




Source: Author's Analysis from BLS data

FIGURE 9

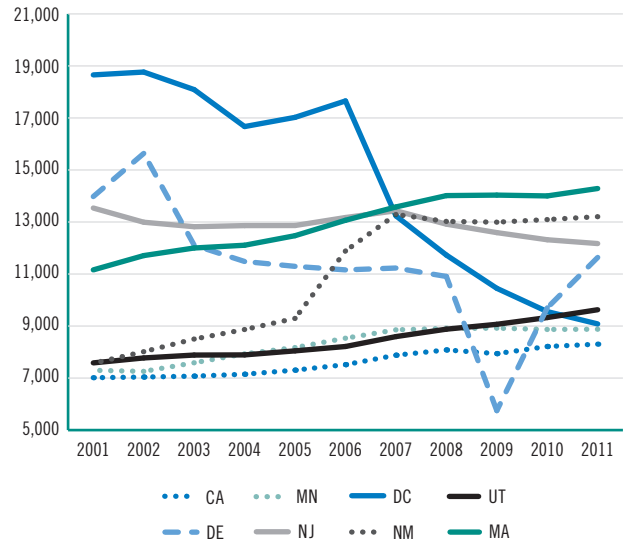
**Employment in Life Sciences Indexed to 2001, Massachusetts vs. Big Competitor States**




Source: Author's Analysis from BLS data

FIGURE 10

**Life Sciences Jobs per 1 Million 2010 Population Top 8 States in 2011, by Year**




Source: Author's Analysis from BLS data

The Commonwealth's main competitors in the life sciences include California, New Jersey, New York, Florida, and Texas. But as **Figure 9** demonstrates, after 2008 the Commonwealth overtook all of these states in terms of its 2001–2011 employment growth rate. Florida's nascent life sciences sector had been growing faster, but has fallen behind the Bay State during the past four years. Texas has been trying to catch up, but still trails Massachusetts. Over the decade, California's life sciences employment grew by just 18.4 percent compared with the Commonwealth's 27.3 percent. The growth rate in New York has been anemic, adding only 2 percent to its life sciences workforce while New Jersey, once the pharmaceutical capital of the nation, has seen its life sciences cluster decline sharply since 2007.

Even with Massachusetts's #1 position in the life sciences employment growth rate, it is not surprising that other states still have a larger absolute number of life sciences jobs. Of the top six states, Massachusetts ranked 5th in 2011, as **Table 5** reveals. California leads the pack with nearly 310,000 life sciences jobs.

Yet even as a much smaller state in total population, Massachusetts now leads all other states in the number of jobs in the vital biotechnology R&D sector within the life sciences super cluster. In 2011, the Commonwealth boasted more than 28,000 jobs, exceeding second place California (22,600) and third place Pennsylvania (11,200).[54] Since 2007, this particular sector grew faster in the Commonwealth than in any other state, adding more than 3,500 jobs.

When we control for population size, Massachusetts is the clear winner for the entire life sciences cluster of industries. In **Figure 10**, we have controlled for the size of population of each state by measuring the number of life sciences jobs per 1 million residents. In 2001, the District of Columbia actually had the highest per capita number of life sciences jobs, presumably because of the physical presence of the National Institutes of Health. Delaware ranked second followed by New Jersey. California actually lagged Minnesota, Utah, and New Mexico on this measure. Massachusetts ranked #4.

But by 2011, given its rapid growth rate, the Massachusetts cluster had risen to #1 in terms of per capita life sciences employment. With nearly 14,300 life sciences jobs per 1 million people, Massachusetts had eclipsed New Jersey (12,171) and continued to far outstrip California (8,300).

TABLE 5

**States with Largest Life Sciences Employment (2011)**

| | |
|---|---|
| California | 309,344 |
| New York | 109,750 |
| New Jersey | 107,007 |
| Texas | 96,969 |
| Massachusetts | 95,615 |
| Florida | 83,836 |

Source: Author's Analysis from BLS data

Clearly, the life sciences cluster has enjoyed stellar growth in the Commonwealth over the past decade, and it appears that after the MLSC was created, the pace of growth outdistanced all of Massachusetts's rivals.

Clearly, the life sciences are flourishing in Massachusetts and the timing of the sector's employment growth suggests at least a correlation between the creation of the MLSC and the ability of the state's life sciences super cluster to overtake the rest of the nation.

*But what evidence do we have of causation rather than simply correlation? What role has the MLSC played in the stellar growth of this set of industries? Here we find the interviews we conducted with key informants provided additional information on the role MLSC has played in this 21st-Century story of industrial success.*

CHAPTER SEVEN

# The Key Role of the MLSC: What We Learned from the Interview Data

To obtain a firsthand view of what part the MLSC may have played in the emergence of the Commonwealth's life sciences ecosystem, we conducted a series of "key informant interviews" with executives in the industry, with leaders of related trade associations, and with a number of scientists who have an intimate knowledge of the range of activities of the Center. In order to obtain an honest and unbiased assessment of the $1 billion initiative itself and the functioning of the Center, we assured each of our informants strict confidentiality. Interviews were carried out with executives in both large and small companies in the industry, with those mostly devoted to research and development, and with those whose companies are now involved with the manufacture of scientific and medical products.

While we probed on many fronts, we asked each informant to consider a fundamental "counterfactual": *Would the life sciences in Massachusetts be much different from what they are today if the MLSC had never been created and the state had not committed long-term funding to assist the array of universities, research institutes, and companies that make up the life sciences super cluster?* What we learned provided us with a vital and deeper understanding of the critical role the MLSC has played.

Here are our key findings.

## The Development of the Life Sciences "Ecosystem"

The leaders of large firms told us that given the scale of their operations, the MLSC plays at best a *minor direct role* in their own development, but an *immense indirect role* that helped to attract them to Massachusetts. The term that surfaced in virtually all of our interviews is "ecosystem," and that the MLSC has been central to the creation of the life sciences ecosystem that has made the Commonwealth more attractive than competing regions.

According to our interviews, the MLSC has indeed been instrumental in bringing together a tight-knit community of life sciences institutions including universities, research hospitals, small start-up bioscience firms, medical device manufacturers, and Big Pharma. These stakeholders all interact on a regular basis to assist each other in the promotion of their activities. The ecosystem includes the nurturing of small firms through the MLSC's accelerator-loan and tax-incentive programs, assistance to the life sciences research labs in the state's public higher education system, the provision of funds for student interns in relevant fields, and countless opportunities for executives, scientists, and industry employees to meet and explore opportunities for expanding the life sciences super cluster in the Commonwealth. The Center has been critical, according to our key informants, in helping to build a "platform" for the entire sector and cultivate a "collaborative gene" among all of its separate parts.

As one recent example of this role, the MLSC helped create the Massachusetts Neuroscience Consortium, announced at the 2012 BIO International Convention in Boston. With charter sponsors including Abbott Labs, Biogen Idec, EMD Serono, Janssen Research & Development LLC, Merck, Pfizer, and Sunovion Pharmaceuticals, Inc., the consortium provides an arrangement whereby companies that normally compete with each other collaborate on funding preclinical neuroscience research under way at academic and research institutions throughout the state. With leadership provided by the MLSC, each of the founding sponsors has pledged $250,000 toward this effort, and the Center will administer the funds.[55] The research results will be shared with all participants and all companies and academic researchers will have access to any tools developed as a result of these investigations. Without the Center playing this convening role, it is unlikely that such a consortium would have come into existence.

The Center has also been responsible for helping to nurture international cooperation among life sciences firms and academic institutions. The Center provided a $300,000 grant to the Northern Ireland Massachusetts Connection (NIMAC) for a new multinational research

study on non-invasive procedures to detect pre-malignant lesions. Finland and Catalonia have joined NIMAC as well. MLSC is also helping to develop alliances between Massachusetts companies and Israeli firms through the Massachusetts-Israel Innovation Partnership (MIIP). The Center has contributed $300,000 to this effort so far, funding two Massachusetts firms working in partnership with Israeli firms. A second round of funding for this program is pending.

All of these efforts are part of building an ever larger life sciences ecosystem based in the Commonwealth.

## The Unique Growth Pattern of Regional Life Sciences Clusters

The most important lesson we derived from our interviews, however, was the unique growth pattern of the life sciences cluster. The regional concentration of life-sciences companies happens in a very different manner than in other industries. In the case of traditional industrial sectors such as auto, aircraft engine, financial services and the like, a region becomes dominant in a particular cluster once a large anchor enterprise or a small number of them establish operations in that locale. Once the anchor enterprise is established, an array of smaller firms is attracted to that region to serve as part of the supply chain for the large anchor enterprise(s).

Once Detroit became home to Henry Ford's car company and General Motors and Chrysler built huge auto assembly facilities in Michigan, hundreds of small parts plants, design studios, and small engineering facilities opened their doors nearby in order to easily serve the industry's "Big Three." The same is true of the aircraft engine industry in New England dominated by Pratt & Whitney in East Hartford, Connecticut, and General Electric's Aircraft Engine facility in Lynn-Everett, Massachusetts. These massive facilities attracted hundreds of aircraft engine parts suppliers to New England, making the region one of the core jet-engine manufacturing centers in the United States. *Essentially, the small firms in the industry are dependent on the large ones.*

For the life sciences, the reverse is true. For companies that crucially depend on the development of breakthrough innovations and sophisticated medical devices, *the large firms prosper by reason of being proximate to a panoply of small start-up firms*. The reason for this is that despite their substantial research budgets, even the largest of the life sciences companies do not have the resources to generate more than a handful of breakthrough innovations in the biosciences, genomics, and other sophisticated fields. These large firms grow and prosper by carefully monitoring the scientific discoveries under way in university research laboratories and in the translational research carried out by small start-up firms. Those few start-ups that end up with potential blockbuster drugs or devices become prime targets for acquisition by the larger firms. Only a fraction of the long-term revenue generated by Big Pharma and the largest biotech and medical device companies has its origin in their own research labs. The majority comes from the absorption of successful smaller firms.

The secret to success in the acquisition process is being where the small firms are located. This permits the large firms to closely monitor the progress of smaller firms and buy the most promising ones before other Big Pharma or other competitors can make a bid. To use a metaphor from nature, the large, globally important life sciences firms want to feed in the waters where the minnows are swimming.

Pfizer, for one, has moved operations into Cambridge from other locations for this purpose.[56] In 2010, it announced that Cambridge would become one of Pfizer's worldwide research and development hubs, and it relocated approximately half of the current employees from its BioTherapeutics R&D organization to Kendall Square. A year later, Pfizer announced plans to move two existing research units, Cardiovascular Medicine (CVMed) and Neuroscience from Groton, Connecticut, to Cambridge, leasing 180,000 square feet of lab and office space from MIT to house these two research units.

In June 2011, Pfizer opened the Boston Centers for Therapeutic Innovation (CTI), an entrepreneurial network of partnerships with leading academic medical centers. According to the company, "these partnerships reduce the time and cost of drug discovery and development by accessing leading translational researchers."[57] Boston is also the global headquarters for the CTI network, which has established partnerships in New York City and San Francisco. The richness of the Massachusetts life sciences ecosystem prompted Pfizer to expand still further in the Commonwealth, with the company's newest building in Cambridge scheduled to be completed in 2013.

Over the past three years, Massachusetts is the only state where Pfizer has added jobs, not California, Connecticut, New Jersey, or New York. As an executive of this company told us in one interview, "Innovation between the big, the small, and the in-between is what makes the industry succeed." Another Pfizer executive noted that while his company has not taken a dollar from the MLSC, the Center has helped the firm by creating a "mentality" about the life sciences that has permeated the state right down to the local level, making it possible to speed local permitting and rezoning where necessary.

Executives at Sanofi-Aventis SA, which acquired Genzyme in 2011 in a $20 billion deal, have relied on the MLSC to "act as a bridge" between the company and such research institutions as the Cummings School of Veterinary Medicine at Tufts University and the University of Massachusetts Medical Complex in Worcester. Like Pfizer, Sanofi is expanding in Cambridge in order to have a "front row seat" for acquisitions.[58]

And here is the key to understanding the central role of the MLSC. *While the large firms can easily exist without the MLSC, the small life sciences firms need the Center to provide them with accelerator loans, research and development funds, and interns who can help them translate their ideas into what could be commercially viable products. While the private venture capital market may provide some funds for this purpose, venture capital often requires a quicker return than can be obtained from this industry, which often has long lag times between initial research, proof of concept, and a final FDA-approved product.*

In 2012, according to data gathered by PricewaterhouseCoopers, venture capital investments in biotech and health-care startups fell to their lowest level since 1995.[59] Investment in biotech firms in the Boston area dropped to $869 million in 2012, a 24 percent reduction from 2011 levels. Regulatory uncertainty facing the health-care industry is making this "a more challenging time for life sciences companies to raise money," according to Terry McGuire, general partner of Polaris Venture Partners, a Waltham-based VC firm with about half its portfolio invested in health-care companies.[60] Another reason biotech investments may be dwindling is that new software companies are on the rise and the return on investments in these firms tends to be much more "capital-efficient," paying off relatively rapidly.

The lack of easy access to VC funds has worried small life sciences firms about the "valley of death"—the gap in funding needed to move basic research into commercial products. In this environment, the MLSC has become an important investment partner for smaller life sciences firms, providing them with funds for translational research and development. These smaller firms may grow out of local research universities and medical complexes, but they can then turn to the MLSC for investment assistance. This tends to help keep them in the Commonwealth instead of losing them to investment funds in other regions.

In a number of cases, we found that smaller companies were being lured to relocate to other states, but according to their executives, the MLSC moved quickly to narrow the interregional cost differential and keep these firms in the Commonwealth. They did this through tax incentives and investment credits. And because these "minnows" stay here, Big Pharma has come from all over the world to swim in this pond. By helping to attract small life sciences companies to Massachusetts as well as incubating new ones begun in the state, the MLSC has created a well-stocked fishing ground for Big Pharma. In 2012 alone, a large array of small- and medium-sized domestic and international firms chose to establish operations in Massachusetts, including Era7 Bioinformatics, Algeta U.S., QServe, Scivax USA, ReproCELL, Inc., Human Metabolome Technologies, Inc., Alacrita, Arrayjet, ARGO Medical Technologies, BioAxone, BioSurplus, Promedior, and KeraFAST.

By the end of 2012, nine of the ten major drug companies in the world had set up shop in Massachusetts.[61] To house these firms, 3.4 million square feet of biotech-related office and laboratory space is now under construction across Massachusetts with massive buildings now being completed for Pfizer and Novartis. This adds to the 2.4 million square feet of commercial lab space erected between 2007 and 2011.[62] The other Big Pharma firms with major investments in Massachusetts are Johnson & Johnson, GlaxoSmithKline, Sanofi (which absorbed Genzyme), AstraZeneca, Abbott Laboratories, Merck, and Bristol-Myers Squibb. A decade ago, none of these global firms had a significant presence or any presence at all in the state, according to Mass Bio, the state's life sciences trade group.[63] Only Roche, the Swiss company and third largest biopharmaceutical firm in the world, has yet to establish a presence in the Commonwealth.

With this growth dynamic at work, Massachusetts appears well positioned to continue to attract new investment in the life sciences cluster.

## The MLSC "Modus Operandi"

In the course of this study, many of those interviewed commented on the protocols that the MLSC follows in carrying out its activities. According to these sources, the Center's success in funding firms is grounded in its reliance on a Scientific Advisory Board (SAB) to guide the Center's Board of Directors in determining which firms show the greatest promise of economic and scientific success. The Center has established a competitive process for securing assistance and the SAB has made certain that the process is transparent. Over and over again, we heard in our interviews words like "rigorous" and "diligent" when describing the processes MLSC uses in selecting awardees.

It should be noted that other states that have created similar life sciences initiatives have had a less-than-stellar record of maintaining a process free of political considerations. In early 2013, the Texas Legislature essentially defunded the state's Cancer Prevention and Research Institute (CPRIT), which had been established by referendum in 2007. This followed the resignation of the agency's chief scientific officer, along with many of the institute's high-profile grant reviewers, in protest over how the independent peer review system had been disrespected.[64] According to the chair of the MLSC's Scientific Advisory Board, here in the Commonwealth the Center has been scrupulous in following the recommendations of the Center's Board of Directors and the SAB.

This has apparently contributed to the Center's exceptional record of assisting firms that ultimately succeed and grow. Accountability measures implemented by the Center have also contributed to the success of the Center's tax program. As **Table 6** reveals, the Center had

TABLE 6

**Firms Receiving Tax Incentive Funding (Program Years 2009-2011)—Active Awards**

| | | Hiring Goal | Hiring Actual | % of Goal | Hiring Potential |
|---|---|---|---|---|---|
| 2009 | Shire | 150 | 153 | 102% | 153 |
| 2009 | Cubist | 58 | 60 | 103% | 60 |
| 2009 | Biogen | 50 | 235 | 470% | 235 |
| 2009 | Merrimack | 50 | 53 | 106% | 53 |
| 2009 | Lightlab | 29 | 32 | 110% | 32 |
| 2009 | Constellation | 26 | 21 | 81% | 26 |
| 2009 | Sepracor | 25 | 108 | 432% | 108 |
| 2009 | InfraReDX | 21 | 25 | 119% | 25 |
| 2009 | OmniGuide | 18 | 10 | 56% | 18 |
| 2009 | Organogenesis | 15 | 26 | 73% | 26 |
| 2009 | Dyax | 15 | 23 | 153% | 23 |
| 2009 | Still River | 10 | 18 | 180% | 18 |
| 2009 | Nova | 10 | 25 | 250% | 25 |
| 2009 | Infinity | 18 | 14 | 78% | 18 |
| 2009 | STD Med | 10 | 54 | 540% | 54 |
| 2010 | Shire | 150 | 141 | 94% | 150 |
| 2010 | Sanofil | 100 | 101 | 101% | 101 |
| 2010 | Vertex | 90 | 136 | 151% | 136 |
| 2010 | NX Stage | 50 | 27 | 54% | 50 |
| 2010 | Merrimack | 50 | 37 | 74% | 50 |

TABLE 6

## Firms Receiving Tax Incentive Funding (Program Years 2009-2011)—Active Awards *(continued)*

| | | Hiring Goal | Hiring Actual | % of Goal | Hiring Potential |
|---|---|---|---|---|---|
| 2010 | Ironwood | 37 | 56 | 151% | 56 |
| 2010 | Instrumentation Laboratory | 30 | 30 | 100% | 30 |
| 2010 | Valeritas | 18 | 10 | 56% | 18 |
| 2010 | Organogenesis | 17 | 44 | 259% | 44 |
| 2010 | Bluebird | 10 | 13 | 130% | 13 |
| 2010 | Bind | 10 | 8 | 80% | 10 |
| 2010 | NormOxys | 10 | –5 | –50% | 10 |
| 2010 | LeMaitre | 19 | 43 | 226% | 43 |
| 2010 | Foundation Medicine | 40 | 25 | 63% | 40 |
| 2010 | Lightlab | 14 | 45 | 321% | 45 |
| 2010 | Nova | 10 | 10 | 100% | 10 |
| 2011 | Shire | 100 | | | 100 |
| 2011 | Vertex | 100 | | | 100 |
| 2011 | AVEO Pharma | 94 | | | 94 |
| 2011 | Biogen Idec | 75 | | | 75 |
| 2011 | Ironwood | 75 | | | 75 |
| 2011 | DePuy Othopaedics | 50 | | | 50 |
| 2011 | Momenta Pharma | 50 | | | 50 |
| 2011 | PerkinElmer | 50 | | | 50 |
| 2011 | Organogenesis | 35 | | | 35 |
| 2011 | Aegerion Pharma | 27 | | | 27 |
| 2011 | Lightlab | 26 | | | 26 |
| 2011 | Cell Signaling Tech | 20 | | | 20 |
| 2011 | Quanterix Corp | 19 | | | 19 |
| 2011 | NinePoint Medical | 15 | | | 15 |
| 2011 | Pharmalucence | 12 | | | 12 |
| 2011 | Metamark Genetics | 11 | | | 11 |
| 2011 | New England Biolabs | 10 | | | 10 |
| 2011 | Nova | 10 | | | 10 |
| 2011 | T2Biosystems | 10 | | | 10 |
| 2011 | Boston Heart Diagnostics | 31 | | | 31 |
| 2011 | Ra Pharma | 10 | | | 10 |
| 2011 | Blueprint Medicines | 15 | | | 15 |
| 2011 | PAREXEL International | 32 | | | 32 |
| 2011 | Moderna Therapeutics | 13 | | | 13 |
| 2011 | Courtagen Life Sciences | 13 | | | 13 |
| 2011 | Knome | 12 | | | 12 |
| | **2009–2011 Awardees** | **1,160** | **1,578** | **136%*** | **2,639**** |

Source: Massachusetts Life Sciences Center

* Proportion of hiring goal for 2009–2010 active awardees only; no data available on 2011 awardees at this time

** Minimum total jobs created if, on average, all firms meet or exceed hiring

31 outstanding tax incentive packages from the 2009 and 2010 programs as of June 30, 2012.

In a number of cases, hiring targets were exceeded by a factor of four or greater. In only one case did a firm receiving an award actually reduce its staff. As of June 30, 2012, the currently active 31 awards from the 2009/2010 program have produced 1,578 new jobs, exceeding the aggregate hiring goal of 1,160 by 36 percent. Adding in the 2011 program awards for which we do not yet have data on hiring, the potential number of new hires could exceed 2,600 if all firms, on average, meet or exceed hiring goals.

As noted above, the accelerator loan program is also meeting with success, with six of the 20 firms that received such loans already repaying them in full.

**Table 7** provides additional data on the outstanding awards to firms from the 2009 program, the first year of the program. The outstanding amount of the tax incentive awards as of June 30, 2012 amounts to $15.25 million. Fifteen firms received tax incentive awards in that year totaling $15.25 million. They ranged in size from $6.3 million to Shire Human Genetic Therapies to $121,000 to STD Med, Inc. In 2009, these firms had a base headcount of 5,427. The target headcount associated with these awards was 5,932—an increase of 505 hires. By the end of 2011, 12 of these firms had met or exceeded their hiring targets.

What adds to the efficiency of these awards is a "claw-back" feature requiring firms that fail to meet their approved hiring goals to return to the Center the funds they were provided. A number of firms have done just that when they were unable to meet their specified minimum job-creation targets.

TABLE 7

## Annual Report: 2009 Tax Incentive Program Results—for annual reporting period ending December 31, 2011

| | | | Per Agreement | | | Actual | 2011 | Actual | |
|---|---|---|---|---|---|---|---|---|---|
| | | $ Award Provided | Base Hdct | Adds | Targeted | 12/31/2011 Hdct | Actual Growth (from base) | % of Adds (from base) | Achieved or exceeded target |
| | **COMPANY** | | | | | | | | |
| | **Active awards** | | | | | | | | |
| 1 | Shire Human Genetic Therapies, Inc. | $6,277,057 | 986 | 150 | 1136 | 1280 | 294 | 196% | Yes |
| 2 | Cubist Pharmaceuticals, Inc. | $1,740,000 | 355 | 58 | 413 | 415 | 60 | 103% | Yes |
| 3 | Biogen Idec MA, Inc. | $1,500,000 | 1899 | 50 | 1949 | 2134 | 235 | 470% | Yes |
| 4 | Merrimack Pharmaceuticals, Inc. | $1,500,000 | 124 | 50 | 174 | 214 | 90 | 180% | Yes |
| 5 | LightLab Imaging, Inc. | $188,951 | 64 | 29 | 93 | 141 | 77 | 266% | Yes |
| 6 | Constellation Pharmaceuticals, Inc. | $513,252 | 41 | 26 | 67 | 62 | 21 | 81% | No |
| 7 | Sepracor Inc. / Sunovion | $750,000 | 601 | 25 | 626 | 709 | 108 | 432% | Yes |
| 8 | Infraredx, Inc. | $630,000 | 60 | 21 | 81 | 85 | 25 | 119% | Yes |
| 9 | OmniGuide, Inc. | $ 540,000 | 62 | 18 | 80 | 72 | 10 | 56% | No |
| 10 | Infinity Pharmaceuticals, Inc. | $ 540,000 | 172 | 18 | 190 | 186 | 14 | 78% | No |
| 11 | Organogenesis Inc. | $ 245,240 | 241 | 15 | 256 | 311 | 70 | 467% | Yes |
| 12 | Dyax Corp. | $ 100,000 | 94 | 15 | 109 | 117 | 23 | 153% | Yes |
| 13 | Mevion (formerly Still River Systems), Inc. | $ 300,000 | 73 | 10 | 83 | 91 | 18 | 180% | Yes |
| 14 | Nova Biomedical Corporation | $ 300,000 | 498 | 10 | 508 | 533 | 35 | 350% | Yes |
| 15 | STD Med, Inc. | $ 121,000 | 157 | 10 | 167 | 211 | 54 | 540% | Yes |
| | **TOTALS** | $ 15,245,500 | 5427 | 505 | 5932 | 6,561 | 1,134 | | |

Source: Massachusetts Life Sciences Center

Based on wage and salary data from the companies receiving tax-incentive awards between 2009 and 2011, we carried out an economic analysis of the cost and benefit of this MLSC program. The results are found in **Table 8**. Our analysis suggests that as of June 30, 2012, the Center had $56.3 million in outstanding tax incentives. Altogether, the firms receiving these incentives added more than 2,500 jobs by 2012. The vast majority (1,843) of these were in pharmaceutical firms with the remainder generated by medical device companies (481) and scientific research enterprises (213). The average annual salary of these jobs exceeded $105,000. As such, these new jobs generated a total of over $266 million in wages and salaries each year.

Based on estimates from the Massachusetts Department of Revenue, we estimate that, on average, the added workers employed by these firms paid more than $4,900 in income taxes to the Commonwealth and $2,400 in sales taxes.[65] Assuming that each of these jobs lasts on average just five years, the added state revenue generated by these workers over that period is close to $37,000 per worker or a total of $93 million in tax revenue.

*Compared with the total cost of the incentive program, each dollar in awards will generate $1.66 to the state in added tax revenue*. This represents an extraordinary rate of return on this public investment.

TABLE 8
**Economic Return on the MLSC Tax Incentive Program**

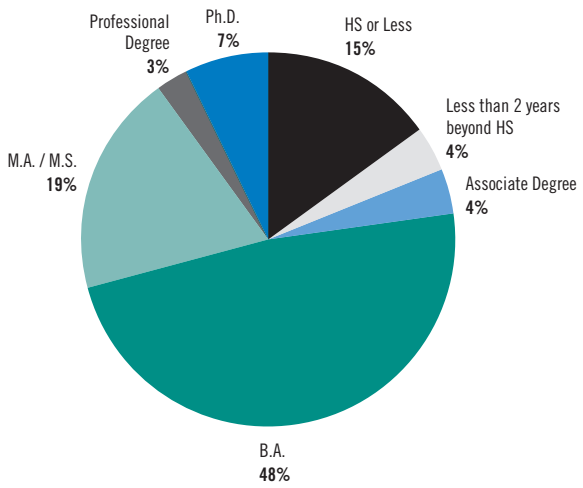
| | Program Year 2009 | Program Year 2010 | Program Year 2011 | 3 Years of Incentives |
|---|---|---|---|---|
| Total Value of MLSC Tax Incentives ($) | $15,245,500 | $20,672,638 | $20,340,884 | $56,259,022 |
| Net New Jobs Created | 901 | 721 | 915 | 2,537 |
| Tax Incentive per Job ($) | | | | $22,175 |
| Annual Tax Incentive per 5-year job ($) | | | | $4,435 |
| Average Salary per Job ($) | | | | $105,037 |
| Total Salaries Generated per Year ($) | | | | $266,479,399 |
| State Income Tax Revenue per Job per year ($) | | | | $4,937 |
| Total State Income Tax per year ($) | | | | $12,524,532 |
| Average Sales Tax per Job ($) | | | | $2,404 |
| Total State Sale Tax per year ($) | | | | $6,099,447 |
| Total Income+Sales Taxes per year ($) | | | | $18,623,979 |
| Average Income+Sales Tax/Job per year | | | | $7,341 |
| Total Income+Sales Taxes per 5-year Job | | | | $36,705 |
| Total Income+Sales Taxes over 5 years | | | | $93,120,585 |
| Net State Revenue Gain (5 years) ($) | | | | $36,860,872 |
| Ratio of Tax Revenue/Incentive over 5 years | | | | 1.66 |

| | Pharma | Medical Devices | Scientific Research | Total |
|---|---|---|---|---|
| Jobs | 1,843 | 481 | 213 | 2,537 |
| Average Salary ($) | $115,222 | $66,913 | $103,009 | $105,037 |
| Total Salary ($) | $212,353,256 | $32,185,280 | $21,940,863 | $266,479,399 |
| Share of Salary | 0.7969 | 0.1208 | 0.0823 | 1.0000 |
| State Income Tax By Sector ($) | $9,980,603 | $1,512,708 | $1,031,221 | $12,524,532 |
| Sales Tax by Sector ($) | $4,860,554 | $736,689 | $502,204 | $6,099,447 |

Source: Dukakis Center for Urban and Regional Policy

FIGURE 11

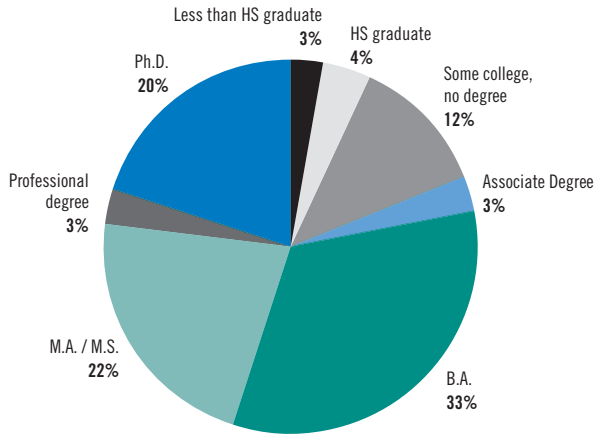
## Education Distribution of New Hires by 2010 MLSC Tax Incentive Awardees




Source: Dukakis Center for Urban and Regional Policy

FIGURE 12

## Education Distribution—Pharma

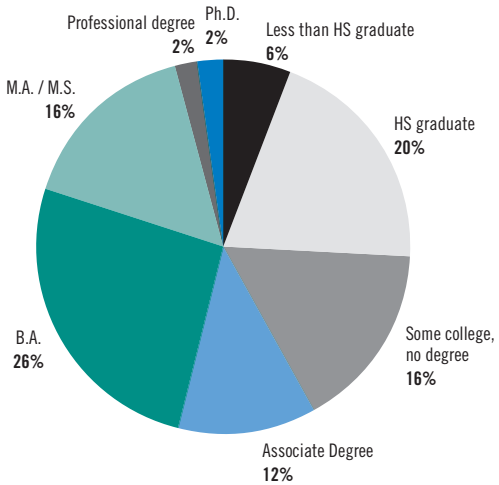



**Less than B.A.: 22%**

Source: Dukakis Center for Urban and Regional Policy

FIGURE 13

## Education Distribution—Medical Devices

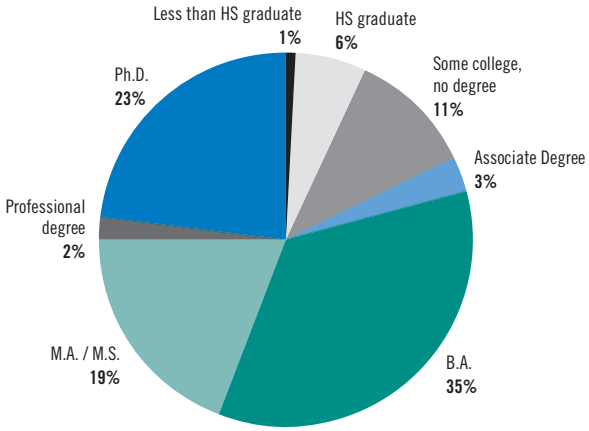



**Less than B.A.: 54%**

Source: Dukakis Center for Urban and Regional Policy

FIGURE 14

## Education Distribution—Diagnostics, Tools, and Related Products and Services



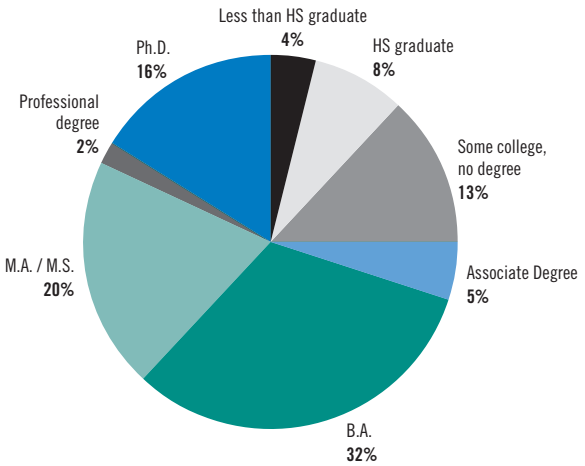

**Less than B.A.: 21%**

Source: Dukakis Center for Urban and Regional Policy

Of course, it is possible that these firms would have generated some or perhaps even many of these jobs without the MLSC award. But given the importance of the life-sciences ecosystem created in the Commonwealth, at least partly as a result of Center activity, it is reasonable to suggest that many of these jobs and their associated tax revenue would not have been created without the help of the Center. Moreover, our estimates do not consider any "multiplier" effects. The added spending of these new hires in the Commonwealth helped generate additional jobs as these workers spent money in the state, creating jobs in a wide range of industries.

FIGURE 15

**Education Distribution—Life Sciences Cluster Pharma/Medical Devices/Diagnostics, Tools, and Related Products and Services**




Less than B.A.: 30%

Source: Dukakis Center for Urban and Regional Policy

A concern that one might have about the employment generated by the life sciences super cluster is that the jobs created all go to the most educated workers in the state, leaving behind those who have not had the benefit of a college degree or post-graduate education. But based on the hiring records of a number of firms in the industry, it turns out that like other industries, life sciences firms need to hire workers who have a range of skills. In addition to Ph.D. scientists and other highly educated workers, these firms need laboratory technicians and clerical staff, and they employ a range of other workers in occupations that require a good deal less education. **Figure 11**, based on these hiring data, reveals that less than a third (29%) of those working in the life sciences have a Master's degree, professional degree, or Ph.D. Nearly half (48%) have the B.A. or B.S. as their highest level of education, while nearly a quarter (23%) of the workforce has no more than an associate's degree, often from a community college.

Using national data from the 2010 *American Community Survey* (ACS) available from the U.S. Census Bureau, we were able to estimate the education distribution for the individual sectors within the life sciences super cluster. As **Figures 12–15** demonstrate, the proportion of workers in each of the cluster segments needing less than a B.A. (or B.S.) ranges from 21 percent in diagnostics, tools, and related products and services and 22 percent in pharmaceutical firms to more than half in medical devices. According to these national estimates, the total workforce in the super cluster requiring less than a 4-year college degree is 30 percent, a bit higher than the 23 percent in Massachusetts. Essentially, with such a highly educated workforce in the Commonwealth, firms here are able to insist on somewhat higher educational credentials for their employees.

What adds to the value of the life sciences labor market in the Commonwealth are the high wages paid in this sector. As **Table 9** reveals, based on an analysis of Census data, the average annual wage in the state's

TABLE 9

**Estimated Annual Earnings for Life Sciences Workers (2006–2010)**

| | Pharma | Medical Devices | Scientific R&D | Total |
|---|---|---|---|---|
| Less than High School graduate | | $35,142 | $51,685 | $36,702 |
| HS graduate | $42,966 | $33,250 | $71,418 | $44,225 |
| Some college, no degree | $62,745 | $46,684 | $61,816 | $55,386 |
| Associate's degree | $96,171 | $61,400 | $53,712 | $61,285 |
| Bachelor's | $95,147 | $98,853 | $85,080 | $92,033 |
| Master's | $102,851 | $114,019 | $102,045 | $105,143 |
| Professional school degree | $150,264 | $118,399 | $182,999 | $161,195 |
| Doctorate | $171,596 | $249,332 | $112,626 | $134,195 |
| **Total** | $102,961 | $78,498 | $96,379 | $91,805 |

Source: Dukakis Center Analysis of American Community Survey (Census) data

life sciences varies from $78,500 in medical devices to nearly $103,000 in the pharmaceutical industry.[66] Those with a Ph.D. earn, on average, nearly $250,000 in the medical-device sector and well over $100,000 in other sectors within the cluster. But even those who have not completed high school average nearly $37,000 a year, the equivalent of more than $18.00 an hour. High school graduates average more than $44,000 and those with an associate's degree, more than $61,000.

Compared with other industries, the life sciences provide some of the highest paying jobs in the Commonwealth. With an average annual salary of nearly $92,000, this sector rewards its workforce with higher pay than those who work in manufacturing as a whole, construction, real estate, education, government, health care, and transportation. The average salary in the life sciences industries in the Commonwealth exceeds the all-industry Massachusetts average by 68 percent.[67]

## The Long-Term Impact of the Commonwealth's Life Sciences Initiative

Based on all of the data we collected about the MLSC and its activities, the analysis we conducted on the expansion of the life sciences industries in the Commonwealth, and the information we gleaned from the interviews, our overall conclusion is that because of its unique comprehensive approach to an entire industry super cluster and its reliance on scientific peer-reviewed procedures for awarding grants, the Commonwealth has reaped a substantial return on its life sciences initiative investment. Moreover, given the number of firms that have been attracted to the state, in large measure because of the ecosystem the Center has helped nurture, the benefits from the state's investment in this initiative are likely to pay off bountifully in the years to come.

Many of our informants for this report noted that by 2018, when the $1 billion Life Sciences Initiative sunsets, the state will still need an agency that encourages innovation among smaller life sciences firms. Innovation, they note, must be a continuous process for the region to remain prosperous. This will be particularly important as China, India, Singapore, and other foreign countries compete for a share of this expanding super cluster by offering massive incentives to life sciences start-ups.

The big question is whether Massachusetts can continue to lead the nation in the evolution of this critical industry or whether other regions of the country will be able to capture this industry and the jobs that go with it. Massachusetts was once the premier textile center of the nation until the south captured much of the industry in the early part of the 20th century. The Commonwealth led in the development of the commercial computer industry in the 1970s and 1980s with the growth of Digital Equipment Corporation (DEC), Data General, Prime Computer, and Wang, but lost out to Silicon Valley in California and companies like Dell in Texas. Today, other states including New Jersey, California, New Mexico, Utah, and Minnesota are all vying to expand their life sciences clusters.The state's concentration of globally prominent "eds and meds" has clearly been critical to the evolution of the life sciences in the Commonwealth.

One area where the MLSC might wish to pay more attention in the years to come is the medical-device industry. As noted earlier in this report, employment in this component of the life sciences cluster has been stagnant. According to our interviews, other states including Indiana, Michigan and Minnesota are targeting this sector with state funding. Unlike Big Pharma, which can be more patient in the marketplace and worry less about cost pressures, medical-device firms need to move quickly in the market to commercialize their products and they need to be vigilant about reducing costs. To the extent that the MLSC can assist these firms, Massachusetts could remain a center for this sector and employment growth could ensue.

But overall, based on the state's continued commitment to the life sciences, we fully expect to see further growth in the size of private-sector investments in the state's life sciences industries and further increases in employment opportunity.

## Assessment of the MLSC Staff

The interviews we carried out also suggested that the Center itself is being run quite effectively and efficiently and in a highly professional manner. Virtually all of our informants praised the management team and especially appreciated the leadership's reliance on peer review and its refusal to permit political considerations to trump scientific merit. As one expert informant noted, the MLSC has "lots of moving parts" and all of them are working well and the Center remains responsive to

industry needs, meeting deadlines, and staying focused on its mission. As another informant put it, with the reliance on the Scientific Advisory Board (SAB) to select awardees, "there is not an ounce of boondoggle in this agency." In its report on creating fiscally sound state tax incentives, the Pew Center on the States singled out the Massachusetts Life Sciences Tax Incentive Program for its focus on annual cost controls and its reliance on scientific merit in making awards.[68]

Still another informant noted that the MLSC is successful because its leadership is committed to working "at the speed of business" and therefore has become a valued partner in the expansion of the industry.

# Conclusions

All of our research suggests that the state will benefit from fully funding the remaining five years of the initiative in order to maintain the lead the life sciences have established in the Commonwealth. This is particularly important as other states ramp up their investments in hopes of creating their own life-sciences ecosystems to entice the small and large firms Massachusetts has successfully attracted. California, Maryland, New Jersey, New York, Minnesota, and Florida are not resting on their laurels, but continue to spend state funds on their own life-sciences industries.

Over time, it should be possible for the Center to reach out to the private sector to help fund more of its initiatives, as it has done with the Massachusetts Neuroscience Consortium. With the plethora of larger, profitable firms coming to the state to expand their operations, one could imagine the Center funding more of its internships with private funds and having private firms contribute to other programs (STEM education, for example), allowing the Center to focus even more of its funding on accelerator loans and tax incentives for firms undertaking translational research.

We should also note that the success of the MLSC has lessons for other quasi-public entities in the Commonwealth. We can mention five of them here:

1. Long-term success in the use of tax incentives and business loans is most likely to occur when funds are focused on a cluster of firms and a set of technologies in a given industry, helping to create an industrial ecosystem which can attract new companies to the state.
2. The use of expert panels to determine the awarding of loans assures that these funds will be well utilized. "Claw-back" provisions protect the taxpayers by requiring firms to repay funds advanced by the Commonwealth if they fail to meet hiring goals.
3. The focus on encouraging firms in their early-stage innovation activity is central to promoting economic growth and prosperity.
4. Helping fund workforce development efforts for critical industries as part of the mandate of the quasi-public helps assure a pipeline of skilled workers for the industry and this itself helps attract new firms to the region.
5. Taking a "portfolio" approach to the entire range of activities in the life sciences—from investments in small innovative firms to helping train the future workforce to underwriting infrastructure—helps sustain the "ecosystem," undergirding a virtuous cycle of discovery, innovation, investment, and employment opportunity.

In the end, we applaud the Governor and the Legislature for their foresight in creating the Massachusetts Life Sciences Center and the $1 billion Life Sciences Initiative. The structure put in place is fulfilling the goals set out in the original legislation and the Center's leadership has continually assured that the structure works effectively and efficiently.

# Endnotes

## Chapter One

1. The Massachusetts Life Sciences Center, "About the Center," www.masslifesciences.com/mission.html.

2. Massachusetts Life Sciences Center, *Fiscal Year (FY) 2012 Annual Report*, "Outpacing the Competition," Cover Letter, September 28, 2012.

3. According to an analysis prepared by the Massachusetts Budget and Policy Center, the Commonwealth faces at least a $1.2 billion deficit in FY2014. This is based on current tax rates and expected spending. See Massachusetts Budget and Policy Center, "A Preview of the FY2014 Budget," January 10, 2013.

4. Following on the early work of Stanley Surrey who served as Assistant Secretary of the U.S. Treasury for Tax Policy, the Congressional Budget and Impoundment Act of 1974 (CBA) defines *tax expenditures* as "those revenue losses attributable to provisions of the Federal tax laws which allow a special credit, a preferential rate of tax, or a deferral of tax liability." See Stanley Surrey, Pathways to Tax Reform: The Concept of Tax Expenditures (Cambridge, MA.: Harvard University Press, 1974); U.S. Congress, Congressional Budget Act of 1974.

5. Joe Stephens and Carol D. Leonnig, "Solyndra: Politics Infused Obama Energy Program," *Washington Post*, December 25, 2011.

6. Carol D. Leonnig, "Battery Firm backed by Federal Stimulus Money files for Bankruptcy," *Washington Post*, October 16, 2012.

7. Jason Schwartz, "End Game," *Boston Magazine*, August 2012.

8. The specific life sciences industry sectors used in this report are based on the non-agricultural 6-digit NAICS (North American Industry Classification System) as reported in the *Battelle/Bio State Bioscience Industry Development 2012 Report* produced jointly by the Battelle Institute, the Biotechnology Industry Organization (BIO), and MPM Public Affairs Consulting, Inc. (June 2012).

9. This set of NAICS industries omits perhaps 50 percent of the growth in life sciences jobs in Massachusetts because it omits life sciences in research in hospitals and universities. These jobs are not counted in the Battelle report because the NAICS industrial coding system cannot distinguish between research jobs in hospitals and other jobs in hospitals such as physicians and nurses, and life sciences research jobs in universities and other jobs such as English and social science professors.

10. It is important to note that because we could not break out faculty, staff, and students involved in the life sciences departments and research institutes from all others employed at universities and hospitals, this report does not include an analysis of the educational attainment, earnings, and occupations for those working in these institutions. Clearly, if we could have done this, our estimates of the number of those employed in the life sciences in Massachusetts would be much greater.

11. Massachusetts Biotechnology Council, "The Complete Guide to the 2012 New England Life Sciences Industry," p. 4.

12. Jane G. Gravelle and Thomas L. Hungerford, "The Challenge of Individual Income Tax Reform: An Economic Analysis of Tax Base Broadening," Congressional Research Service, 7-5700, March 22, 2012.

## Chapter Two

13. The largest of these include the exclusion from taxable income of employer contributions for medical insurance premiums and medical care; the net exclusion of contributions to 401(k) pension plans, Individual Retirement Accounts (IRAs), and Keogh plans; the deductibility of home mortgage interest on owner-occupied homes, the deductibility of charitable contributions, and the preferential tax rates on long-term capital gains.

14. Tad DeHaven, "Corporate Welfare in the Federal Budget," Policy Analysis No. 703, Cato Institute, July 25, 2012.

15. Ibid., Table 1, pp. 3–5.

16. See Louise Story, Tiff Fehr and Derek Watkins "As Companies Seek Tax Deals, Governments Pay High Price," *New York Times*, December 1, 2012, p. 1; "Lines Blur as Texas Gives Industries a Bonanza," New York Times, December 2, p. 2; "Michigan Town Woos Hollywood, but End Up with a Bit Part," *New York Times*, December 3, p. 1.

17. MA Film Office, "Mass Film Tax Credit by the Numbers," http://www.mafilm.org/mass-film-tax-credit-by-the-numbers

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18. Robert Pollin and Dean Baker, "Public Investment, Industrial Policy and U.S. Economic Renewal," Center for Economic and Policy Research, Working Paper Series Number 211, December 2009, p. 2.

19. DeHaven, op. cit., p. 6.

20. DeHaven, op.cit., p. 6

21. Pollin and Baker, op. cit., p. 3

22. Barry Bluestone and Bennett Harrison, *Growing Prosperity: The Battle for Growth with Equity in the 21st Century* (New York: Houghton Mifflin Company and The Century Foundation, 2000), p. 207.

23. Bluestone and Harrison, op. cit., p. 207.

24. Paul Romer, "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Vol. 8, No. 1 (Winter 1994).

25. Bluestone and Harrison, op. cit., p. 210.

26. See Jeremy Greenwood, "The Third Industrial Revolution," Paper prepared for the American Enterprise Institute, October 25, 1996.

27. See B. Jovenovic and S. Lach, "Product Innovation and the Business Cycle," *International Economic Review*, February 1997.

28. See a series of papers by Erik Brynjolfsson and Lorin M. Hitt including "Computers and Productivity Growth: Firm-Level Experience," MIT Sloan School of Management, January 1997; "Information Technology as a Factor of Production: The Role of Differences among Firms," *Economics of Innovation and New Technology*, Vol. 3, No. 4 (1995); and "Paradox Lost: Firm-Level Evidence on the Returns to Information Systems Spending," *Management Science*, Vol. 42, No. 4 (April 1996).

29. Battelle Institute, "2012 Global R&D Funding Forecast," *R&D Magazine*, December, 2011.

30. Battelle Institute, op.cit, p 6.

31. Bluestone and Harrison, op.cit., p. 216.

32. Ben S. Bernanke, "Promoting Research and Development: The Government's Role," Remarks before the Conference on New Building Blocks for Jobs and Economic Growth," Washington, D.C., May 16, 2011.

33. See Martin Bailey, "Trends in Productivity Growth," in Jeffrey C. Fuhrer and Jane Sneddon (eds.), *Technology and Growth: Conference Proceedings*, Federal Reserve Bank of Boston, Conference Series No. 40, June 1996.

34. Matt Hourihan, "The Federal R&D Budget: Process and Perspectives," Presentation before the AAAS Leadership Seminar in Science and Technology Policy, American Association for the Advancement of Science, November 12, 2012.

35. MassBio "Biopharma Industry Snapshot, 2012," p. 22 based on data from the National Institutes of Health and the U.S. Census.

36. Congressional Budget Office, "Federal Support for Research and Development," June 2007.

37. National Science Board, *Science and Engineering Indicators 2012* (Washington, D.C.: National Science Foundation, January 2012).

38. See Economic Geography Glossary, http://faculty.washington.edu/krumme/gloss/a.html.

39. Steven J. K. Walters, "Unions and the Decline of U.S. Cities, *Cato Journal*, Vol. 30, No. 1 (Winter 2010), p. 119.

40. For a fascinating history of Silicon Valley, see the three-part series on National Public Radio, *The Birth of Silicon Valley* produced by Laura Sydell. These include "A Rare Mix Created Silicon Valley's Startup Culture" (April 4, 2012); "America's Magnet for Innovation and Investments" (April 5, 2012); and "Intel Legends Moore and Grove: Making It Last" (April 6, 2012).

41. IEEE History Center, "A Brief History of the U.S. Federal Government and Innovation (Part III): World War II and Beyond (1945-1987) (Washington, D.C.: Institute of Electrical and Electronic Engineers, n.d.).

42. See National Research Council, Funding a Revolution: Government Support for Computing Research, (Washington, D.C. 1999), pp. 2–3.

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43. This section is based on Mark R. Trusheim, Ernst R. Berndt, Fiona Murray, and Scott Stern, "American Entrepreneurial Chaos or Collaborative Industrial Policy: The Emergence of the Massachusetts Biotechnology Super-Cluster," Contributed Paper for the 2nd Conference on Corporate R&D (European Commission, 2010).

44. Trustheim, Berndt, Murray, and Stern, op.cit., p. 13.

45. MassBio "Biopharma Industry Snapshot, 2012," p. 23 based on MassBio membership reports and the *Boston Business Journal Book of Lists, 2012.*

46. See Greg Turner, "Boston is a Big Force in Pharma, *Boston Herald*, December 14, 2012.

47. Jones, Long LaSalle, "Life Sciences Cluster Report: Global 2011," p. 16. Boston ranked #1 on each component of the composite score with the exception of venture capital funding where it ranked #2.

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48. MassBio, "Massachusetts Life Sciences Incentives," Fact Sheet, September 2012.

49. "Refundable" tax credits are payments made to a taxpayer by the Internal Revenue Service or the Commonwealth's Department of Revenue. Such payments can offset other tax liabilities or in the case of no tax liability are a form of "negative" tax.

50. Massachusetts Life Sciences Center, *Fiscal Year (FY) 2012 Annual Report*, p. 4.

51. According to an MLSC memo to the Secretary of Administration and Finance, "The MLSC Tax Incentive Program has enforcement mechanisms, including strict monitoring and reporting requirements for recipient companies. Within 30 days of the end of each calendar year following the award, awardees are required to provide an annual report to the Center that permits the Center to determine whether the awardee's job targets have been met. The statute provides for 'clawback' provisions for companies that are found not to be fulfilling their job creation commitments to the state. Companies that fail to achieve at least 70% of their job targets at the end of any annual reporting period are subject to an investigation to determine the cause of this 'material variance.'" In cases where it is found that the company cannot meet its requirements, the Center

notifies the Massachusetts Department of Revenue so that the department can initiate claw-back procedures to recover the tax value any award provided. If a company has met at least 70% of its goal, the Center may permit the company a second year to fully meet this requirement before notifying the DOR. See memo to Jay Gonzales, Secretary, Executive Office for Administration and Finance from Susan Windham-Bannister, President and CEO of the Massachusetts Life Sciences Center, August 27, 2012.

52. Massachusetts *Life Sciences Center, Fiscal Year (FY) Annual Report*, op. cit., p. 6.

53. UMass Donahue Institute, *Growing Talent: Meeting the Evolving Needs of the Massachusetts Life Sciences Industry* (Cambridge, MA.: Massachusetts Life Sciences Center and Massachusetts Biotechnology Council, 2008), p. 15.

54. U.S. Bureau of Statistics, *Quarterly Census of Employment and Wages* as reported in MassBio "Biopharma Industry Snapshot, 2012," p. 4. These statistics are for NAICS Code 541711.

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55. See D.C. Denison, "Drugmakers, Mass. Form Consortium," *The Boston Globe*, June 20, 2012, p. B1.

56. Pfizer: Science at our Core, "R&D Locations: Cambridge, MA." http://www.pfizer.com/research/rd_works/cambridge.jsp.

57. Pfizer: Science at our Core, op. cit.

58. See Jeanne Whalen and Mimosa Spencer, "Sanofi wins Long-Sought Biotech Deal," *Wall Street Journal*, February 17, 2011.

As a case in point, on January 29th, 2013 Sanofi announced the launch of LeGoo, a biopolymer gel that allows surgeons to temporarily stop blood flow during surgery without the use of clamps, elastic loops or other conventional occlusion devices that may risk trauma to blood vessels. LeGoo was developed by Pluromed, a young company that was one of the first to receive a loan through the Center's Accelerator Loan Program in 2009. The Accelerator Loan provided support for Pluromed at a critical stage in the development of LeGoo. Pluromed repaid its loan with interest to the Center following its acquisition by Sanofi.

59. See Michael B. Farrell, "Startup Funding Declines Across US," *The Boston Globe*, January 18, 2013, p. B5.

60. Michael B. Farrell, "Startup Funding Declines Across US," op. cit., p. B9.

61. See Greg Turner, "Boston is a Big Force in Pharma," *Boston Herald*, December 13, 2012.

62. MassBio "Biopharma Industry Snapshot," 2012, p. 9.

63. Greg Turner, "Boston is a Big Force in Pharma," op.cit.

64. Monya Baker, "Texas Cancer Institute gets no Funds for new Grants in Proposed Budget," *Nature.com*, January 16, 2013.

65. According to estimates prepared by the Mass DOR from recent annualized tax revenue data, state income tax revenues in the Commonwealth average 4.7% of wage and salary income and sales tax revenues average 48.7% of income tax revenues.

66. These estimates are based on data for 2010 from the American Community Survey (ACS).

67. See Barry Bluestone, et. al, *Staying Power II: A Report Card on Manufacturing in Massachusetts 2012*, Dukakis Center for Urban and Regional Policy, September 2012, Table 1.10, p. 32 based on data from the U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages.

68. "Avoiding Blank Checks: Creating Fiscally Sound State Tax Incentives, Pew Center on the States, December 2012, Table 1, p. 5 and p. 14.