ANNUAL REVIEW AND ANALYSIS OF REAL ESTATE TRENDS IN THE LIFE SCIENCE INDUSTRY

Elements 2007

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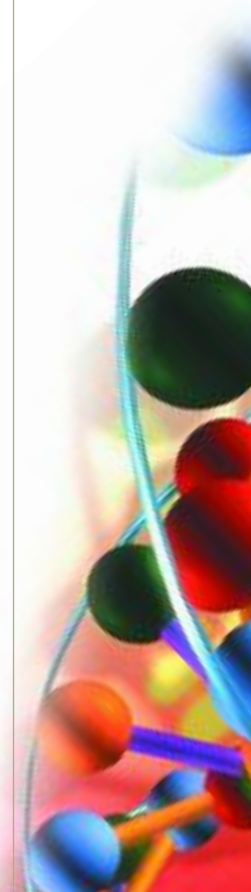

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The synthesis of market analysis, technology, and experience create the innovative environments that accelerate future discoveries.

Change is inevitable, as the analysis of the life science industry presented in this report indicates. This year, Colliers International is proud to present its highly successful report, previously entitled *Alchemy*, in a new and updated format with a new name, *Elements 2007*. This report builds on the information provided in the previous *Alchemy* reports and highlights overall trends in the life science industry, as well as in the key major and emerging life science real estate markets.

The overall outlook for the life science industry remains strong in large part to the following underlying industry drivers:

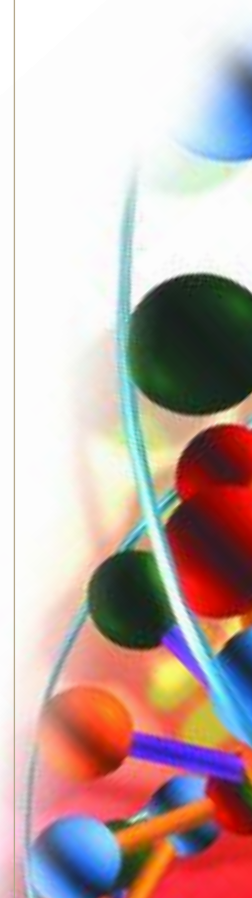
- Worldwide, people are living longer and requiring more health care services, as well as new drug treatments, especially for chronic diseases. The rising cost of healthcare has provided an increased emphasis on new drugs and treatments that can drive down costs and make health care accessible to all.
- Widespread research breakthroughs at the convergence of biological science, bioinformatics, and nanotechnology continue to spawn the development of new life science products and services.
- The convergence of technology and medicine through "translational science" is facilitating a paradigm shift toward predictive, preventive, personalized, and participatory health care.
- Continuing and emerging threats to human health from infectious disease and bioterrorism has spawned new research endeavors in this area.
- Financial investment in the industry remains strong, although the sources of this investment are changing.
- Creative new relationships amongst pharmaceutical and biotechnology companies, U.S. federal and state governments, private research institutes and foundations, as well as private donors are all contributing to continued growth.
- The industry is becoming increasingly global, with many foreign governments investing heavily in developing their research and development and production capacity.

Despite the positive outlook, regulatory, scientific, and policy challenges have arisen. Given the enormous investment made in advancing scientific breakthroughs to improve human health, and the very real progress that has been made, there is reason to believe that these challenges will be met. The industry can and will change according to the solutions worked out.

The growth in the life science real estate marketplace has been truly extraordinary, with financial investors and lenders demonstrating a more sophisticated understanding of the market, as well as publicly traded companies assembling national and, in some cases, international portfolios of life science real estate, generating good returns for investors.

As in the past, each of the life science real estate markets are unique, with its own characteristics and industry drivers, as covered in Chapter 2 of this report. Colliers possesses a deep understanding of the life science industry and these markets, and stands ready to assist clients in meeting the challenges of change in the future.

Nancy J. Kelley
Elements Editor and Chief Researcher



COLLIERS INTERNATIONAL

Colliers International is a global real estate services firm with over 9,000 employees in 266 offices in 54 countries, generating $1.5 billion in annual revenue and over $40 billion in annual transaction volume. It offers a complete range of services on a local, regional, and international basis to tenants, owners, and investors.

This pioneering tradition of global breadth and local depth sums up Colliers' unique approach to the business of commercial real estate. By having the best firms around the world gathered under the umbrella of a single affiliation, Colliers International provides clients with superior global service through local in-depth knowledge and expertise.

"Our strength begins in your market
. . . and takes you anywhere in the world."

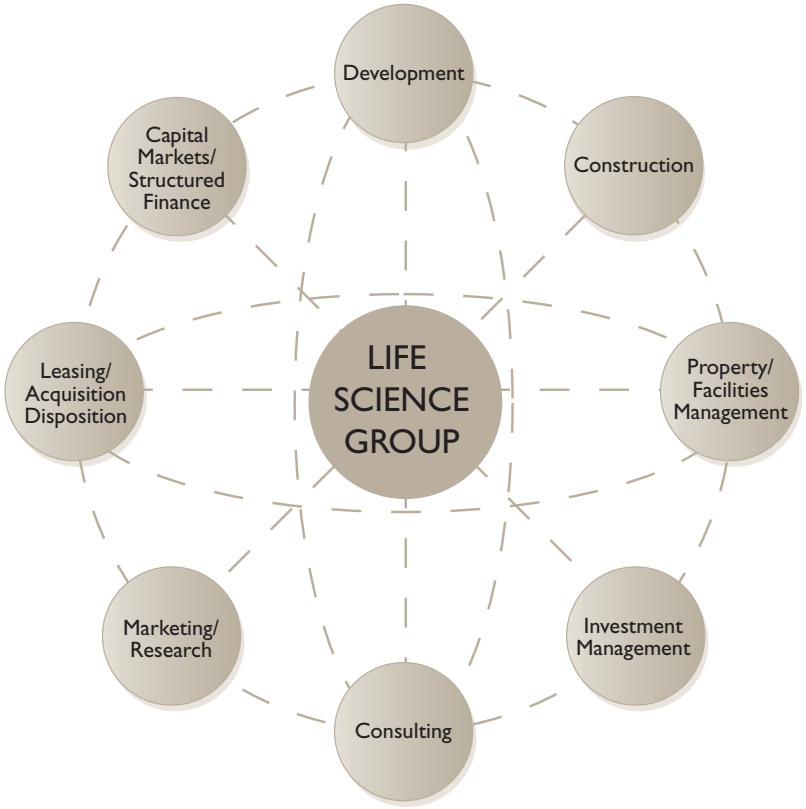
COLLIERS INTERNATIONAL LIFE SCIENCE PRACTICE

In life science research, integration is a powerful force. Even the most promising molecules, in isolation, rarely have much impact. Put the right combination together and something magical happens. Something powerful. Something that transforms human health.

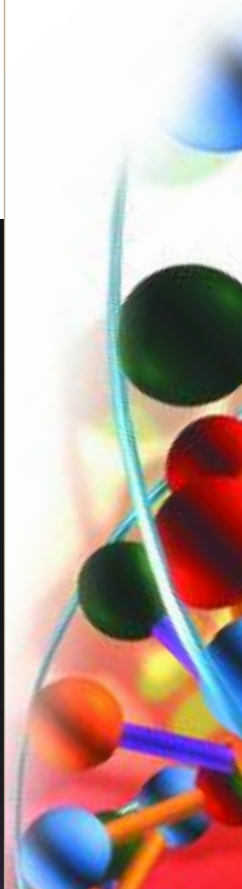
The same is true in real estate. Colliers provides innovative real estate solutions to the life science industry worldwide, through a dedicated group of more than 100 professionals in investment sales, construction, leasing, facility management, finance, and development. The Group has a major presence in each of the life science clusters and emerging markets in the United States, Canada, Europe, and Asia, bringing a truly global understanding of the developments driving the life science industry, a national understanding of the U.S. market, and a local perspective as a major player in each local market it serves.

Our formula of experience + talent + market research + proprietary technological tools creates exceptional environments that inspire innovation and speed drug development. We have earned a solid reputation for rapid, on-time, and under-budget delivery of the most sophisticated life science projects for the world's leading research centers and largest life science companies.

Colliers provides fully integrated real estate services in order to finance, develop, build, manage, and lease life science real estate.



TOGETHER, WE MAKE IMPOSSIBLE CHALLENGES, POSSIBLE.



GIVE ME A PLACE TO STAND AND I WILL

Move the Earth.

– Archimedes

NATIONAL LIFE SCIENCE

Industry Drivers

Widespread research breakthroughs at the convergence of biological science, bioinformatics, and nanotechnology continue to drive the growth and development of the life science industry, which has become truly a global presence. Companies involved in new drug development, medical devices, and biosecurity are bringing new products to market to improve human health, while states, regions, and countries around the world are nurturing the industry in order to spawn economic development and the creation of high-wage jobs.

The fundamental demographic and innovation drivers that have fueled the spectacular growth of the industry over the last few years are still relevant today. Rising life expectancies has resulted in a worldwide aging population with a rising demand for healthcare, especially to combat chronic disease. With healthcare costs rising, innovation in genomics and proteomics have allowed the creation of new products that will drive the cost of care down, by focusing on prevention and personalized treatment.

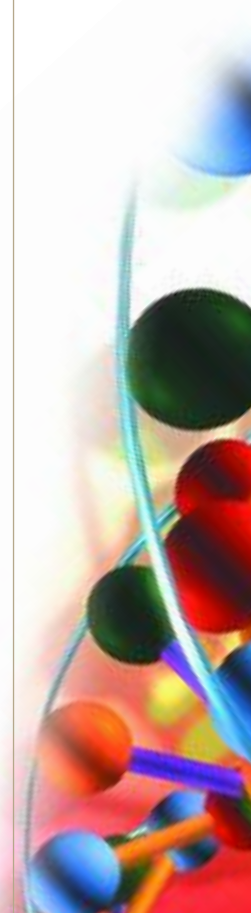
According to the Biotechnology Industry Organization,

- There are more than 300 biotech drug products and vaccines currently in clinical trials targeting more than 200 diseases, including various cancers, Alzheimer's disease, heart disease, diabetes, multiple sclerosis, AIDS, and arthritis.
- As of Dec. 31, 2003, there were 1,473 biotechnology companies in the United States, of which 314 were publicly held.
- Many biotechnology companies have evolved over the years into profitable, fully integrated biopharmaceutical firms, like Amgen, Biogen, Genentech, and Gilead.
- Market capitalization, the total value of publicly traded biotech companies (U.S.) at market prices, was $311 billion as of early April 2005.
- The biotechnology industry has mushroomed since 1992, with U.S. health-care biotech revenues increasing from $8 billion in 1992 to $39 billion in 2003.

In the United States, total employment in life sciences in 2004 (the last date for which data is available), reached 1.2 million, with the majority of employment falling into the medical device, research, testing, and laboratory area. These jobs generated an additional 5.8 million in related industries, resulting in total employment of seven million, with an average annual wage of $65,000, more than 50% higher than the average private sector annual wage.

(Source: Growing the Nation's Bioscience Sector: State Bioscience Initiatives 2006, April 2006. Battelle Technology Partnership Practice and SSTI, "The Batelle Report").

Financial investment in the industry, for both new products and companies, is still climbing, despite some difficult trends. After years of double-digit increases, financial support for the industry through the National Institutes of Health (NIH) has dwindled over the last several years, increasing the competition for grants in the basic science area. In addition, venture capital, while still plentiful, has focused on later-stage companies with products closer to market, leaving critical support for early-stage companies just emerging from the laboratory harder to find. Similarly, initial public offerings as a means of raising capital and providing an exit strategy for investors are increasingly available only to later-stage companies with proven technology platforms and products in Stage III clinical trials.



Several new players are stepping in to provide funding for research and development and early-stage companies, however. The growth in the value of strategic alliances between pharmaceutical companies and biotechnology firms has increased, with a renewed interest in early-stage deals. Many of the large drug makers are looking towards mergers and acquisitions as a means of filling their drug and development pipelines. Universities are devising new paradigms for transferring technology from the laboratory to start-up companies, taking on the early-stage development risk by attracting private donors and angel investors. In the United States, states are also supporting early-stage, proof-of-concept activities with pools of capital set aside from tobacco litigation settlements and by creating freestanding commercialization centers providing assistance with venture formation, recruitment of management teams, and strategic planning.

Other challenges remain. The pharmaceutical industry is facing a period when many of the patents on blockbuster drugs will expire, opening them to competition from lower-priced generic drugs. At the same time, their innovative productivity has diminished, while research and development costs have risen and reduced health care budgets have placed greater scrutiny from payers on prescription drug costs.

In addition, the life science industry is one of the most regulated industries in the world. The regulatory environment in the United States has become increasingly difficult the last two years. In addition to diminished funding from NIH, the FDA has experienced problems in its approval and monitoring process and with its conflict of interest policy, which has slowed the approval process for new drugs. Issues with Project Bioshield have delayed the development and commercialization of new products to combat infectious disease and bioterrorism. This year, a newly elected Democratic-controlled Congress has made the legislative and regulatory front more uncertain, with changes in the leadership of several critical oversight committees for the industry promising new legislative initiatives and regulatory review.

Finally, few institutions have managed to link basic and clinical research in a manner intended to speed results "from bench to bedside", so called "translational research." And controversial new research, like stem cell research, which blurs the lines between science and ethics, has prompted a public debate in which these efforts have been cut off or delayed. Scientific controversy surrounding the research of Korean scientists in this area has further complicated the environment.

Still, institutions, cities, states, regions, and countries around the world continue to nurture the life science industry in order to spawn economic development and produce new benefits for human health. Thanks to these efforts, the industry has become truly global in nature, promising continued growth and innovation for the future…as well as increasing competition.

National Industry Life Science Drivers 2006

Cluster	NIH Funding (FY2006)	Rank	VC Funding (2006)	Rank	Life Science IPO's (2006)	Rank
Boston	$2,204,289,140	3	$1,047,413,200	2	3	5
NY/NJ/CT	$2,590,331,520	2	$459,808,400	5	5	T-2
Philadelphia	$1,391,964,926	5	$528,617,500	4	0	9
Washington DC/Baltimore	$1,437,713,399	4	$306,225,900	7	5	T-2
Raleigh/Durham	$932,769,228	6	$172,508,300	9	1	T-7
Seattle	$813,356,455	7	$347,336,500	6	2	6
San Francisco	$3,142,616,266*	T-1	$2,178,763,100	1	7	1
Los Angeles	$3,142,616,266*	T-1	$250,967,400	8	1	T-7
San Diego	$3,142,616,266*	T-1	$755,304,600	3	4	4

** Regional data for NIH funding not available so state data was used*
Source: National Institutes of Health, Pricewaterhouse Coopers MoneyTree Report, Renaissance Capital's IPO Home

EMERGING Trends

The emerging global environment for the life sciences industry is mixed.

In the United States and internationally, the life science industry continues to experience substantial investment from pharma, venture capital, and public sources. Although NIH funding remained flat in the past year, in the United States, state subsidies and private investment in the life science industry has reached an all-time high, as the following trends indicate for 2006. In addition, positive developments continue with further definition of the NIH Roadmap for Biomedical Research and increasing investments in bioinformatics and the fight against bioterrorism and infectious disease.

In spite of this positive financial environment, there are indications of growing issues in the global regulatory arena for the approval of new drugs and generic biologics as well as continuing controversy over promising areas of research regarding stem cells.

Finally, increasing global investment, specialization, and competition may suggest a restructuring of the industry, from U.S. dominance to a more balanced distribution of life science activity throughout the world.

NIH Funding Remains Flat

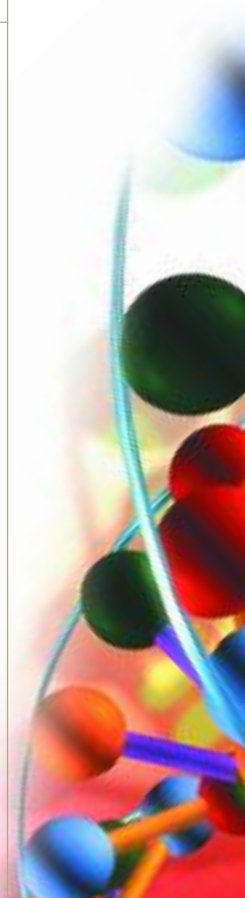
After nearly doubling in size from 1998 to 2003, the level of growth in NIH funding has slowed significantly in the past few years. Congressional appropriations for NIH grew between 13.9% and 16.2% annually from 1998 to 2003. Since 2004, the growth rate has been at or below 3%. In fiscal year 2006, NIH funding was cut for the first time in more than three decades. For FY 2007, the Bush administration requested NIH funding of $28.6 billion, effectively freezing spending in FY 2007, at the same level as FY 2006. If enacted, it will be the fourth year in a row that NIH funding has failed to keep pace with the rate of biomedical inflation, estimated at 3.5%.

Congress has not yet passed a budget appropriation for NIH funding for FY 2007, leaving it to operate at FY 2006 levels under a continuing resolution or until new budgets are approved. This uncertainty has made the awarding of grants and institutional planning at the NIH very difficult. In December, 2006, Congress passed a bill authorizing a 7% increase of $2 billion for FY 2007 and an 8.2% increase of $2.5 billion for FY 2008, subject to appropriations. This was positive as it set a target of what NIH funding should be. Nevertheless, in February, 2007, the Bush administration submitted a budget request that maintained NIH funding levels for FY 2008 at roughly the same level as 2007.

For biomedical research, all of this activity has dramatic effects. The demand for funding continues to rise, jumping from 19,000 researchers in 1998 to 34,000 last year. This has created significant competition for grant money with only 20% of all requests receiving funding. The current environment means fewer and smaller grants, with young investigators finding it more difficult to get their research funded.

On a more positive note, in December Congress passed the American Competitiveness and Innovation Act, a bill that would earmark $20 billion in new spending over five years to enhance innovation and competitiveness by boosting Federal research, as well as science and math education.

(Source: Continuing news coverage from www.the-scientist.com/daily).



R&D Investment by Biopharmaceutical Industry

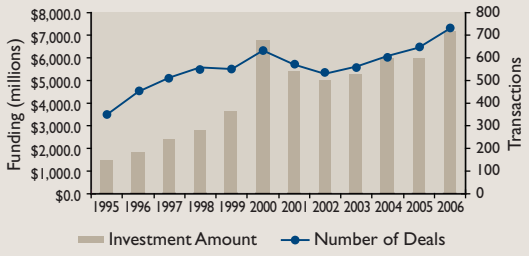
R&D investments in new medicines by the biopharmaceutical industry was just over $55 billion in 2006, representing an almost 8% increase over 2005 expenditures.

(Analysis conducted by Burrill & Company and the Pharmaceutical Research and Manufacturers of America.)

Record Year for Venture Capital

Since 2002, venture capital funding of the life science industry, which includes biotechnology and medical device firms, has trended upwards with 2006 reaching an all-time high, even exceeding the transaction volume seen during the tech boom of 2000. According to the MoneyTree Survey, conducted by PricewaterhouseCoopers, Thomson Venture Economics, and the National Venture Capital Association, in 2006 there were 731 venture capital transactions in the life science industry, totaling $7.2 billion. This was 19.2% higher than the $6.0 billion seen in 2005. The life science industry was the most popular sector among venture capitalists, representing 28% of the total deal volume of 2006.

Historical Life Science VC



Initial Public Offerings

Returns on overall IPO performance for 2006 were 26%, far exceeding the increase in the national market indices. 198 companies offered securities, dominated by life science offerings. As is usually the case, some of these life science offerings provided investors with large losses based on disappointing news after their entrance into the market, and many of the life science offerings priced below their proposed ranges. Nevertheless, two biotech deals were among the top five performers for 2006.

The overall IPO market had another strong showing on the international front, with 28 total pricings in 2006, which included some life science companies in the Chinese market, such as Mindray Medical, a fast-growing provider of patient monitoring, ultrasound, and diagnostic systems.

(Source: Renaissance Capital's 2006 Annual IPO Review. www.ipohome.com)

Strategic Alliances

The growth in the value of strategic alliances between pharmaceutical companies and biotechnology firms has increased, with a renewed interest in early stage deals. In 2006, the U.S. biotechnology industry generated revenues in excess of $20 billion through partnerships, up from $15 billion in 2005 and $11 billion in 2004. In 2006, 50% of partnering deals with significant terms involved preclinical assets.

(Source: Burrill & Co.)

Mergers and Acquisitions Increasing

Given the difficult IPO market, mergers and acquisitions (M&A) are playing a larger role in realizing investor exits, especially for private investors seeking greater multiples for late-stage products. M&A transactions continue to increase in both deal value and numbers.

Many of the large drug makers are looking towards mergers and acquisitions as a means of filling their drug pipelines. In 2006, there were 402 M&As in the life science industry, up from 362 in 2005 and 239 in 2004, according

Best Performing IPOs

IPO Date	Company	Business Description	Return*
4/20/06	Omrix Biopharmaceuticals	Develops biosurgical bleeding control and passive immunotherapy products.	203%
2/9/06	Acorda Therapeutics	Developing drugs for the treatment of multiple sclerosis and spinal cord injuries.	164%

*Source: Renaissance Capital's IPOhome.com * Based on offer price to 12/29/06 closing prices*

to Capital IQ. During 2006, the top 40 pharmaceutical and biotechnology companies spent over $16 billion acquiring more than 20 biotech and specialty pharmaceutical companies. Some of last year's most significant transactions include Bayer's $19.2 billion acquisition of Schering AG, Abbott Laboratories' $3.7 billion acquisition of KOS Pharmaceuticals, and Eli Lilly's $2.3 billion purchase of biotech company ICOS Corp. This trend is expected to continue as large pharmaceutical and biotech firms look to acquire small firms in order to bolster their development pipeline.

Significant Life Science Mergers and Acquisitions 2006

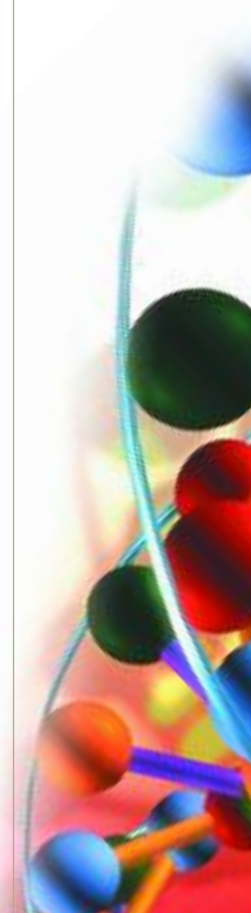
Date	Buyer	Target Company	Transaction Value (mm)
03/23/2006	Bayer AG	Schering AG	$21,667.0
05/07/2006	Thermo Electron	Fisher Scientific International Inc.	$12,366.4
09/21/2006	Merck KGaA	Serono S.A.	$9,055.3
09/21/2006	Nycomed	ALTANA Pharma AG	$5,366.0
11/05/2006	Abbott Laboratories	KOS Pharmaceuticals Inc.	$4,190.9
07/28/2006	Barr Pharmaceuticals Inc.	Pliva D.D.	$2,738.0
10/16/2006	Eli Lilly & Co.	ICOS Corporation	$2,565.9
10/01/2006	Gilead Sciences Inc.	Myogen Inc.	$2,477.0
09/20/2006	Hospira Inc.	Mayne Pharma	$2,005.9
03/12/2006	Watson Pharmaceuticals Inc.	Andrx Corp.	$1,968.0
04/25/2006	Millipore Corp.	Serologicals Corp.	$1,518.5
05/15/2006	AstraZeneca UK	Cambridge Antibody Technology Group	$1,074.2
10/30/2006	Merck & Co. Inc.	Sirna Therapeutics Inc.	$1,035.0
10/22/2006	Stiefel Laboratories, Inc.	Connetics Corporation	$925.1
08/28/2006	Mylan Laboratories Inc.	Matrix Laboratories Limited	$723.4
07/14/2006	Stada-Arzneimittel AG	Hemofarm Koncern	$614.5
08/30/2006	Genzyme Corp.	AnorMED Inc.	$599.4
11/12/2006	Illumina Inc.	Solexa Inc.	$586.4
12/13/2006	Forest Laboratories Inc.	Cerexa, Inc.	$580.0
06/07/2006	Novartis Pharma	NeuTec Pharma plc	$567.1

Source: Capital IQ

U.S. Drug Approvals Reach Eight-Year Low

After a period of improved new drug approvals with shorter review times, the drug approval process hit a rough spot in 2004. Several high-profile blockbuster drugs taken by millions of patients were found to deliver serious side effects to a significant portion of consumers. Merck announced that it was pulling Vioxx, its popular Cox-2 inhibitor pain medication for arthritis, from the market because the drug raised the risk of heart attack and stroke in some patients. Later, the FDA announced that a clinical trial involving another Cox-2 inhibitor for arthritis pain, Pfizer's $3 billion blockbuster drug, Celebrex, was to be discontinued.

The year 2006 was another tough year for drug makers as the U.S. Food and Drug Administration (FDA) only approved 18 "new molecular entities" or new drugs with novel chemical ingredients. Although this was the same level as the previous year, the number of drug approvals was well off the 31 drugs seen in 2004 or the 53 drugs seen in 1996. Drug makers are spending more on research but are producing fewer drugs. From 1993 to 2004, the annual research and development expense reported by the pharmaceutical industry



"Leaders in the newly elected Democratic-controlled Congress have proposed bills that would give the FDA authority to approve generic biologics without the full testing required of the original drugs."

increased 147% from $16 billion to $49 billion. Drug approvals originating from the top 10 pharmaceutical companies accounted for less than half of the approvals in 2006, although Pfizer and Merck both had two drugs approved.

(Source: "2006 Drug Approvals: Finding the Niche," by Joanna Owens, Nature Reviews Drug Discovery 6, 99-101 (February 2007))

An Improved Environment for Generic Drugs?

Traditionally, large pharma companies, the makers of small-molecule drugs protected by patents, enjoy 10-15 years of exclusivity during which time they can sell their drugs at a high price, presumably to recoup the high cost of the research and development of such products. After this period expires, generics manufacturers are allowed to enter the market and the price of the drug usually plunges since small molecule drugs can often easily be reproduced and the generic companies do not bear the initial cost of R&D.

This has not generally applied to products offered by biotechnology companies like Amgen and Genentech, whose drugs are called "biologics" or proteins manufactured in living cells. These drugs are harder to copy and harder to prove that a copy is effectively equivalent in improving human health. Because of this, biotech drugs often never face competition from generic manufacturers, even after their patents expire.

That is changing. In 2004, the European Medicines Agency, which oversees all drug regulation in the European Community, released new guidance on its policy with respect to generic biologics, paving the way for generic companies to offer alternative products to drugs such as erythropoietin, or EPO, the product sold as Epogen by Amgen with global sales in 2006 of $2.51 billion. In response, two companies have already applied to introduce new versions of the drug in Europe.

Given the high cost of health care and growing pressures to make prescription drugs more affordable, the United States may soon follow Europe's lead. Leaders in the newly elected Democratic-controlled Congress have proposed bills that would give the FDA authority to approve generic biologics without the full testing required of the original drugs. Biotechnology companies are fighting this legislation, stating that the generic products should undergo extensive testing prior to approval because they are not identical scientifically or commercially and therefore pose a risk to public health. In addition, the introduction of generic biologics in this manner will economically harm biotechnology companies, which provide a growth engine for their communities, and will provide a serious disincentive for biotechs to invest in new biologics to improve public health for the future.

Despite these arguments, many believe that generic biologic drugs will be approved for use in the United States. Some large pharma companies and many smaller generic companies are preparing for this event, which could have a huge financial impact on many of the larger and profitable biotechnology companies.

(Source: "For Booming Biotech Firms, A New Threat: Generics", by Anna Wilde Mathews and Leila Abboud, The Wall Street Journal, March 14, 2007."

Update: The NIH Roadmap for Biomedical Research

The NIH Roadmap for Biomedical Research is a series of initiatives designed to pursue major opportunities and gaps in biomedical research that no single NIH institute could tackle alone. These initiatives fall into three major areas:

- **New Pathways to Discovery**, which invests in emerging areas of research such as biological pathways and networks; structural biology; molecular libraries and imaging; nanotechnology; and bioinformatics and computational biology.
- **Research Teams of the Future**, which supports both individual creativity and team efforts by supporting interdisciplinary research, high-risk research, and public-private partnerships.
- **Re-engineering the Clinical Enterprise**, which assists clinical research through harmonization efforts of regulatory policies, multi-disciplinary training, development of networking and diagnostic tools, and facilitating the establishment of academic homes for clinical and translational research.

(Source: www.nihroadmap.nih.gov)

"NIH's portion of biodefense-related spending continues to increase, totaling $1.9 billion, a 6.2% increase of $110 million."

Research projects already funded under the Roadmap fund range from a large grant establishing a seven-state collaborative proteomic network, to individual research grants for pioneering young investigators. In FY 2007, NIH will direct $443 million toward Roadmap initiatives. In 2008, the NIH has selected five additional topics for further consideration as major Roadmap initiative proposals.

BioSecurity: The Front Line Against Bioterrorism and Infectious Disease

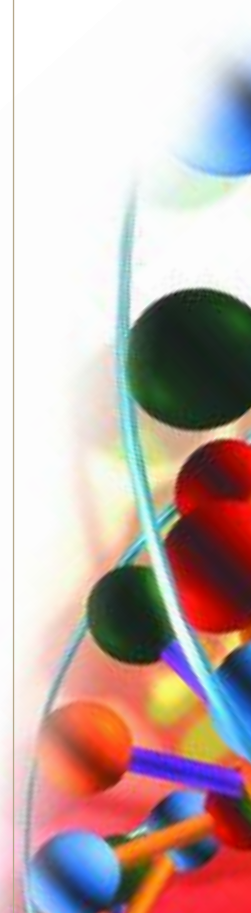
In July 2004, President Bush signed into law Project BioShield, which provided $6 billion in funding over the next 10 years to purchase vaccines and drugs protecting against anthrax, botulinum toxin, Ebola virus, plague, and other pathogens. At the time, the measure was positively received by the life science community.

So far, large pharmaceuticals have not been interested in developing products for BioShield, because the legislation did not provide indemnification for litigation and damages if a vaccine or drug should result in adverse health effects. In addition, in response to the federal government's threat to override Bayer's patent on the antibiotic Cipro if Bayer did not reduce its prices during the 2001 anthrax attacks, they are also unwilling to spend large sums on development before they are assured of a government contract. Consequently, industry executives have called on the federal government to provide indemnification as well as guarantees of procurement.

Illustrative of the problem is the experience of VaxGen, a small San Francisco biotech company developing an anthrax vaccine under an $877.5 million contract with the Department of Health and Human Services. The Agency terminated its contract with VaxGen in December, 2006, because the vaccine developed by VaxGen was too unstable to be tested in clinical trials and due to delays in the delivery schedule for the vaccine. The Company received approximately $115 million in grants for its work, but had spent nearly $175 million developing the vaccine. The cancellation will delay the creation of a recombinant-based stockpile of vaccines for anthrax sufficient to immunize 25 million people for at least three years.

In December 2006, Congress passed a measure giving pharmaceutical and biotech companies immunity from lawsuits if they develop vaccines and drugs against bioterrorism and natural outbreaks. Entitled the "Pandemic and All-Hazards Preparedness Act", the bill creates a Biodefense Medical Countermeasure Development Fund with $500 million in annual grants to help companies bridge the funding gap between discovery and procurement for bioterror-related vaccines and therapies.

In the meantime, biodefense research is continuing. The National Institute of Allergy and Infectious Disease (NIAID), has solicited grant proposals



under BioShield's accelerated development provisions. And NIH's portion of biodefense-related spending continues to increase, totaling $1.9 billion, a 6.2% increase of $110 million. The FY 2006 defense bill includes $3.8 billion for avian flu preparedness to develop and stockpile countermeasures, boost surveillance, and improve public communications in case of a pandemic.

Finally, at the end of 2006, President Bush signed into law legislation creating a new government agency – the Biomedical Advanced Research and Development Agency, to fund and coordinate government research and development efforts into countermeasures for bioterrorism and infectious disease outbreaks. This Agency is intended to breathe new life into Project BioShield and will be housed in the Department of Health and Human Services. It is intended to provide a bridge between the end of initial testing and commercial manufacture of products in the bioterrorism arena. Details about how the new Agency will operate have not yet been resolved.

(Source: Continuing news coverage from www.the-scientist.com/daily).

> ***"In addition to Canada, Europe and Japan, international markets which were covered in previous Colliers reports, China, India, Singapore and Dubai have now joined the growing ranks of life science power houses worldwide."***

BioInformatics

Life science research is information intensive and generates large amounts of data. In order to truly analyze the complex bits of information generated by their work, scientists require computer programs and other tools to evaluate, combine, and visualize their data. Consequently, bioinformatics and computational biology has become an important and growing segment of the life sciences industry. This area is also a major initiative under the NIH Roadmap.

As part of NIH efforts to build the nation's capacity in this area, the NIH created seven National Centers for Biomedical Computing. The goal of these centers is to link "big science" and "small science" together in a kind of information superhighway, where all researchers can share data and ideas gathered from large experiments using a common set of software tools.

Animal Rights Terrorism

Animal rights terrorism has become an increasing concern for the industry, illustrated most recently by violence incited against Huntington Life Sciences, a contract research organization in the United States and United Kingdom. In 2006, a federal judge sentenced three animal rights activists to four to six years in prison and ordered them to pay more than $1 million in restitution for their activities in connection with this incident.

In December 2006, Congress passed the Animal Enterprise Terrorism Act to expand protection for researchers by outlawing economic damage against "animal enterprises," which include organizations involved in academic and commercial research and testing. The legislation provides a graduated scale of prison time and fines for those found guilty of harassing, intimidating, trespassing against, or vandalizing the property of anyone associated with animal research.

Stem Cell Technology: A Continuing Contentious Debate

As Colliers reported in *Alchemy 2005*, in the United States the debate concerning stem cell research highlights the often contentious conflict between scientific breakthroughs and moral and ethical beliefs. It has pitted the federal government, which limits stem cell research to an approved list of stem cell lines derived prior to August 9, 2001, with state governments that question whether the federally imposed limit on cell lines available for federally funded research is too restrictive.

In response, a number of states have taken action to fund and allow research on human embryonic stem cells. Of these initiatives, California's is the largest, but New Jersey became the first state in the country to actually issue grants to 17 research teams at institutions across the state. New Jersey later established the New Jersey Stem Cell Institute, funded by $11.5 million in FY 2005.

California passed the most significant measure when it created the California Institute of Regenerative Medicine (CIRM), after voters approved California's Stem Cell Research and Cures Act (Proposition 71), making $3 billion in state bonds available for stem cell research. Lawsuits challenging the constitutionality of the legislation filed by opponents to the measure have delayed the release of any funding under this program. Although efforts to block the program suffered a setback in 2006 when a state judge ruled the program constitutional, the ruling is now under appeal.

In spite of the legal climate, CIRM is proceeding to press forward, currently operating under a $5 million philanthropic grant. Its organizers have adopted ethical guidelines and approved $38.9 million in training grants to 16 state institutions. Some of these funds will be used to create a three-year stem cell training program for predoctoral, postdoctoral, and clinical fellows.

At the federal level, in 2006 the Congress passed legislation to extend federal research funding to newly derived stem cell lines, but lacked the support necessary to override a presidential veto. The legislation was reintroduced in early 2007 as the Stem Cell Act Research Enhancement Act of 2007.

Despite the setbacks in Korea, many countries are moving forward with legislation designed to loosen restrictions around this research and support it financially. Recently, the British government approved plans to allow women to donate eggs for stem cell and cloning research, with compensation to cover costs such as travel or lost work time.

The Growing International Reach of the Life Science Industry

The United States is the largest market for life sciences in the world. Despite the birth and early growth of the industry here, foreign countries from around the world are now investing billions of dollars into life sciences research and development, as well as the infrastructure required to grow and strengthen their own positions in this market. In addition to Canada, Europe, and Japan, international markets which were covered in previous Colliers reports, China, India, Singapore, and Dubai have now joined the growing ranks of life science powerhouses worldwide.

SCIENCE DOES NOT KNOW ITS DEBT TO
imagination.
– Ralph Waldo Emerson

WHAT'S New

Universities and Technology Transfer: A New Paradigm

The United States' success in scientific research and development has been the result of a partnership among academia, the federal government, and industry. Research institutions take the risk of building and developing scientific capacity; the federal government, through a competitive peer-review process, funds the best science; and industry plays the critical role of bringing new, safe, and effective products to the public.

The primary driver for this growth is the Bayh-Dole Act of 1980, which gave universities the right to own the technology of their scientists, patent discoveries, and license them to companies with the capacity to develop, test, manufacture, and market new products. In response to this legislation, a number of universities have increased their efforts in technology transfer, building up valuable expertise in helping to negotiate deals with commercial companies. Currently, the Association of University Technology Managers (AUTM) now seeks to promote, support, and improve U.S. academic technology transfer worldwide. Their work has been instrumental in enabling public use and benefit from federally funded technologies, including from the life sciences, and strengthening U.S. competitiveness.

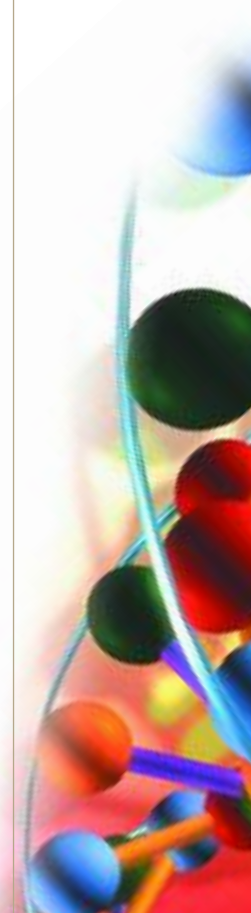
The 2005 AUTM U.S. Annual Survey indicates that collectively, invention disclosures, patenting, and commercialization activities have been robust: 28,349 commercial licenses have been granted by universities to companies; a total of 3,541 new products have reached the marketplace since 1998; and a total of 5,171 new spinout companies based on academic research have been created since 1980. Technology transfer has become a major driver in the creation of new jobs and economic development.

Internationally, other countries have followed suit, adopting laws similar to the Bayh-Dole Act. Germany, Korea, Taiwan, Singapore, and Japan, among others, all allow academic institutions to own inventions resulting from research in their labs. Britain and Canada have established pools of funds to accelerate the commercialization of university research.

Thirty years after scientists from Stanford and UC San Francisco developed commercial applications for their work on recombinant DNA and Genentech was formed, growth in the life science industry continues to rely on collaborations between technology transfer offices at major pharma and universities, staff scientists, venture capitalists, and start-up companies.

A recent Milken report measured the success of the technology transfer process for life science development at the world's major universities, focusing on an "innovation pipeline" that enabled a university to convert its research into intellectual property that could be commercialized. The Milken Report based their assessment on three performance indicators: publications, patents, and commercialization performance. Key findings included:

- Harvard ranked first in terms of biotech research, followed by the University of Tokyo and University of London. U.S. universities hold eight of the top 10 positions; the UK and Japan hold three of the top 25 rankings.
- The University of Texas system scored first on the biotech patent composite index, followed by UC San Francisco and Johns Hopkins. Nine of the top 10 patent holders are U.S. universities. The University of London ranked first among foreign universities.
- MIT led the list with respect to technology transfer and commercialization, which included factors such as licensing and start-ups.



- The United States continues to lead in invention disclosures, patents filed, licenses executed, and licensing income, but European universities surpass their U.S. counterparts in startups established.

(Source: "Mind to Market: A Global Analysis of University Biotechnology Transfer and Commercialization," September 2006, by Ross DeVol and Armen Bedroussian, The Milken Institute.)

Despite this success, the process of managing technology transfer has become more complex and challenging, with recent criticism from industry officials, academics, and others asserting that technology offices are staffed with poorly trained personnel who do not understand the technical achievements of scientists and their commercial application, fail to respond to scientists seeking protection and commercialization of their work, and seek onerous royalty arrangements that discourage private companies from pursuing commercialization. A handful of U.S. universities are responsible for the vast amount of commercialization.

Nevertheless, universities will continue to play an increasingly important role in ensuring that discoveries in basic science get translated into products and services that will advance human health as venture capital flows into later-stage companies.

A new paradigm for technology transfer is emerging at many major universities that may increase their involvement and importance in early-stage drug development. Often, university research results are at such an early stage that pharmaceutical companies are uninterested in licensing technology unless hard data exists with respect to toxicity, efficacy, and sometimes even Phase I clinical data.

So, universities are stepping in to bridge that gap. Licenses are increasingly being made to start-up companies that can work closely with an investigator to further develop the technology prior to forging partnerships with large pharmas. In addition, some universities, like Harvard, are increasingly taking on the early-stage development risk themselves, raising money from wealthy individuals to pay for preclinical development of a handful of promising products such as drug candidates, diagnostic tests, and medical devices. With this approach, the gap between academic research and commercialization could be more effectively bridged.

This shift will also require new types of facilities, modeled on incubators, that can provide space for young companies close to the academic labs that developed the technology they are commercializing, in order to foster close collaboration for development in the early stages of new drugs and products.

Strategic Alliances: Fueling Early Stage Life Science Development

The growth in the value of strategic alliances between pharmaceutical companies and biotechnology firms has increased, with a renewed interest in early-stage deals.

Traditionally, the rationale driving partnerships between biotech firms and big pharma has been based on the relative competencies between the two. With diminishing drug pipelines and the imminent expiration of many blockbuster patents, big pharmas need new products and technologies. In addition, as the pace of technological discovery increases, big pharma can no longer expect to stay competitive by relying on their own research groups alone. Biotech companies, on the other hand, need financial investment to weather long drug development cycles, help with clinical trials and regulatory filings and marketing strength.

Previously, big pharma preferred to partner on later-stage deals, where drugs were clinically proven and closer to market readiness. Terms of the strategic alliances between the two partners

often took two forms. Under a standard licensing agreement, the pharma partner would supply a target and the biotech would use its technology to provide an optimized drug candidate. The pharma partner would then take over development and pay royalties to its biotech partner. Under a strategic research and marketing collaboration, the pharma partner would make an up-front investment in the biotech partner, either a one-time payment and/or equity investment, and make development milestone payments. The pharma partner would remain responsible for commercialization efforts.

Recent changes in the marketplace have changed this emphasis, however. The decline in venture capital and IPOs for early-stage companies has increased the competition for investing in later-stage deals, making attractive partners harder to find and driving up the cost of the transactions. For example, in addition to the traditional payments required, recent transactions with late-stage companies have also involved profit-sharing between the pharma and biotech partners on co-promoted products.

"Nevertheless, universities will continue to play an increasingly important role in ensuring that discoveries in basic science get translated into products and services that will advance human health as venture capital flows into later stage companies."

As a result, many pharma companies are providing the expertise and financing for early-stage companies in the biotech industry. Pharma ceutical partners are recognizing the value of partnering with biotechs early, in order to use their experience with the FDA to guide the testing of promising drug candidates and avoid costly delays. The current structure of deals provides for more collaboration in the lab as a means of maximizing the long-term value of assets, as well as risk-sharing from discovery through commercialization. This approach has increased the value of partnerships, driving milestone payments and royalties higher, and made the deals more complex, covering a larger number of variables.

All of this activity has changed the way big pharma approaches strategic alliances, with many companies setting up a formal infrastructure for pursuing and managing them. For example, GlaxoSmithKline several years ago divided its research and development into seven Centres of Excellence for Drug Discovery (CEDDs). In 2005, Glaxo added the Centre of Excellence for External Drug Discovery, an eighth CEDD that targets access to outside technology through partnership, joint research, and licensing.

In addition to the developments described above, global competition is driving an increase in regional licensing deals that specifically exclude major territories such as North America, the United States, and Europe, and include a growing number of Asian territory-only deals. This development is being driven by the rapidly expanding biopharma industry in China, India, Japan, Singapore, Korea, and Taiwan. This trend is likely to continue, as the life sciences industry becomes more global and competitive.

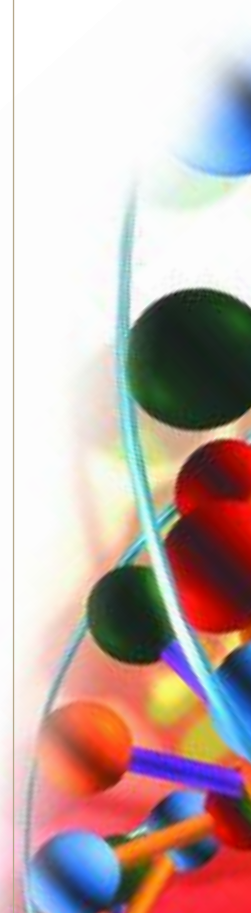
(Sources: Burrill & Co.; "The Partnership Push," by Rick Mullin, C&EN Northeast News Bureau, Chemical & Engineering News, March 6, 2006, Volume 84, Number 10, pp. 21-27)

The Changing Face of the FDA

Andrew von Eschenbach was confirmed as the FDA Commissioner in December, 2006, after serving as acting chief for more than a year. Although the presence of a permanent head may help to speed up the regulatory review and approval process, the uncertainty of a Democratic-controlled Congress promising more active oversight for the FDA may hinder the FDA's initiatives.

Drug Safety Concerns

After a series of highly publicized recalls for approved drugs and devices over the last several years, including COX-2 inhibitors and Guidant's pacemaker device, the Food and Drug Administration has come under increasing scrutiny with respect to its efforts to monitor safety, ensure manufacturing standards, and check medical ads for accuracy. In addition, the Agency's recent handling of its review of the clinical trials of the antifibrinolytic drug aprotinin (Trasylol), has raised further safety questions with respect to the accuracy and completeness of data



disclosed to the FDA by investigators and drug companies in the evaluation of new drugs. The presence of outside experts on FDA advisory committees who help to evaluate new drugs, and who also serve as consultants to the drug companies but have been excused from the Agency's conflict-of-interest policies, has only compounded the public's perception that the FDA is not fulfilling its mission of ensuring drug safety for the public.

In 2006, a number of reports issued by the Department of Health and Human Services, the Government Accountability Office, and the Institute of Medicine criticized the FDA's deficiencies in safety monitoring. These reports were reinforced by medical reviews published in leading medical journals.

As a result, several new pieces of legislation have been introduced in Congress. A bill introduced by Senators Grassley and Dodd would give additional resources to the FDA's drug safety office and make it structurally independent of the Agency's drug approval division, addressing the conflict-of-interest concerns. It would also give the Agency more power to demand that manufacturers conduct post-marketing surveillance to track safety issues of newly approved drugs. Other measures will address managing conflicts of interest among FDA scientific review committee members and giving the agency greater oversight over clinical trials. The Enhancing Drug Safety and Innovation Act of 2006, introduced by Senators Enzi and Kennedy, would strengthen the government's clinical trial registry by requiring the registration and disclosure of all late-phase 2, phase 3, and phase 4 clinical trials, even those that report negative results.

In addition, the FDA plans to develop new policies and regulations of its own in the areas of drug-safety assessments and post-marketing surveillance of new drugs and clinical devices.

Whatever the measures adopted, it is safe to say that the FDA will undergo considerable change in the coming year.

(Source: Continuing news coverage from www.the-scientist.com/daily).

Personalized Medicine

The recent spate of drug withdrawals from the marketplace after detrimental effects to patients is prompting a paradigm shift in the market away from treating existing diseases with blockbuster drugs toward a model of preventive care and personalized medicine.

"Blockbuster drug development has long been the business driver for both big pharma and biotechs alike."

Blockbuster drug development has long been the business driver for both big pharma and biotechs alike. Current medicines are developed to detect and treat existing diseases across a broad range of patients, disregarding the fact that different patients have different symptoms and may respond to therapy differently based on genetic differences. More than 100,000 deaths occur from unanticipated side effects from medication in the U.S. each year, illustrating the high cost of this "one size fits all" approach. Of the $1.4 trillion healthcare spent in the U.S. today, 80% is spent on chronic care. The best way to reduce chronic care is prevention of a disease itself.

Personalized medicine employs new methods to better manage a patient's predisposition to a disease and their illness. It involves counseling a patient about the probability of contracting a disease based on their unique genetic profile, using behavioral and other interventions to prevent the disease from occurring, diagnosing a disease in its early stages when it can be better treated, and tailoring the right medicine to an individual at the right time in the context of the patient's unique genetic and environmental profile.

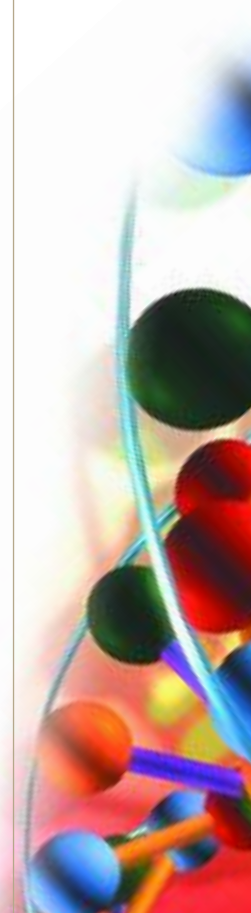
This approach offers the possibility of not only improved health outcomes, but more cost-effective health care delivery. It will require a number of new healthcare tools in the areas of prediction, diagnosis, monitoring, and treatment of disease, including a low-cost way to provide patients with the definition of their personalized genome.

Consequently, the life sciences industry is witnessing a shift by both biotech and big pharma companies towards identifying disease biomarkers for use in proprietary diagnostics and the development of genetically targeted, patient-specific therapies. In addition, companies are looking towards "evidence-based medicine," which emphasizes closer collaboration between basic and clinical research, in order to treat individual patients more effectively.

In 2006, The Foundation for the National Institutes of Health, the National Institutes of Health, the Food and Drug Administration, and the Pharmaceutical Research Manufacturers of America announced the launch of a major public-private biomedical research partnership – The Biomarkers Consortium, intended to search for and validate new biomarkers as a means of "accelerating the delivery of successful new technologies and medicines for prevention, early diagnosis, and treatment of disease." Several companies are currently working on ways of sequencing human genomes quickly and inexpensively.

Still, the realization of personalized medicine to reduce health care costs will take some time. Regulatory challenges at the FDA will require better understanding of targeted therapies to design trial protocols and procedures aligned with this approach. Without privacy protection, information about an individual's predisposition to disease could affect employment and insurance decisions. Public policy makers and regulators need to understand the importance of shifting the paradigm in health care delivery.

(Sources: The Burrill Personalized Medicine Report: "Personalized Medicine: A Transformation in Healthcare", Burrill & Company, October 2005; "Who Wants the X Prize?", The Scientist, February 2007)



MEN LOVE TO WONDER, AND THAT IS THE
seed of
science.
– Ralph Waldo Emerson

Creating

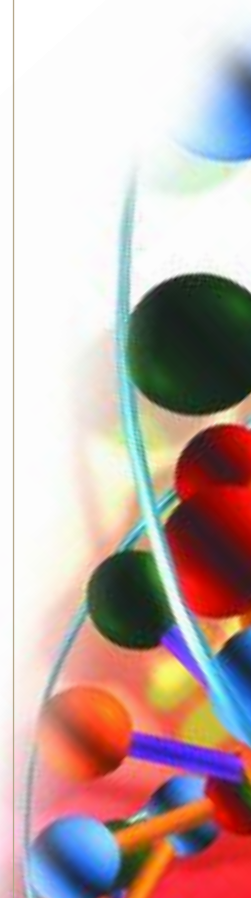
THE INFRASTRUCTURE:

A Recap of Challenges/Characteristics of Life Science Real Estate

This chapter provides an overall analysis and review of lab market conditions nationally and key supply and demand trends that have impacted or could impact the life science real estate market.

Until recently, the life science industry has been concentrated in nine geographic areas, primarily in the United States, where a convergence of government research funding, strong academic institutions and research, successful technology transfer, entrepreneurial scientists and private capital, and a highly educated work force combined to create a "cluster" of life science activity that nurtured itself and grew into a potent force for job growth and economic development.

Today, as more states and foreign countries invest in and support policies conducive to the industry, life science activity has become more geographically dispersed. Secondary markets are now becoming important hubs of their own. A 2006 report entitled *Growing the Nation's Bioscience Sector: State Bioscience Initiatives 2006*, prepared by Battelle Technology Partnership Practice and SSTI (the Batelle Report), states that 11 states and Puerto Rico have large employment bases and are specialized in at least one industry subsector. Some of these secondary markets are covered in this publication. We will be focusing over the next year on devising some metrics to further refine the market and to determine which secondary markets are strong enough to join the primary clusters in an expanded analysis.



COLLIERS INTERNATIONAL

Challenges of the Life Sciences Real Estate Industry

The life science industry, more than some other industry sectors, requires a specialized infrastructure – buildings, equipment, and personnel – to provide the foundation for its activities. This infrastructure plays an important role, not only in productivity of life science personnel (stimulating the best and most creative thinking), but also in enabling and protecting the work that must be done to create, produce, and deliver new drugs and treatments to improve human health.

- To conduct biomedical investigations, for example, scientists depend on access to specialized facilities such as laboratories that meet certain structural, safety, and scientific requirements; clinical research environments where human subjects may be studied; and animal facilities suitable for maintaining the health and well-being of laboratory animals.
- In order to commercialize the results of discovery, biotechnology and pharmaceutical companies require manufacturing facilities (both pilot and scale-up) where new drugs and treatments can be produced.
- Finally, in order to deliver the new drugs, treatment, and therapies to patients, clinical teaching hospitals and community hospitals need accessible, state-of-the-art clinical environment, where patients are comfortable and physicians can deliver quality care.

Building and maintaining this infrastructure is not an easy task, however. Several challenges confront the users, developers, and owners of life science real estate for the following reasons.

Life Science Industry Fundamentals Are Different

The life sciences industry trades on expectations of future developments, not profitability. The cost of research, development, and commercialization of new products is high. It takes years to bring these products to market. Consequently, the majority of publicly traded and privately held life science companies are loss-making enterprises.

"The life sciences industry trades on expectations of future developments, not profitability."

This means that most life sciences enterprises are not credit-worthy tenants, lacking the profitability to support financial instruments to finance buildings. In addition, most of the organizations that conduct federally sponsored biomedical research are not-for-profit universities or research institutions without the profit margins of commercial businesses, and therefore lack access to additional capital for facility construction as volume of research grows. Although some institutions are better positioned financially than others to absorb the costs of building or modifying research space, institutions of all types and sizes encounter obstacles when trying to create the facility infrastructure for their work. Lenders must conduct specialized underwriting criteria, evaluating the location of a facility and the science being conducted by tenants in order to evaluate the risk of financial investment in real estate for this industry.

Real Estate Product Is Different

As described in the next section of this report, life science real estate facilities are complicated and expensive structures to build and maintain. The structural, zoning, permitting, and operational requirements are unique and require specialized knowledge, licenses, and certifications for organizations and individuals developing and running this real estate product.

Analysis Is a Specialized Subset of General Real Estate Statistics

The relative newness of this industry and the unique characteristics of the life science product and market mean that little information is available to assess the demand, availability, and vacancy rates in all kinds of space in the life science real estate marketplace. Often, the value of a facility will be affected not only by local market conditions, but by the national market as well, and the type of activity or science being conducted within it.

Characteristics of Life Science Real Estate

Life science space is qualitatively different from office space. The required structural characteristics, strict environmental and safety restrictions, coupled with the hybrid nature of space required by hospitals and lab tenants, make new construction highly-specialized and an integral part of the clinical delivery and scientific discovery process. The additional amenities and physical characteristics required means that these buildings generally command a much higher price per square foot than office space. Construction costs can range from $175 to $500 per square foot. Tenant improvement costs can range from $75 to $100 per square foot.

Described below are some characteristics that differentiate life science facilities from general commercial properties.

Lab to Office Space Ratio
Most lab facilities include a split of 60% lab and 40% office use on a floor-by-floor basis. Additionally, new life science facilities are offering multiple common areas such as lounges and cafés, where researchers can meet, discuss, and collaborate, as well as shared support services.

Building Services
Special consideration must be made for the proposed research in each respective building, including an evaluation of the chemicals that will be stored and transported, and how biological waste will be disposed of.

HVAC
Sufficient air circulation is critical to life science users and required ventilation systems must be worked into the base building upgrades.

Electrical
The electrical design criteria for a state-of-the-art research facility have skyrocketed as science and technology have become interdependent. The power grid must be capable of supplying the appropriate electrical capacity for augmented HVAC requirements, research data, and scientific analysis tools.

Clear Height and Structure
Sufficient clear height (13' to 16' floor-to-floor) for fume hoods and exhaust is essential. Additionally, concentrated equipment and work-bench areas in lab buildings require heavy loading.

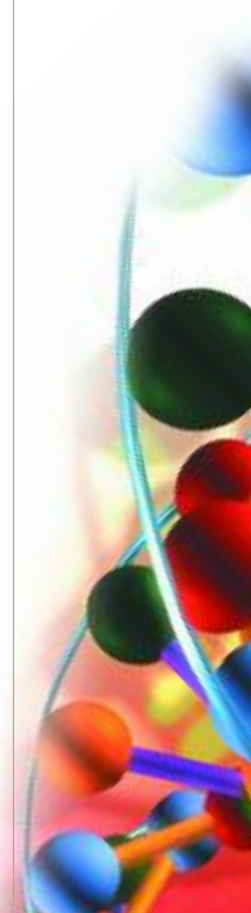
Vertical Shafts
A life science building must contain ample vertical space for supplying sufficient air and removing the exhaust fumes of any biotech user, without over-burdening cost or compromising the function of the space.

Lab Module
An efficient lab planner must identify critical lab space requirements such as bench layouts, and add flexibility to the design so as to allow future growth and different scientific pursuits.

Acoustics, Air Quality, and Vibration
The potential for vibration from equipment and the street environment to effect sensitive lab experiments is a key factor. Often, building adjustments must be made to prevent such vibrations from affecting sensitive scientific experiments.

Zoning
Zoning restrictions and other state and federal regulations can inhibit or prevent use changes, the handling of hazardous materials, and the ability to locate equipment or systems on the tops of buildings.

Flexibility
The only thing certain is change. Every floor of each building should be built with its own infrastructure so all the air, electric wiring, and plumbing can be easily modified and office space turned into lab space or clinical space if necessary.



Design Criteria	Building Services
90-100% Fresh Air	Elevator Size/Capacity
60/40 Split: Lab/Office Space per Floor	Delivery Loading and Shipping
HVAC: Min 2.0 cfm/sq ft at labs; Min 1.2 cfm/sf at Support Areas	Chemical Storage
Upgraded Electrical Capacity 25 – 40 Watts psf of Power and Emergency Power	Emergency Power
Core/Wall Dimension	Redundant Systems
Lab Module	Lab Waste Treatment
Lab and Fume Hood Exhaust	Utility Upgrades
Acoustics	Penthouse and Screening for Roof Top Equipment
Air Quality	Emergency Procedures
Vibration	Security
Vivarium Space	

Biosafety Levels

In addition to the characteristics described above, each life science facility must meet certain standards for biosafety depending upon the type of research being conducted. Regulations as to safety and security requirements and licenses for buildings vary depending upon this research.

Classification of Biohazardous Agents by Risk Group (RG)	
Risk Group 1 (BSL1)	Agents that are not associated with disease in healthy adult humans
Risk Group 2 (BSL2)	Agents that are associated with human disease which is rarely serious and for which preventive or therapeutic interventions are often available
Risk Group 3 (BSL3)	Agents that are associated with serious or lethal human disease for which preventive or therapeutic interventions may be available (high individual risk but low community risk)
Risk Group 4 (BSL4)	Agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not usually available (high individual risk and high community risk)

Life Cycle of a Life Science Enterprise

The drug-development value chain can be divided into four basic steps: research in which promising compounds to treat a particular disease are identified; development, where the compound is refined and tested in clinical trails in animals and humans; manufacturing, where the compound is produced in large quantities; and commercial, including activities such as sales and marketing.

The Drug Development Value Chain

GOVERNMENT OVERSIGHT					
Research	Development			Manufacturing	Commercial
	Pre-clinical	Clinical	FDA Review	→ FDA Approval	
Company and academic researchers find an innovative way to treat disease.	Companies test product candidates in animals to determine if one is suitable to test in humans.	Company tests product in patients to determine if it is safe and effective as a potential treatment.	The U.S. Food and Drug Administration (FDA) analyzes the testing results to determine if the product is safe and effective for its intended use.	Company uses complex processes to manufacture sufficient product quantities.	Company shares information about product with patient groups and with doctors, who prescribe treatment for patients.

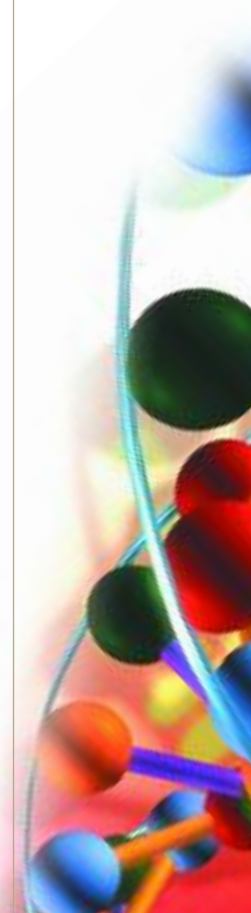
Each section of this value chain poses a different set of considerations for a life science company in choosing to locate to a particular area. For example, a company engaging in research may choose a location based on the combination of the amount of funding and investment activity there is in the region, and the availability of an educated labor pool. A company engaged in initial development and pilot manufacturing might gravitate toward areas that are surrounded by research facilities. An entity conducting clinical trials may choose to locate in an area in which there is a concentrated presence of accomplished clinical investigators and leading research hospitals. At the manufacturing stage, companies need to find facilities that are less costly, while still providing access to drug development resources. Finally, a company that has reached the commercial phase of development needs to locate itself globally to handle the distribution and regulatory challenges of bringing the product to market.

Life Cycle in Life Science Companies

Stage I Start-Up	Stage II Focus	Stage III Integration	Stage IV Optimization	Stage V Maturity
Discovery/ Early Development	Preclinical/ Phase I and II	Late Clinical/ Early Commer.	Full pipeline w/ significant approved products	FIBCO
<100 employees, emphasis on scientific skills	75–200 employees; still emphasize scientific skills, but adding development capabilities.	150–500 employees; balance of scientific, technical, and business skills	250–1000 employees in multiple disciplines	Over 1000 employees
<40,000 SF Ratio of lab to administrative space: 65%	40,000–80,000 SF Ration of lab to administrative space: 65%	>70,000 SF Ratio of lab to administrative space: 50%	Build-to-suit facility	Multi-site campuses

Time

Source: "Creeping Over the Chasm: Biotech's Perilous Managerial Transitions," Walter E. Mardis and Jeffrey B. Aibel, Mardis, Aibel & Associates, In Vivo: The Business and Medicine Report, December 2003



THE IMPORTANT THING IN SCIENCE IS NOT SO MUCH TO OBTAIN NEW FACTS AS TO

discover new ways of thinking about them.

– William Lawrence Bragg

Growing
THE INFRASTRUCTURE:
Major Trends in Life Science Real Estate

Traditionally, life science real estate has fallen into four different categories:

- Build-to-suit, owner-owned properties like Novartis and Amgen in Cambridge
- Academic or institutional space related to basic discovery and clinical application
- Buildings created as part of an economic development project, designed to help jump start or grow the life science industry in a given geographic region
- Investor-owned, multi-tenant buildings offering space to all kinds of life science companies from start-ups to mature entities.

These four types of life science real estate all still play an important part in creating demand and availability in the market. But today, academic space, economic development projects, and investor-owned buildings are becoming increasingly important drivers.

University-Driven Life Science Space

In a previous report, Colliers noted the shortage of institutional life science space fueled by obsolete facilities built 30 or more years ago by more than 900 biomedical research-performing institutions in the U.S., including 617 academic institutions, 171 nonprofit research organizations, and 125 research hospitals. The report projected that the amount of research space financed under construction and undergoing renovation and repair would rise in record numbers.

That trend has continued, fueled in part, by NIH funding increases over the prior decade and new state investment in such facilities. The National Science Foundation reported an 11 percent increase between FY 2002 and FY 2003 in the amount of research space at such institutions, the largest increase ever. Fifty-six percent of the $7.6 billion planned for new construction was targeted toward research in life sciences.

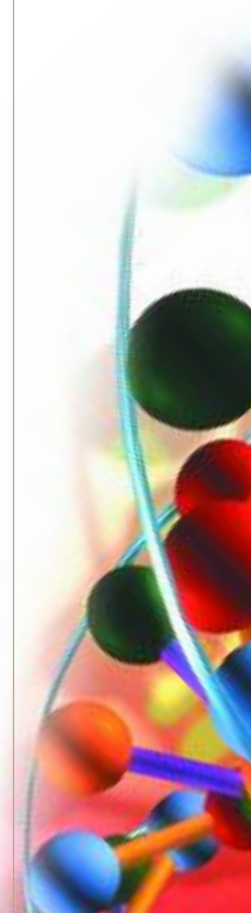
The nature of these buildings is different than in the past since they are designed to promote the science of the future. The space is designed to house large funded projects, multi-disciplinary in nature, that use supportive technologies and multi-institutional collaboration to drive their work.

Although private donors have become increasingly important to the financing of these facilities, one important factor that could have a dampening effect on this growth is the leveling off and decline of NIH funding for scientists who would utilize this space. The current maxim that state-of-the-art facilities will attract star researchers, who would in turn attract additional talent and funding may change.

State-Sponsored "Mixed Use" Developments

Recognizing the importance of the life science industry as an engine for job growth and economic development, more and more states and foreign national governments are investing in large, "mixed use" developments around university and academic medical centers, building facilities designed to leverage the scientific strength of the academy to attract private companies and investment.

Such "mixed use" developments are located nearby an academic anchor, and provide private incubator space for spin-out companies, facilities housing shared scientific support services, hotel and



COLLIERS INTERNATIONAL

conference centers for scientific meetings, as well as laboratory space for larger companies and pharma that want to be located close by. The Batelle Report states that 44 states and Puerto Rico have major new bioscience research buildings that have been constructed since 2004 or are currently under construction, with funding coming from state, federal, and private sources.

Investor-Owned Life Science Real Estate

Another major new development in the life science industry is the entry of several publicly traded institutional investors into the marketplace, driving demand in a big way.

Over the past year, competition for prime life science properties in core markets has escalated, leading to shrinking cap rates and high prices per square foot. One market where this has been prevalent is Greater Boston, where several high-profile sales have taken place at prices usually only seen in trophy high-rise assets. Another factor driving up the price per square foot is escalating rental rates in the lab market. East Cambridge, which is known for being home to many of the nation's largest biotech firms, has seen rental rates climb to the low to mid-$60.00 range on a triple net basis while the Longwood Area of Boston, home to many of Boston's premier hospitals, has seen rental rates climb as high as $85.00 triple net.

"Fifty-six percent of the $7.6 billion planned for new construction was targeted toward research in life sciences."

In 2006, the average cap rate for office properties in downtown Boston was 6.1% while the average price per square foot was $436 per square foot, according to Real Capital Analytics. While some of the top office properties saw cap rates drop below 6%, including 1 Lincoln Street with a 5.8% cap rate, the lowest cap rates seen in the market were lab building transactions. For example, Life Science Square in Cambridge was sold for $515 per square foot with a cap rate of 5.2%.

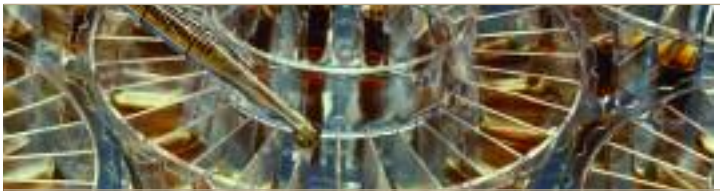
BioMed Realty Trust's purchase of seven Lyme Properties in Cambridge and New Hampshire for $531 million or nearly $500 per square foot in 2005 was followed by several high-profile acquisitions in 2006. First, Technology Square in East Cambridge, which was owned by the Massachusetts Institute of Technology, was sold to Alexandria Real Estate Equities for $600 million or $518 per square foot. With tenants such as Novartis and TolerRX, this was the first example last year of a life science REIT purchasing a significant life science property from a local owner.

Second, BioMed purchased the Center for Life Science Boston from Lyme properties for $473 million. The company plans to invest in excess of $700 million, including the purchase price, to complete construction and finalize the project. BioMed's total investment in the 702,940 square foot property will be close to $1,000 per square foot. This project, which is in the Longwood Medical Area of Boston, was 80% pre-leased at the time of the sale on a long-term, triple net basis, to several renown life science institutions: Dana-Farber Cancer Institute, Beth Israel Deaconess Medical Center, the CBR Institute for Biomedical Research, and Children's Hospital Boston.

The second significant transaction of last year was also transacted between BioMed Realty Trust and Lyme Properties. BioMed agreed to purchase Lyme's remaining portfolio assets throughout the country for $511 million. The acquisition included approximately 600,000 square feet of existing and under-construction life science space and land representing 266,000 square feet of developable lab space in the Kendall Square area of Cambridge. One of these properties, 301 Binney Street, was under construction and 27% pre-leased at the time of the sale. BioMed intends to invest an additional $100 million to complete this lab building by late 2007.

Although these transactions are a small snapshot of the overall real estate investment market, they demonstrate the fierce competition and investors' willingness to acquire prime life science properties at price levels usually reserved for the most premier trophy properties.

(Source: Biomed Realty Trust Press Releases; Real Capital Analytics)



"Over the past year, competition for prime life science properties in core markets has escalated, leading to shrinking cap rates and high prices per square foot."

INCREASING COMPETITION AMONGST STATES: THE FORT DEVENS CASE STUDY

Teamwork Trumps Subsidies in Landing Major Biopharmaceutical Investment

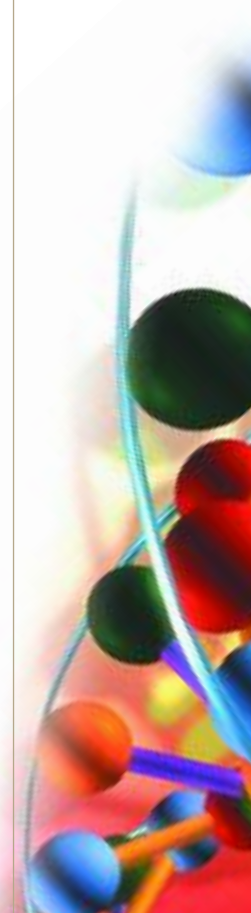
Bristol-Myers Squibb Co., an international pharmaceutical company with $3 billion in net earnings, $19.2 billion in net global sales, and 43,000 employees, needed a site of 80 to 100 acres to build a 750,000 square foot manufacturing facility that would create more than 500 bio-manufacturing jobs with average salaries of $60,000. The manufacturing facility would produce a new bioengineered rheumatoid arthritis medication called Orencia. Bristol Myers was considering sites in the United States – North Carolina, New York, Rhode Island, and Massachusetts – as well as abroad.

In June 2006, the Company decided to build its $660 million facility on the former Fort Devens US Army Base in Harvard, Massachusetts after an eight-month effort by Massachusetts state officials, state and federal legislators, MassDevelopment, the Massachusetts Biotechnology Council, educators, and union leaders to convince the Company to locate there. Reportedly, New York offered a much bigger package of subsidies connected with a competing site in Syracuse, New York. But company officials cited Massachusetts as being able to provide a highly trained workforce and its readiness to get a technically demanding project up and running quickly. The plant is scheduled to open in 2009.

To capture the investment, a large number of Massachusetts officials had to cooperate and to agree on financial terms in a short period of time.

- In response to an initial inquiry, the Massachusetts Office of Business Development quickly identified sites that could accommodate the project and sent off information on the State's work force from the University of Massachusetts.
- The head of the Massachusetts Biotechnology Council arranged a meeting between executives from Bristol-Myers and other companies with large drug manufacturing operations in Massachusetts to talk about recruiting.
- Harvard town officials agreed to exempt the building from a local 75-foot zoning height restriction.
- State legislative leaders agreed to legislation, which the Governor promised to sign, that would provide the Company with $33 million in refundable tax credits as well as a $34 million bond issue that would pay for the Company's water, sewer, and power requirements.
- Union leaders agreed to keep wages low by tightly controlling overtime costs and limiting strikes and work stoppages.
- Educators from state and community colleges met with Bristol-Myer executives to extol the quality of the Massachusetts workforce.
- Elected federal officials arranged a land swap that made it possible to assemble the total acreage needed for the project.

The decision by Bristol Myers Squibb was a much needed win for a state that has lost manufacturing jobs recently. Now, the Commonwealth is launching a initiative designed to allow local communities to identify sites for expedited permitting and to create a $100 million fund to attract facilities that create jobs. The money will be used to build up needed municipal infrastructure such as sewers and highway ramps. To qualify, a Company has to add at least 100 jobs within two years and keep them for at least five years.



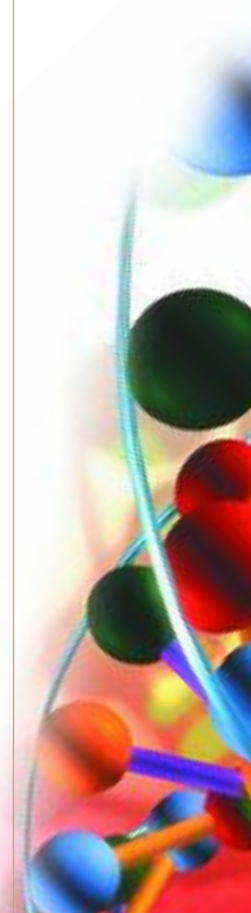
EXCEPTIONAL ENVIRONMENTS INSPIRE

Innovation

OVERVIEW OF THE Life Science Market

Nationally, Colliers Life Science Group tracks commercial lab space in the nine major clusters and key emerging markets. This Chapter provides overall characterization, supply and demand dynamics, as well as key trends for these markets. Where actual square footage numbers are available, they are provided. Some of this information has been provided by third parties such as economic development entities from the respective states or cities and has not been independently verified by Colliers. Nevertheless, the overall numbers are consistent with the presentation in previous reports.

As stated previously, the national lab market is still significantly concentrated in the nine major life science clusters. Boston, Philadelphia, and San Francisco are the largest lab markets in the country amongst the major clusters. The emerging markets have a smaller but growing inventory, with developments and future life science prospects tied closely to economic development initiatives and university-related centers. As stated previously, more states and foreign governments are investing in and supporting policies conducive to the industry. As a result life science activity is becoming more geographically dispersed and some of the emerging markets have grown to the point where they may be classified as an "intermediate", if not a major market. Colliers will be focusing over the next year on devising some metrics to further refine the market and to determine which secondary markets are strong enough to join the primary clusters in an expanded analysis.



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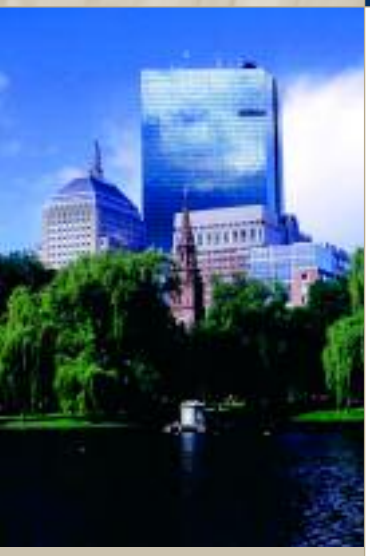


OVERALL MARKET PROFILE

- **Inventory (SF)*** 13,491,000
- **Availability – with Sub-Lease (SF)** 1,841,000
- **Availability Rate (%)** 13.6%
- **Sublease (SF)** 726,000
- **Asking Rents (NNN)** $15-$75/SF

** Inventory numbers include biotechnology-research type real estate only regardless of owner occupancy status. Previous Alchemy issues included certain bio manufacturing real estate, which is no longer included in these figures. The total square footage of office, research and production space occupied by companies engaged in biotechnology research is significantly greater than the figures presented here.*

MARKET OVERVIEW

Boston has long been recognized as a world leader in breakthrough scientific research, developing innovative medical technologies and providing world-class healthcare. The Boston "super cluster" benefits from the interaction between scientific researchers in large academic institutions, medical practitioners at the world's leading teaching hospitals, and entrepreneurs in public and private companies. This has led to the formation of a vibrant, dynamic, and expanding life science "super cluster," which continues to spawn revolutionary advances in medicine and science. In October 2006, the Nobel Assembly awarded The Nobel Prize in Physiology or Medicine for 2006 to the University of Massachusetts Medical School's Craig C. Mello, PhD, and his colleague Andrew Fire, PhD, of Stanford University, for their discoveries related to RNA interference.

As a global leader in life science, this year Boston will be hosting the BIO International Convention. Global leaders from the life science industry will be coming together to discuss the state of the life science industry, analyze the trends, and identify how each company large or small can make a significant contribution to the future success of this thriving industry.

The focus of Boston area life science tenants remains scientific research and discovery, not large-scale commercialization, manufacturing, or corporate functions, although some of the largest biopharma companies, like Genzyme and Biogen, were founded here and maintain their corporate headquarters here. In addition, Bristol Myers Squibb recently bought 89 acres to build a 1.5 million square foot biologics manufacturing facility. The region's surging life science market continues to be fueled by the abundance of skilled labor, a strong venture capital market, large pharmas such as Novartis, Wyeth Pharmaceuticals, Astra Zeneca, among others, and the many colleges and universities.

Boston and Cambridge remain the epicenter of the region's life science activity that also spreads out to core suburban Boston towns along Route 128 and farther out west to Worcester.

INDUSTRY DRIVERS

Institutional Expansion Driven by Public/Private Donations

The Boston area has 13 institutions that grant life science Ph.D.s, three of which are ranked among the top 20 nationally in life science research. Local private universities, such as Harvard University and the Massachusetts Institute of Technology, are the most productive biotechnology patent holders, actively patenting many of their biotechnology innovations. Eleven universities and hospitals in the Boston area are among the top 100 NIH funding recipients, accounting for a total of $2.1 billion in 2005.

These institutions have continued to grow and expand, despite the slowdown in federal research funding, primarily due to sizable contributions from wealthy donors, establishing new research institutes and financing new state-of-the-art facilities.

- For example, the McGovern Institute for Brain Research at MIT was established in 2000 by a gift from Pat and Lore McGovern of approximately $350 million, the largest gift ever received by MIT. The MIT Picower Institute for Learning and Memory was expanded in 2002 with a generous gift from the Picower Foundation. Both of these institutes are housed in a new building at MIT for the Brain and Cognitive Sciences which unites multidisciplinary labs under one roof and includes facilities and support services shared with other MIT brain science initiatives. Features include wet and dry laboratories, teaching facilities, a conference center, research and administrative offices, clinical space, and a soaring atrium.

- More recently, MIT announced the formation of the Ludwig Center for Molecular Oncology, made possible by a $20 million grant from the Ludwig Fund. MIT plans the construction of a new $210 million, 330,000-square-foot cancer research facility to house its expanding cancer programs.
- The Harvard Stem Cell Institute, launched after a $5 million gift from Howard and Stella Heffron, will be housed in a state-of-the-art, 695,000-square-foot Science Complex, with shared services available to other Harvard science and engineering programs.

Not only does this development create thousands of construction jobs and the demand for more researchers, but each of these institutes also provides seed grants to young investigators, laying the groundwork for technology transfer into the new start-up companies of the future.

Relocation/Expansion of Major Pharma Research and Development

Adding to this academic and clinical engine, large pharma companies have continued to expand in Boston and Cambridge. A few years ago, Novartis moved its worldwide research headquarters, the Novartis Institutes for BioMedical Research, to Cambridge, and now occupies 950,000 square feet of space. Last year, it increased its occupancy by 60,000 square feet, making it the largest laboratory occupant in Cambridge. Merck, Shering-Plough, AstraZeneca, and others are also expanding.

Investor-Owned Activity

The life science real estate market has responded to all of this activity. As the perception of biotechnology changes to a maturing industry with deep ties to the established pharmaceutical industry, buildings customized for their use are now viewed as far less risky investments. Financial investors have moved into the market to purchase these properties, releasing biotech companies from the requirements of owning their own real estate and freeing up capital toward R&D efforts. This has occurred in Boston, Cambridge, and the surrounding suburban markets. These new landlords join Forest City, owner of the 2.3 million square foot University Park near MIT as owner/investors in lab real estate.

Laboratory Investment Timeline

2003

- 620 Memorial Drive, Cambridge becomes first large Cambridge asset to sell for more than $500 per square foot.

2004

- ArQule's headquarters in Woburn sells for $327 per square foot, one of the most expensive suburban transactions in history.
- BioMed Realty Trust becomes the second largest commercial landlord in Cambridge following the acquisition of a 1.1-million-square-foot portfolio from Lyme Properties.

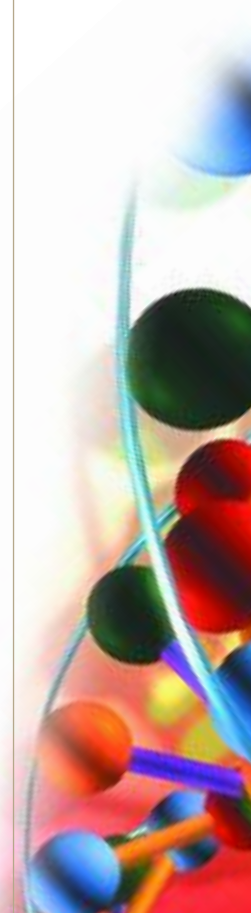
2005

- 830 Winter Street in Waltham sells for $281 per square foot; with the building nearly 70% vacant, it shows tremendous validation of a dynamic suburban lab market.

2006

- Preferred Real Estate Investments acquires Cambridge Research Building (43,587 square feet) from Wyeth Pharmaceuticals in a multi-million dollar sale/lease back transaction.
- Kendall Square in Cambridge purchased for $210.5 million by a joint venture of Beal Cos and Rockwood Capital. The owners plan to reposition the nine-building, 676,440-square-foot mixed-use property set on nine acres near MIT, which includes 47% lab space, 39% office space, 11% retail space.
- Alexandria dramatically furthers its Cambridge presence through the acquisition of the 1.2-million-square-foot Technology Square campus for $600 million or $514 per square foot.
- Biomed Realty Trust announces its intention to acquire the Center for Life Sciences in Boston, a 705,000-square-foot lab building under construction for over $1,000 per square foot.
- Biomed Realty Trust purchases remaining Cambridge corporate assets of Lyme Properties located at 320 Bent Street and 301 Binney Street.

Sources: bioStatus, Q3, 2006, Richards Barry Joyce and Partners, LLC, Meredith & Grew, Market Viewpoint, 4th Quarter, 2006



Major New Developments Planned

In response to all of this market activity, a new wave of construction activity is underway in Cambridge and the Longwood Medical Area (LMA) that will add millions of square feet to the market. This location of this activity may change in the very near future, as East Cambridge and the Longwood Medical area are becoming developed to their fullest potential. There is the possibility that older, lower-density areas of East Cambridge will be redeveloped with new higher-density, state-of-the-art buildings. Future activity may also be centered in Allston, Northpoint, western Cambridge, and the suburbs.

MAJOR DEVELOPMENTS

New Construction

Project Name/Address	Submarket	Total RSF	Delivery Date	Comments
Center for Life Sciences	Boston	705,000	2008	Nearly 600,000 sf has been committed by Beth Israel, Children's Hospital and Dana Farber Cancer Institute
National Emerging Infectious Diseases Laboratory Boston University, BioSquare	Boston	195,000	2009	Community/environmental activists filed federal lawsuit to stop construction
Harvard Allston Science Complex	Boston	695,000	2010	Will house Harvard Stem Cell Research Institute
MIT Cancer Research Facility	Cambridge	330,000	2009	
301 Binney Street	Cambridge	420,000	2007	Built by Lyme on spec; Microbia leased 100,000 sq ft
One Hampshire Street	Cambridge	188,000	2006	Second development will house build-to-suit for Schlumberger Technology Corporation
Northpoint	Cambridge	2 million +	Proposed	
AstraZeneca Expansion	Waltham	200,000	2008	Second expansion on site in as many years

MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Boston University Harvard University Massachusetts Institute of Technology Tufts University University of Massachusetts	Beth Israel Deaconess Medical Center Boston Medical Center Brigham and Women's Hospital Children's Hospital Boston Massachusetts General Hospital Tufts – New England Medical Center	Broad Institute Dana-Farber Cancer Institute Joslin Diabetes Center Whitehead Institute for Biomedical Research McGovern Institute for Brain Research Harvard Stem Cell Institute Picower Institute for Learning and Memory Ludwig Center for Molecular Oncology

MAJOR SECTOR PLAYERS		
Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Abbott Laboratories, Worcester	Alkermes, Cambridge	Abiomed, Inc., Danvers
AstraZeneca International, Waltham	Amgen, Cambridge	Boston Scientific, Quincy & Natick
Bayer Diagnostics, Norwood	Biogen Idec, Cambridge	Millipore, Billerica
EMD Lexigen Research Center, Billerica	Dyax Corporation, Cambridge	Zoll Medical Corporation, Chelmsford
Merck & Co., Boston	Genzyme Corporation, Cambridge	
Novartis Pharmaceuticals, Cambridge	Millennium Pharmaceuticals, Inc., Cambridge	
Pfizer, Inc., Cambridge	Vertex Pharmaceuticals, Inc., Cambridge	
Serono, Inc., Rockland		
Wyeth, Cambridge		

LAB MARKET SNAPSHOT

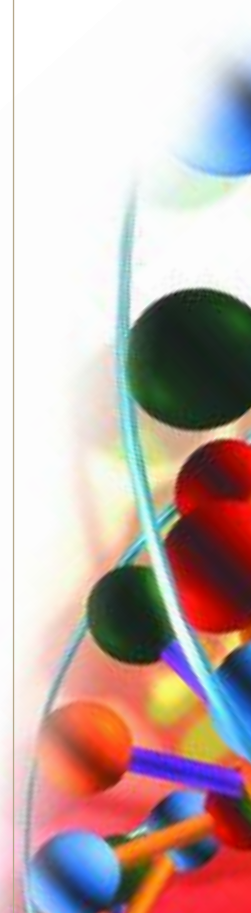
The greater Boston area boasts one of the largest commercial lab markets in the nation, with over 16 million square feet of investor-owned life science research space and more than six million square feet of owner-occupied space. A majority of this space is located in Boston and Cambridge. Overall vacancy rate was 12.1%.

Boston's lab market revolves squarely around the city's institutions of education and medicine. Boston is home to internationally renowned academic institutions, hospitals, and health care organizations that occupy millions of square feet of clinical, educational, and research space. Massachusetts General Hospital is Boston's largest employer and several of the other hospitals such as Brigham and Women's and Beth Israel Deaconess Medical Center are close behind, indicating how important the sector is to Boston's economy.

Boston has historically lagged Cambridge and the suburbs in terms of commercial lab development, due to the high cost of land and the institutional nature of the sector downtown. Boston's commercial lab market totals approximately 2.5 million square feet, with a very low vacancy rate of 4.1%, clustered in a few key areas including the Longwood Medical Area, Boston University's Biosquare, and the Charlestown Navy Yard. A large portion of this leased space is occupied by the major institutions rather than the private sector, a trend that will continue as Beth Israel Deaconess Medical Center has announced plans to expand its operations by up to 900,000 square feet by 2010. Space constraints may prove to be Boston's largest challenge in its effort to compete with Cambridge and other markets for biotech jobs.

Nevertheless, circumstances may change as Harvard begins to develop its Allston campus and some institutional players, such as the Harvard Department of Public Health, shift their operations from the LMA to the newly developed campus. Additionally, the City of Boston has set a goal of increasing biotechnology research employment in the City to 10,000 people from its current level of 1,300 people by 2010, requiring development of an additional one million square feet of life science space. The City has also worked to attract interest to the Marine Industrial Park and the Crosstown Corridor, with varying degrees of success.

Boston's Longwood Medical and Academic Area (LMA) is located three miles southwest of downtown Boston on a 210-acre site that represents a unique mix of institutional ownership, private real estate development, and private sector companies congregating on a shared campus. This mix is a prime example of how translational needs in the industry are increasing and fostering the exchange of information between clinicians and scientists and driving critical real estate decisions. The LMA's concentration of 21 institutions include four major Harvard-affiliated teaching hospitals (Beth Israel Deaconess,



Brigham and Women's, Children's Hospital, New England Baptist), two research treatment centers (Dana Farber Cancer Institute and Joslin Diabetes Center), and three Harvard schools (Medical, Public Health, and Dental). Merck recently completed its Edward M. Scolnick Research Center there. The year's biggest news for the LMA was Biomed Realty Trust's announced acquisition of the Center for Life Sciences from Lyme Properties for a purchase price of approximately $1,000 per square foot. The 705,000-square-foot facility is still under construction and is 80% pre-leased to a diverse tenant roster led by Beth Israel Deaconess.

Boston University's Biosquare is located along Boston's Albany Street corridor and encompasses 14 acres with a development potential of 2.5 million square feet of research, laboratory, and office space. The Biosquare complex currently consists of 700,000 square feet of space that houses institutional research, private corporations and a research incubator. In addition, on February 2, 2006, Boston University Medical Center received regulatory approval from the federal government to fund the construction of a BSL laboratory at Biosquare. The 195,000 square foot facility, the National Emerging Infectious Diseases Laboratories, will join the national network of BSL institutions dedicated to study infectious diseases occurring naturally or through acts of bioterrorism. It is dedicated to helping to develop diagnostics, drugs, vaccines, and treatments against emerging and re-emerging infectious disease. When completed, it is expected that it will have a significant influence on the location and formation of companies associated with Project Bioshield.

Several life science tenants have research operations across the inner harbor from downtown Boston in **Charlestown**. Among them, Massachusetts General Hospital owns and occupies a 650,000 square-foot research facility.

Cambridge, anchored by MIT and Harvard University, is the region's core lab market, with over seven million square feet of investor-owned space that is a mix of new Class A facilities and older office or R&D buildings that have been revamped by tenants or owners for life science use. Positive absorption has caused a drop in the vacancy rate to 10.1%. Over the last several years, the Cambridge lab market has been driven by numerous large build-to-suit projects for biotech and pharmaceutical companies, as well as research institutes, including Alkermes, Biogen, Millennium Pharmaceuticals, Vertex Pharmaceuticals, Genzyme, Novartis, and the Broad Institute. This activity has propelled new levels in valuation, as demonstrated by the price per square foot paid by recent investors in the market.

Lease rates have also increased to nearly $70 per square foot NNN for state-of-the-art laboratory space, most notably in the East Cambridge area, where vacancy has dropped to 6.3% and a shortage of large blocks of space exists. At the same time, the average tenant improvement allowance has dropped to an average of $125 to $150 per square foot.

Selected Recent Leases

Tenant	Submarket	Size (SF)
Vertex Pharmaceuticals	Cambridge	100,000
Schering-Plough	Cambridge	68,000
Novartis	Cambridge	60,000
CombinatoRx	Cambridge	65,000
Helicos Biosciences	Cambridge	27,000
Pharmamar	Cambridge	24,000
Alnylam	Cambridge	18,000

Boston's suburban lab market totals 7.4 million square feet clustered in several towns along central and northern Route 128 and 495, including Waltham, Lexington, Woburn, Framingham, and Worcester. Lab space in the suburbs is generally a mix of new build-to-suit projects and retrofitted office and R&D facilities, which provide a cost-effective alternative to the Boston and Cambridge markets. Rental rates in the suburbs are roughly half, or $30-per-square foot versus the $60-$70 per square foot range in Cambridge. Vacancy rates have dropped to 21.2%. Another significant factor for the move to the suburbs is the changing demographics of the workforce. Many of the executives for these small life science firms live in the suburbs, making it an attraction to work near

home. Yet while the developing trend may pull more life science firms away from Cambridge, the city will still remain the epicenter of the booming industry.

The **Worcester** lab submarket is anchored by the University of Massachusetts (UMass) Medical Center and a new 700,000 square-foot Worcester Medical Center. The majority of Worcester's commercially available lab space is located in the Massachusetts Biotechnology Research Park, a development in close proximity to the UMass Medical Center. Demand is significantly less than in Boston, Cambridge, or the inner suburban market and is primarily driven by companies with a connection to the UMass Medical Center. The Abbott BioResearch Center, the drug discovery and biologics manufacturing unit of Abbott Laboratories, is located in a 370,000-square-foot owner-occupied building on a 30-acre site adjacent to the Massachusetts Biotechnology Research Park and UMass Medicial Center. It is expected to slowly expand in the Worcester area in the future.

INCENTIVES (STATE OR CITY)

The Commonwealth of Massachusetts has supported a number of key initiatives to provide support for the growing life science industry. Below are some of the public and private organizations that provide support services, economic development, and incentives.

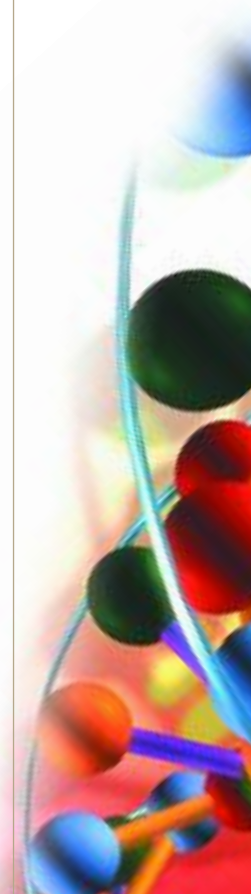
- **Massachusetts Technology Collaborative (MTC)** gives the state the ability to make grants for research-based initiatives, including most recently grants worth $16 million in awards in commitments.
- **John Adams Innovation Institute**, established by MTC, gives the state for the first time ever the ability to make grants for research-based initiatives, including a $20 million Research Center Matching fund to create or expand centers that can attract federal or industrial support in three prespecified fields including biotechnology.
- **The Massachusetts Development Finance Agency (MassDevelopment)** the state's development finance agency, has created a $25 million Emerging Technology Fund that can make loans up to $2.5 million for biotechnology facilities financing, including in biomanufacturing, and with some flexibility to help leverage federal grants.
- **The Massachusetts Biomedical Initiative (MBI)**
- **The Massachusetts Biotechnology Council**
- **Angel Healthcare Investors**, Boston is one of the few communities to have a healthcare-focused angel fund. Recently, several local hospitals systems also have plans to create an angel network to assist them in financing spin-out ventures at the earliest stages.
- **Bioventure Investors, LLC**

Incentives offered to the area's life science companies include:

- R&D Tax Credit – a company can claim a credit equal to 10% of any excess qualified research expense over a base amount, plus 15% of basic research payments.
- Emerging Technology Fund – provides loans and guarantees for specialized build-outs and equipment needs.
- Investment Tax Credit – allows a company a credit of 3% of the cost of qualifying tangible property, after deduction of any federally authorized credit.
- R&D sales tax exemption
- An exemption from local property taxes for R&D and manufacturing firms.

IN THE NEWS

- Harvard University plans for a multibillion-dollar campus expansion to turn America's oldest university into one of the world's top hubs for stem-cell research and other life science. Construction should begin summer of 2007. The master plan calls for a science complex, museum space, new student housing, parks, and a public square on more than 200 acres of land, adding an entire campus in Boston's Allston district across the Charles River from its main Cambridge campus.
- The Massachusetts Institute of Technology (MIT) sold Technology Square in Cambridge to Alexandria Real Estate Equities Inc., a California real estate firm, for $600 million,



double what the university paid for it five years ago. Among the tenants are Novartis AG and Forrester Research Inc.

- Lyme Properties LLC sold an 18-story 705,000-square-foot building, currently under construction, called the Center for Life Science Boston, in the Longwood Medical area for $1000 per square foot to BioMed Realty Trust. Eighty percent of the building has already been leased by tenants including two neighbors, Beth Israel Deaconess Medical Center and Children's Hospital Boston. The project includes a 300-car garage being constructed underground, in an area where available parking, like office space, is hard to find.
- Bristol-Myers Squibb bought 89 acres from MassDevelopment to build a biologics manufacturing facility in Devens, Massachusetts. Permits for the first phase of the plant, which includes lab, office, and manufacturing space, were granted within 49 days of the start of the process. The new manufacturing facility will allow Bristol-Myers to expand its capacity to produce a commercial drug called Orencia. The plant also will help Bristol-Myers meet future production needs for drugs currently in development.

CASE STUDY

Harvard Unveils Big Campus Expansion

Harvard University plans for a multibillion-dollar campus expansion to turn America's oldest university into one of the world's top hubs for stem-cell research and other life science. The plan that will take shape over the next 50 years calls for a science complex, museum space, new student housing, parks, and a public square on more than 200 acres of land, adding a campus in Boston's Allston district across the Charles River from its main Cambridge campus. During the first 20 years of expansion, Harvard would build four million to five million square feet of buildings and create at least 5,000 jobs. Construction is set to begin this summer and will begin with the 695,000-square-foot science complex that will house the school's stem-cell researchers and other institutes. Many school officials have said that this science complex would be the nucleus for new interdisciplinary research and is expected to boost Boston's economy by encouraging partnerships with biotechnology firms that may displace the region's long-fading manufacturing base.

Credit:
Brendan Carroll, *Director of Research*
Richards Barry Joyce & Partners LLC
Tel: 617-439-9313

"Boston and Cambridge remain
the epicenter of the region's life science activity."

COLLIERS INTERNATIONAL

New York/New Jersey

MARKET OVERVIEW

The New York-New Jersey area is an attractive location for life science activity because of its world-class academic and research institutions and its pharmaceutical headquarters. The New York-New Jersey life science cluster is comprised of the following geographical areas: the five boroughs of New York City (Brooklyn, Bronx, Manhattan Queens, and Staten Island); Westchester, Nassau, and Suffolk counties in New York; and a 12-county area in Northern and Central New Jersey.

New York

New York City has all of the attributes necessary to be a world-class bioscience cluster.

Eleven major academic research institutions spend over $1.9 billion on research and development, supported by 26 research centers and 72 hospitals occupying 1.7 million square feet of biomedical research space. These institutions have generated 6,800 bioscience-related patents during the last decade, more than any other U.S. metro area. Sixty percent of the U.S. pharmaceutical industry is located in the immediate vicinity of New York City. One half of the nation's oncology trials are conducted here.

On average, NYC academic institutions create 30 companies annually. Hundreds of companies have been launched in NYC, 112 are currently located here and five pharmaceutical companies have established New York City as the site of their national headquarters. The City and New York State have collectively invested over $60 million in life science incubators.

More than 100 Nobel Laureates in the sciences and over 25% of National Medal of Science recipients have studied, taught, or worked in New York City, as have 33 Howard Hughes Medical Institute Investigators (more than in any other area) and 146 active members of the National Academy of Sciences. With five PhD programs in biology, the New York metropolitan area produces more bioscience and engineering graduates than most states, with 535 biomedical engineering graduates per year. NYC ranks second in the number of its medical students (3,703), placing it only 100 students behind Chicago (3,803). Nearly 30,000 physicians are employed in the City, in addition to 450,000 employees in healthcare and life sciences.

New York City follows only Boston in NIH funding and is home to over 130 venture capital firms that invest in healthcare companies. It ranks in the top four locations for investment in life science firms.

Recent financings include:

- Small Bone Innovations, Inc. raised $42 million, the largest venture capital funding in orthopedic history
- Intercept Pharmaceuticals received a $41 million private placement
- ZIOPHARM received equity funds exceeding $67 million
- XTL Biopharmaceuticals raised over $28 million in a private equity transaction
- Innovive Pharmaceuticals and IRX Therapeutics both raised over $12 million each
- Danube Pharmaceuticals and SIGA Technologies each raised close to $10 million

In order to leverage all of the City's assets in life sciences, Mayor Michael R. Bloomberg has created a dedicated bioscience business development team, which is targeting both domestic and international bioscience companies. To date, the team has traveled to 15 countries and met with more than 500

bioscience companies. The companies indicate they are searching for strategic locations with the following four characteristics: proximity to world-class science, access to talent, access to capital, and quality of life. New York City is a world leader in each criterion.

Until recently, the one limiting factor has been the availability of new commercial life science space. Today, plans include the development of more than two million square feet to house headquarters of growing companies; divisions of established multi-national companies and institutional research programs; and young companies established by scientists from the region's top institutions. The most notable of these projects is the East River Science Park, a 1.1 million rentable square foot, speculative, mixed-use urban life science campus located on 3.5 acres between Bellevue Hospital and New York University's Medical School.

New Jersey

The Biotechnology Council of New Jersey reports that New Jersey's pharmaceutical and medical technology industry has a $20 billion impact on the State's economy. Three-quarters of the world's leading pharmaceutical companies are located there, as are some leading smaller companies such as LifeCell, Pharmacopeia, Celltech Group and Vyteris. Some 124 biotechnology companies are also located in New Jersey.

Routinely, New Jersey accounts for 24% of all private R&D dollars spent in the country. What draws the pharmaceutical industry to New Jersey is a unique combination of human capital, sector-specific infrastructure, and quality of life.

Roughly 175,000 employees work in New Jersey's life science sector with salaries well above the median household income. Per capita, New Jersey has more scientists than any other state and ranks eighth in the U.S. for educational achievement of individuals 25 years or older.

The State's higher educational system includes 20 public and private four-year colleges, 21 public two-year colleges, two engineering schools, one medical college and two dental colleges. Princeton and Rutgers Universities, University of Medicine and Dentistry of New Jersey, the New Jersey Institute of Technology, and Stevens Institute of Technology are all located there.

INDUSTRY DRIVERS

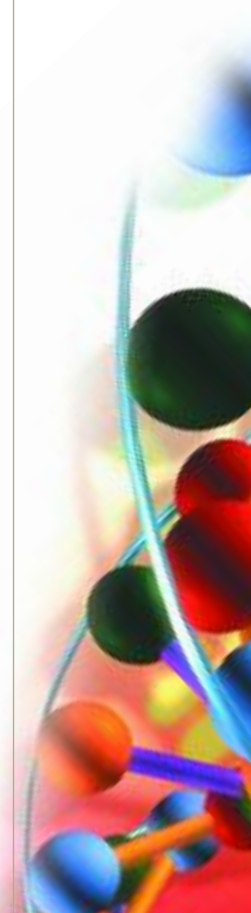
New York

New York City enjoys the nation's largest assembly of traditional life science industry drivers: research, intellectual, and financial resources, and investment capabilities. The strongest and newest industry driver is the New York City Bioscience Initiative created by the Bloomberg administration. The Bioscience Initiative was launched to foster the development of the City's commercial bioscience industry by bringing together leaders in New York City's public, private, and academic/medical spheres to promote the City's existing assets and address its shortfalls in an effort to make NYC a better place to launch and grow bioscience companies. This partnership combines the resources of policymaking, strategic planning, and investment (from the public sector), financing and access to companies (from the private sector), and access to academic research and clinical expertise (from the academic medical community).

New Jersey

In New Jersey, the life science industry is driven by its large and world-renowned pharmaceutical industry. The state is the headquarters location of 15 of the world's largest pharmaceutical companies that include names that have defined the industry throughout the 20th century – companies like Bristol-Myers Squibb, Johnson & Johnson, Novartis, Pfizer, Wyeth, Novo Nordisk, Merck, and Schering Plough. The State holds a leading role in the nation in FDA-approved drugs and biologics.

New Jersey has world-class academic researchers and facilities. Rutgers and Princeton Universities, as well as New Jersey and Stevens Institutes, are all on the cutting edge of research.



MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Albert Einstein School of Medicine	Beth Israel Health Care Center	Brookhaven National Laboratory
Columbia University Medical Center	Columbia Presbyterian Medical Center	Cold Spring Harbor Laboratory
Mount Sinai School of Medicine	Lenox Hill Hospital	Memorial Sloan-Kettering Institute for Cancer Research
Weill Cornell Medical College	Memorial Sloan-Kettering Cancer Center	
New York University	New York Presbyterian Hospital	
Princeton University	NYU Medical Center	
Rockefeller University	Saint Vincent's Hospital and Medical Center	
Rutgers University	St. Luke's Roosevelt Hospital	
State University of New York (SUNY) Downstate		

MAJOR SECTOR PLAYERS

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Aventis Pharmaceuticals, Bridgewater, NJ	Berlex Laboratories, Inc., Wayne and Montville, NJ	Cambrex Corporation, East Rutherford, NJ
Bayer Healthcare, Morristown, NJ	Celgene Corporation, Warren, NJ	Janssen Pharmaceutical Products, Inc., Titusville, NJ
Bristol-Myers-Squibb Co., New York, NY, Lawrenceville, NJ	Enzon Pharmaceuticals, Inc., Bridgewater, NJ	Pall Corporation, East Hills, NY
Forest Laboratories, New York, NY	Eyetech OSI Pharmaceuticals, Inc., New York, NY, Melville, NY	Small Bone Innovations, Inc., New York, NY
Hoffmann-La Roche, Inc., Nutley, NJ	ImClone Systems, Inc., New York, NY, Branchburg, NJ	Intercept Pharmaceuticals, New York, NY
Johnson & Johnson, New Brunswick, NJ	Lexicon Genetics, Inc., Princeton, NJ	ZIOPHARM Oncology, New York, NY
Merck & Co., Whitehouse Station, NJ	Medarex, Inc., Princeton, NJ	XTL Biopharmaceuticals, New York, NY
Novartis Pharmaceuticals, East Hanover, NJ	Progenics Pharmaceuticals, Inc., Tarrytown, NY	Innovive Pharmaceuticals Inc., New York, NY
Pfizer, Inc., New York, NY	Regeneron Pharmaceuticals, Inc., Tarrytown, NY	
Schering-Plough, Kenilworth, NJ		
Wyeth, Madison, NJ		

LAB MARKET SNAPSHOT

New York

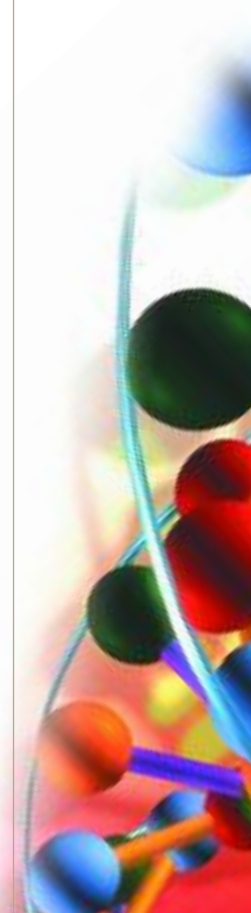
The existing academic lab space in New York City stands at 1.7 million square feet and is growing.

- The Albert Einstein College of Medicine is nearing completion of its Michael F. Price Center for Genetic and Translational Medicine, a 201,000-square-foot, $200 million facility that will house 40 high tech laboratories in addition to research support facilities and a 100-seat auditorium.
- Columbia University Medical Center continues the development of Audubon Biomedical Science and Technology Park (Audubon) dedicated to fostering academic and commercial research and development. Located in the Upper Manhattan Empowerment Zone, the park will consist of five buildings with more than 600,000 square feet of research laboratory space and more than one million gross square feet in total development, with costs exceeding $400 million. The 304,000-square-foot Irving Cancer Research Center is currently under construction and will house research teams in cancer, genetics, genomics, and immunology. A second commercial building, of 280,000 square feet, to house life science companies is planned next to the Audubon Business and Technology Center.
- Memorial Sloan Kettering nearly doubled its research capacity when it built the 623,000-square-foot, Mortimer B. Zuckerman Research Center, with 16 laboratory floors. A second building, scheduled for completion in 2009, will add a conference center with a 350-seat auditorium and a number of "dry laboratories" for computational biology. Memorial Sloan Kettering also recently opened a new 72,000-square-foot surgical center in Manhattan and an 85,000-square-foot outpatient cancer treatment facility in Basking Ridge, New Jersey.
- New York University Medical School opened the 13-story, 230,000-square-foot Smilow Research Center to house multidisciplinary teams conducting research in cancer, cardiovascular biology, neuroscience, dermatology, and infectious disease.
- The Office of NYC's Chief Medical Examiner recently completed a 15-story, $243 million DNA Laboratory, designed to house crime labs for the recreation of crime scenes and testing for forensic evidence.
- Weill Cornell Medical College opened and dedicated its new 330,000-square-foot, Ambulatory Care and Medical Education Building, featuring 13 stories to house patient care, research, and education activities.

All of this activity suggests growing demand for private sector lab space as spin-off companies are formed and companies from outside New York City are attracted to locate nearby. The deans of many of New York's preeminent research institutions have committed a number of important resources to fueling this growth, including access to their research facilities, faculty privileges for qualified company employees, collaborative research projects, access to patient populations for clinical trials and participation in academic seminars and events.

There are two existing bioscience incubators for commercial companies in New York City, Audubon Center and SUNY Downstate's Advanced Biotechnology Incubator. Audubon Center is a 100,000 square foot facility designed to house small companies, with rental rates of $55/sq ft NNN. Sixteen companies are located there now. SUNY's Advanced Biotechnology Park in Brooklyn includes a life science incubator, a commercial chemistry laboratory and space for early-stage life science companies needing expansion space of 4,000 to 30,000 square feet. When completed, the Advanced Biotechnology Incubator will measure 50,000 square feet. Phase I is currently completed and houses six companies, with average rental rates of $26/sq ft NNN. Phase II is under construction. When completed it will add 38,000 square feet to the lab space in this market, and will accommodate the research space needs of up to 20 to 30 companies. The Park also includes space for biomanufacturing and job training programs.

In addition to this activity, New York City is actively preparing to develop an additional two million square feet of space for commercial life science ventures. The most ambitious of these



projects is the East River Science Park. The City is also planning the development of the Brooklyn Army Terminal for research, laboratory, and bio-manufacturing uses. Phase I of the project consists of 120,000 square feet with additional expansion space of 360,000 square feet.

New Jersey

As a major life science submarket of the New York-New Jersey cluster, New Jersey has since the 19th century been known as the "Nation's Medicine Cabinet." With over three million square feet of pure R&D space, the cutting-edge science taking place here is fundamental to the sector as a whole.

The majority of the three million-square-foot New Jersey lab market is concentrated in the Greater Princeton and Cranbury areas of the Route I Corridor between Rutgers University and Princeton University.

Innovation zones are in areas clustered around New Jersey's research universities in Newark, New Brunswick, and Camden. Each of these Innovation Zones has a life science business incubator. The New Jersey Institute of Technology Incubators (50,000 and 80,000 square feet respectively) serve Newark. The Commercialization Center for Innovative Technologies is a 50,000-square-foot incubator located at the Technology Center of New Jersey and serving the Rutgers complex in New Brunswick and Piscataway. The Rutgers Technology Incubator is located at Waterfront Technology Center, a 100,000-square-foot facility that serves the Rutgers-Camden campus.

New Jersey has some major research parks. The Technology Center of New Jersey is located on a 50-acre former Johnson & Johnson campus, with 400,000 square feet utilized predominantly for life science use. University Heights Science Park in Newark is anchored by the International Center for Public Health, a 160,000-square-foot, $66 million facility housing research in infectious disease, microbiology, and genetics. The New Jersey Economic Development Agency recently completed the Waterfront Technology Center in Camden, the first of six buildings planned for that area.

INCENTIVES (STATE OR CITY)

Among the incentives to spur further bioscience development in New York state are:

- Investment in the life science-related Center of Excellence programs exceeds $400 million.
- A Qualified Emerging Technology Company (QETC) tax credit program that includes refundable tax credits up to $25,000 a year per firm.
- New York State Office of Science, Technology and Academic Research (NYSTAR), which provides funding to recruit entrepreneurial life science faculty and grants to promising young investigators.
- Regional Technology Support Centers.
- An Investment Tax Credit (ITC) program that grants tax credits of up to 10% of eligible investments. New businesses may elect to receive a refund of certain credits, and all unused credits can be carried forward for 15 years.
- Empire Zones Program.

More at http://www.nystar.state.us/uNYvation/iaf.htm

In New Jersey, some of the incentives offered to the industry include:

- Edison Innovation Zones

The New Jersey Economic Development Authority gives preference on all of its various incentive programs to firms that agree to locate in zones surrounding public research universities, principally in Newark, the Greater New Brunswick area, and Camden. The plan also includes the creation of facilities for commercialization and business acceleration in each of the zones.

- Technology Tax Credit Transfer Program

This tax credit program allows certain New Jersey biotech and technology companies the chance to sell their unused net operating losses and unused R&D credits at a minimum of 75% of their value.

- Capital Programs

New Jersey offers a variety of funds to assist life science companies from loans for proof-of-concept and commercialization research to investment guarantees for early-stage ventures, to bridge grants.

- Garden State Life Sciences Venture Fund

A $40 million fund, developed jointly with the Biotechnology Council of New Jersey, with public investment of $10 million, privately managed by Quaker BioVentures.

IN THE NEWS

New York

- In his first address to the Legislature, New York Governor Eliot Spitzer called this month for passage of a $2 billion, 10-year bond initiative for research and development, at least half of which would be set aside to pay for stem cell research.
- In the spring, Alexandria Real Estate Equities broke ground on New York City's first commercial life science campus, called the East River Science Park. The first tenants are expected in 2009. Upon completion, the $400 million complex will have three buildings encompassing 1.1 million rentable square feet of specialized laboratories and office space.
- Small Bones Innovations (SBI), a New York City-based orthopedic device company announced the largest-ever venture capital funding in orthopedic history when it closed its Series B round of financing with a raise of $42.2 million. SBI was the first company to focus purely on the orthopedic care of arthritis and trauma in small bones and joints.
- Clinilabs, a technology-based clinical trials organization that provides key drug development services to pharmaceutical and biotechnology companies, opened a new 24,400-square-foot headquarters that will employ 140 people.

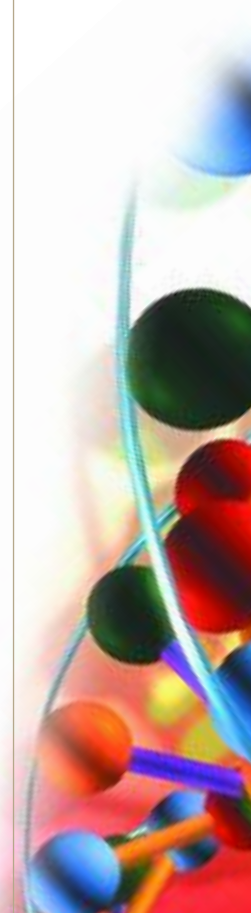
New Jersey

- The pharmaceutical/medical technology industry plans to construct more than $4.6 billion in new life science facilities in 2007 and 2008.
- Bayer Pharmaceuticals announced it would centralize its nationwide activities in New Jersey, making the State its U.S. headquarters. The consolidation is expected to bring 400 to 1,000 research and administrative jobs to the State in the next two years.
- New Jersey was called one of the top five life science growth markets by FierceBiotech, an internationally recognized e-mail newsletter for the biotechnology industry.
- Genesis Biotechnology Campus is a new research park on 50 acres located in Einstein's Alley that will be a collaborative center for research excellence created by scientists, for scientists. The campus will consist of 410,000 square feet. The first building of 120,000 square feet, currently under construction, will be anchored by Humigen, an operating group owned by the developer/scientist.

MARKET OUTLOOK

New York

The outlook for the life science industry in New York City has never been stronger. The fundamental market drivers such as world-class research institutions, public and private funding for life science companies, and a large skilled workforce, among others, have provided a solid foundation. Now continued academic expansion, the creation of competitively priced life science space for commercial companies, and governmental initiatives such as the creation of the New York City Bioscience Initiative and the City's dedicated bioscience business development team, should propel New York City into an epicenter for life science. Ease of access to New York City is also playing a role as the bio landscape expands.



New Jersey

New Jersey's biotechnology industry continues to experience strong growth, with the number of employees in publicly held companies growing by 19 percent between 2001 and 2005, according to a survey conducted by Ernst & Young in 2006 entitled *New Jersey… A Thriving Biotechnology Cluster*. The same report indicated that research and development at publicly held companies in New Jersey increased by 40 percent to $737 million, and revenues for both public and private companies exceeded $2 billion. The number of biotechnology companies located in New Jersey has nearly doubled since 2003.

Despite this positive outlook, some problems remain. The State is facing increasing competition from other, less expensive and less tax-laden regions such as eastern Pennsylvania. New Jersey's lab market will also continue to be driven by the significant pharmaceutical presence in the State. The American pharmaceutical industry has been faced with declining drug pipelines, layoffs and spending cuts, competition from generic drug companies, as well as the recall of blockbuster drugs. As a result, the New Jersey real estate market will feel the impact.

MAJOR FUTURE DEVELOPMENTS

New York

FUTURE LAB SPACE

Project Name/Address	Submarket	Proposed (SF)	Currently Under Construction (SF)	Delivery Date
East River Science Park	Manhattan	872,000 GSF	540,000 GSF	2009
SUNY Downstate Advanced Biotechnology Incubator (Phase 3)	Brooklyn	50,000	38,000	2007
Brooklyn Army Terminal	Brooklyn	300,000		
Columbia Audubon IV	Manhattan	280,000		
Total		**1,502,000**	**578,000**	

The Greater Metropolitan New York Commercial Market

- The Landmark at Eastview, Tarrytown (Westchester County), New York: 750,000 square feet of laboratory and office space in eight buildings with tenants including Regeneron, Crompton Corporation, and Emisphere Technologies. Current availability rate is 7.6% with asking rents between $20 per square foot and $25 per square foot.
- Valley Technology Center, Yonkers (Westchester County), New York: 116,000-square-foot renovated manufacturing building which includes some bio-tech lab space. Current overall availability is 50% with asking rents of $17 per square foot.
- Broad Hollow Bioscience Park, Farmingdale, Long Island, New York: Two buildings with the first a 63,500-square-foot facility, home to OSI Pharmaceuticals; second building is a 43,000-square-foot incubator facility set for completion in September 2007; primary use will be for start-ups and early-stage companies. Average asking rent is $40 per square foot.
- Long Island High Technology Incubator, Stony Brook, Long Island New York: Small lab space (500 – 1,000 square feet) available on Stony Brook University campus

CASE STUDY

The East River Science Park (ERSP) is set to become New York City's premier flagship destination for commercial life science use. This mixed-use urban life science campus located on 3.5 acres north of the Bellevue Hospital Center between East 28th and 29th streets and First Avenue and the FDR Drive, will encompass approximately 1.1 million rentable square feet upon completion. It will include research and development space for a spectrum of life science uses, as well as a conference center, restaurant, street-level retail, and open space.

The development is intended to capitalize on its close proximity to NYC's top academic medical research institutions, including NYU Medical Center, Columbia University, Memorial Sloan-Kettering Cancer Center, The Mount Sinai Hospital, Rockefeller University, Weill Medical College of Cornell University, as well as a myriad of independent research institutions, world-renowned scientists, and medical professionals. Alexandria Real Estate Equities is the developer of the Park, and NYC provided important public financial and technical support to the project.

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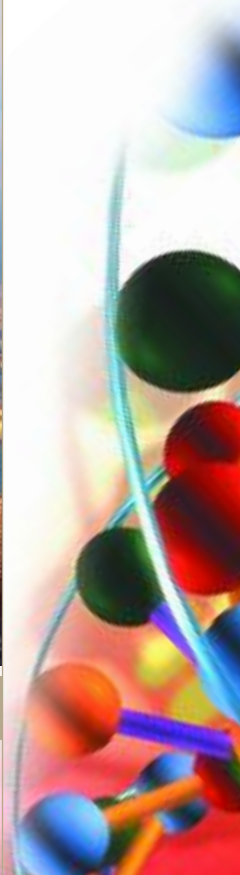

COLLIERS INTERNATIONAL

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OVERALL MARKET PROFILE

- **Inventory (SF)**
  20.7 m
- **Availability – with Sub-lease (SF)**
  1,326,306
- **Availability Rate (%)**
  6.4%
- **Asking Rents (NNN)**
  $15.00 to $22.00
- **Total Owner Occupied – with Sublease (SF)**
  60%
- **Total Combined Available – with Sublease (SF)**
  1,326,306

MARKET OVERVIEW

The Greater Philadelphia area includes Philadelphia County and the five suburban Pennsylvania counties of Bucks, Chester, Delaware, and Montgomery, along with Camden, Burlington, and Gloucester counties in New Jersey and New Castle County in Delaware. The area maintains an impressive array of collaborative research enterprises engaged in cross-discipline, multi-institutional, and private partnerships stemming from the region's hospitals, research institutions, and the highest per capita concentration of higher education institutions in the country. For example, the market includes:

- Four general medical schools, a school of osteopathic medicine, two schools of dentistry, two schools of pharmacy, a school of veterinary medicine, a school of podiatry, and a school of optometry.
- A high concentration of leading medical/bioscience research institutions, including the University of Pennsylvania, Thomas Jefferson University, The Children's Hospital of Philadelphia, Temple University Hospital, The Wistar Institute, the Fox Chase Cancer Center, and Hahnemann Hospital / Drexel University. In all, more than 20 universities and non-profit institutions were engaged in life sciences-related research. The University of Pennsylvania consistently ranks in the top 10 of NIH funding in the country.
- A center of bioscience business that is within an hour's train ride to the world's financial center in New York City and two hours to the U.S. regulatory center in Washington, D.C.
- A center for life sciences innovation within the heart of the nation's bio-pharma corridor – eight of the world's largest pharmaceutical companies are within a 50-mile radius of Philadelphia – providing access to a deep talent pool and partners for the region's emerging biosciences companies.
- Critical business support systems required for a thriving biotechnology industry such as research parks, biotechnology incubators, business schools, contract research organizations, diagnostics and testing companies, and venture capital funds and strong public sector support.
- High quality of life for families and a competitive cost of doing business, with stable real estate rates to help companies plan for growth.

The region also has a long and distinguished list of first accomplishments in the fields of medicine, medical education, research and discovery, and life-saving medical procedures.

INDUSTRY DRIVERS

Located in the Greater Philadelphia area are the U.S. headquarters for GlaxoSmithKline and Shire Pharmaceuticals. In addition, Northern New Jersey-based Wyeth, Merck, and Johnson & Johnson have manufacturing and/or R&D facilities in the Philadelphia area. The larger companies benefit from the area's educated workforce, research infrastructure, and the geographic location. Located midway between New York and Washington D.C., Philadelphia is midway between the investors and the regulators.

Globally, there are only a handful of profitable biotechnology companies and two of them, Cephalon and Centocor, are located in Philadelphia.

Smaller biotech companies who are doing much of the drug and process patent development need to be near the larger drug companies with whom they have current or potential alliances.

In 2006, Governor Rendell proposed the formation of a $500 million Jonas Salk Legacy Fund that will provide matching grants to the state's leading bioscience researchers in academia and industry, generating up to $1 billion for cutting edge medical research. As many as 12,000 new jobs could result from the program. To pay for the Legacy Fund, the

Governor is proposing to use 10% of Pennsylvania's share of the tobacco settlement funds as backing for the issuance of bonds. The Fund will be administered by an independent body made up of university, medical research, bioscience, and public agency representatives. A portion of the money will be used to help academic medical centers, research colleges, and universities buy tools and equipment for research. Of the total funds, $400 million will be used as grants to be awarded to companies and institutions planning to build laboratories and incubators.

MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Pennsylvania University	Albert Einstein Medical Center	Center for Advance Biomedical Research
Thomas Jefferson University	Children's Hospital of Philadelphia	Center for Bioinformatics
University of Pennsylvania	Fox Chase Cancer Center	Center for Recombinant Protein Production and Structure Evaluation
	Hospital of the University of Pennsylvania	Lankenau Institute for Medical Research
	Magee Rehabilitation Hospital	Monell Chemical Senses Center
	Pennsylvania Hospital	Nanotechnology Institute
	St. Christopher's Hospital Temple University Hospital	National Disease Research Interchange
	Thomas Jefferson University Hospital	Wistar Institute
	Wills Eye Hospital	

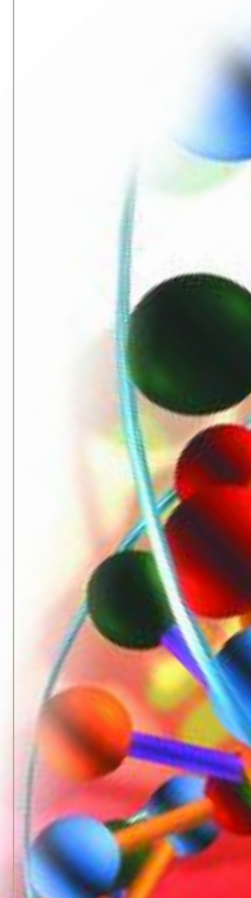
Pharmaceutical Companies		Biotechnology Companies	
GlaxoSmithKline, Inc.	Shire Pharmaceuticals	Adolor Corporation	Centacor
Merck & Company	Wyeth	BioRexis Pharmaceutical Corporation	Charles River Laboratories
Pfizer		Cephalon, Inc.	Immunicon Corporation

LAB MARKET SNAPSHOT

The Greater Philadelphia lab market is approximately 20.7 million square feet. The inventory of lab space in Greater Philadelphia has been almost entirely end-user driven. There has been little or no speculative product and as a result, much of the occupied lab inventory is office or flex space that has been fit-out or converted on an as-needed basis. Space that is currently vacant or under development is termed "lab capable" and marketed for a variety of uses.

The region's resident pharmaceutical companies GlaxoSmithKline, AstraZeneca, The West Company, Wyeth, Merck and Johnson & Johnson own over 11 million square feet of R&D/manufacturing space and lease additional office facilities.

Small firms take advantage of the local incubator opportunities such as the Science Center in Philadelphia and the Delaware Technology Park in Newark, Delaware. A partnership between the Hepatitis B Foundation and Delaware Valley College recently opened the Pennsylvania Biotechnology Center of Bucks County, a 62,000-square-foot bio-incubator.



PHILADELPHIA

Institutions such as the University of Pennsylvania, Thomas Jefferson University, Children's Hospital, and The Fox Chase Cancer Center continue to expand their research capabilities. Children's Hospital recently commenced on a 558,000-square-foot translation research facility. The $400 million building comprises eight stories – four new laboratory floors, administration and conference space, and a two-story ground floor housing a lobby and cafeteria. An additional four stories below grade will consist of infrastructure and laboratory support space. There is the potential to expand the building to 22 stories.

The largest blocks of "spec" lab space currently on the market are at former user or institutional campuses that are being repositioned as multi-tenant facilities such as Preferred Real Estate's Bridge Business Center in Bristol, a former Rohm & Haas complex, and the former Medical College of Pennsylvania in Philadelphia that was purchased by a nonprofit corporation and is being marketed as the MCP Life Services Campus.

INCENTIVES (STATE OR CITY)

Major initiatives to spur further bioscience development in Pennsylvania currently include:

Research & Development Tax Credit Program

This targeted tax credit incentive allows companies to apply for a credit equal to the increase in qualified R&D expenditures from one tax year to the next. For example, a company that spent $500,000 on R&D one year and $550,000 the next could apply for a 10% tax credit of the $50,000 increase, or $5,000. This program also has a tradability component that allows companies to sell unused credits for cash to qualified businesses.

Keystone Innovation Zones (KIZ)

In this innovative program, key KIZ-designated zones will be established around institutions of higher education. Starting in 2006, 25 million per year in tax credits will be available for KIZ companies that are less than eight years old and in a priority industry.

EXISTING LAB SPACE

	Total SF	Available SF (Vacant/Sublease)	Vacancy Rate
Philadelphia	2,888,325	1,026,900	35.6%
Pennsylvania Suburbs	16,385,545	1,026,900	6.3%
Southern New Jersey	343,533	91,500	26.6%
New Castle County, DE	1,944,735	63,482	11.9%
Total	**20,744,737**	**1,326,306**	**6.4%**

MARKET ASKING RENTS

Submarket	Asking Rent Shell Space (NNN)	Allowance Tenant Improvement (TI)
Philadelphia	$21.00	Negotiable
Pennsylvania Suburbs	$22.00	Negotiable
Southern New Jersey	$15.00	Negotiable
New Castle County, DE	$15.00	Negotiable

IN THE NEWS

- In the third quarter of 2006, the following life science companies received venture investments:
  – Prism Pharmaceuticals, $30 million
  – NuPathe, Inc., $15 million
  – Red Path Integrated Pathology, Inc., $700,000
- In November, the Science Center received the Outstanding Research Park of the Year Award from the Association of University Research Parks.
- The National Institutes of Health awarded the University of Pennsylvania School of Medicine a $68 million NIH Clinical and Translational Science Award over the next five years. With additional institutional commitments of $30 million from the School of Medicine, other Penn schools, and the Children's Hospital, the translational medicine consortium's commitment will total nearly $100 million. The award will link this consortium with 11 other academic health centers throughout the country to energize the discipline of clinical and translational science in order to apply new scientific advances to real-world practice.

MARKET OUTLOOK

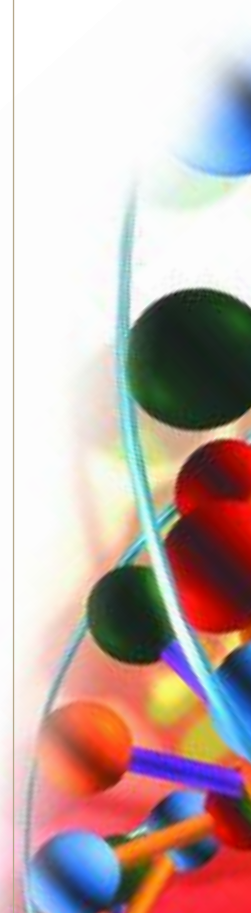
Like New Jersey, Greater Philadelphia's lab market is likely to be impacted by the financial health of the large pharmaceutical companies over the next year. Drug safety concerns, decreasing innovation pipelines, and increasing competition from generic manufacturers will affect employment and demand.

However, the smaller biotech companies should continue to grow in the region. While widespread construction of lab space in the suburbs is not expected, there may be a concerted effort by owners and developers to more actively market existing flex and office space to biotech users as the economic outlook improves. In addition, the impetus toward translational research could spawn the creation or expansion of bioinformatics companies and those conducting clinical trials.

The Philadelphia Navy Yard includes a master-planned research park of 81 build-to-suit acres, with 935,000 square feet of capacity to house life sciences, pharmaceutical, research and development, manufacturing, and distribution. AppTec Laboratory Services was the first company to locate there, occupying a 75,000-square-foot facility. Construction of a second 45,000-square-foot facility is currently underway.

In addition, there are major plans for the University City area in Philadelphia. The University Science Center recently announced a major new strategic plan, created a $10 million investment capital fund, expanded its management program to assist start-up companies and will redevelop its real estate assets along Market Street to attract an even greater number of life science and technology businesses in two million square feet of new space.

Children's Hospital of Pennsylvania (CHOP) is also undergoing a major expansion that will add 1.2 million square feet. The South Campus Research Complex comprises nearly eight acres of land directly across from the Hospital's current clinical and research facilities. Once complete, Children's Hospital South Campus will house a translational research facility, a central utility plant, underground parking and garage, and an ambulatory building with outpatient care, day medicine, day surgery, and imaging, as well as enhanced amenities for patients and families. Total facility development is estimated at $845 million.



MAJOR FUTURE DEVELOPMENTS

Major Players

FUTURE LAB SPACE

Project Name/Address	Total Size (SF)	Submarket	Currently Under Construction (SF)	Delivery Date	Comments
3711 Market Street: University City Science Center	170,000	Philadelphia	2007-2008	Eight stories total, four lab floors over retail and parking	3711 Market Street: University City Science Center
Children's Hospital Translational Research Facility	558,000	Philadelphia	2007-2008	Eight stories total, four lab floors, expandable to 22 floors for future growth	Children's Hospital Translational Research Facility
Camden Waterfront Technology Center	100,000	Southern New Jersey	2006 (Completed)	Production, laboratory and office space geared to high-tech and life science companies	Camden Waterfront Technology Center

CASE STUDY

In October 2006, construction began on the $600 million expansion of the Science Center in Philadelphia. The overall expansion will more than double the size of the Science Center campus from 1.7 million square feet to 3.5 million square feet in an effort to position the campus as the premier science and technology center of the world.

First of the five buildings planned along Market Street to break ground was a 400,000-square-foot building that will include 150,000 square feet of laboratory and office space, as well as shops on the first floor and parking for 500 vehicles.

A second new Science Center, on the southwest corner of 38th and Market Street, will have mostly residential space, with some parking, retail, and office space. The third building, at 36th and Market Street, will be the hotel and conference center. The plans calls for two more research buildings in the next three years.

Centrally located one mile west from the heart of Philadelphia, the Science Center is close to the University of Pennsylvania, Drexel University, and the Wistar Institute. With already more than 30 science companies calling the Science Center home, the additional buildings will provide laboratory space and offices for 5,000 to 7,000 new scientists and workers within the next decade.

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"Globally, there are only a handful of profitable biotechnology companies and two of them, Cephalon and Centocor, are located in Philadelphia."

COLLIERS INTERNATIONAL

WASHINGTON DC/BALTIMORE

OVERALL MARKET PROFILE

Metro DC

- **Inventory (SF)**
  More than 7 million square feet

Baltimore

- **Inventory (SF)**
  2,117,261
- **Availability – with Sub-lease (SF)**
  479,500
- **Availability Rate (%)**
  23
- **Asking Rents (NNN)**
  $25 - $36 Per SF
- **Total Owner Occupied – with Sublease (SF)**
  1,430,602
- **Total Combined Available – with Sublease (SF)**
  3,572,863

- **Estimated Federal Life Science-Related Available Space (SF)**
  10,500,000

MARKET OVERVIEW

The Washington DC/Baltimore, Maryland corridor is home to two of the primary institutional research forces in the life science industry. The National Institutes of Health (NIH), located in Bethesda, Maryland, is the nation's primary federal organization for funding medical research and scientific discovery. Johns Hopkins University (JHU) in Baltimore and Montgomery County, Maryland, is one of the largest federally supported academic research institutions in the country and boasts one of the leading medical centers in the world. This established federal and academic infrastructure has created a life science "power alley," positioning the region to grow as one of the core locations for the expanding life science industry.

In suburban Maryland, the federal segment of the life science industry alone (NIH and FDA) employs approximately 25,000 people and occupies over 10.5 million square feet of facilities. The presence of these institutions of regulatory power and guiding vision for scientific research drug discovery define the region's life science hub.

The State of Maryland also maintains high rankings in the areas of federal research and development expenditures, NIH contract awards, and concentrations of PhD's, doctoral scientists and engineers. The life science business in Washington DC/Baltimore continues to be driven by the area's two dominant academic research centers – Johns Hopkins and the University of Maryland. Discovery-level research at these institutions attracts hundreds of millions of annual research funding from the National Institutes of Health as well as private foundations.

This continued growth of academic research has triggered the predictable proliferation of early stage start-ups, as well as international life science companies. 360 life science companies are located here, with 55% of them located in Montgomery County and 23% located in the Baltimore area. These companies are focused on human therapeutics, life science services, and research tools and diagnostics. More than half of them employ fewer than 20 people. Consequently, there is increasing demand for incubator and small suite bench space throughout the area.

The regional commercial lab market is segmented into two submarkets. The Metro DC market consists of over seven million square feet of lab space primarily located along I-270 in Montgomery County, Maryland, and in isolated spots within northern Virginia, while the Baltimore submarket in and around Baltimore consists of just over three million square feet of commercial lab space.

INDUSTRY DRIVERS

The National Institutes of Health is the world's single largest source of funding for medical research. As a result of NIH funding, the Washington/Baltimore region has historically been among the top recipients of federal support. While federal funding has been abundant, the region as a whole has historically lagged other core biotech clusters in venture capital funding.

The life science market in the Greater Baltimore region is driven in large part by the amount and quality of the research and development. The region's institutions receive more than $7 billion in R&D funding. Their ability to effectively translate this R&D activity into viable commercial ventures—whether they are in the form of new companies, marketed products, or drawing new industry to the region—is crucial to success.

Recognizing that this research is the cornerstone of to technical innovation, Maryland has invested more than $450 million in bioscience infrastructure.

The commitment of Greater Baltimore's stakeholders to working together to move the

market forward is another critical element driving this life science market. Some of the largest stakeholders in the Baltimore life science market include: The Annie E. Casey Foundation, the city of Baltimore and the six surrounding counties, East Baltimore Development Initiative (EBDI), Forest City Enterprises, Johns Hopkins University, the State of Maryland, the university system of Maryland, Wexford Development, and Whiting-Turner. These institutions and organizations have the expertise to grow the life science market, as well as a vested interest in its success.

We anticipate the growth in Maryland's biotech sector will continue. The sustained interest at Johns Hopkins in commercializing products and in working with industry will facilitate and drive the development of the life science market in the future. Additional support includes economic incentives offered by both the state and local governments the support given to early stage companies in the form of grants and incubator space by organizations such as TEDCO and the University of Maryland system of schools and the continued transfer of technology from other local research institutions.

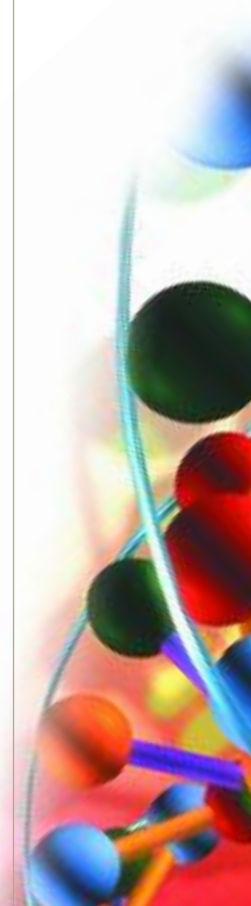
MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Georgetown University	Georgetown University Medical Center	Carnegie Institution of Washington
George Washington University	George Washington University Medical Center	Howard Hughes Medical Institute
Johns Hopkins University	Johns Hopkins Bayview Medical Center	The Institute for Genomic Research (TIGR)
University of Maryland	University of Maryland Medical Center	Kennedy Kreiger Institute
University of Maryland at Baltimore		National Biomedical Research Foundation
		National Cancer Institute
		National Institutes of Health
		UMD Biotechnology Institute
		US Army Medical Research Institute of Infectious Diseases

Pharmaceutical Companies	Biotechnology Companies	
Cambrex	BioReliance/Invitrogen Bioservices	GenVec
Chesapeake Biological Laboratories	Celera Genomics	Human Genome Sciences
Shire US Manufacturing	Digene	MedImmune, Inc.
Pharmaceutics International	EntreMed, Inc.	
Sequoia Pharmaceuticals		



WASHINGTON DC/BALTIMORE

LAB MARKET SNAPSHOT

Metropolitan Washington DC Area

With a vast community of federal government and research institutions such as Johns Hopkins University, Georgetown University, George Washington University, and Howard Hughes Medical Institute, the metropolitan Washington, DC, area has no shortage of knowledge to help grow the area's life science industry. The area's commercial lab space is concentrated along the I-270 Corridor in Montgomery County, home to the majority of Maryland's biotech and pharmaceutical companies and federal agencies.

As is typically the case with this lab market, the largest new developments and the driving force behind the real estate side of the life science sector are institutional, not commercial. The NIH is constantly growing. In addition, the Food and Drug Administration and the Howard Hughes Medical Institute each have undertaken major new developments on their campuses in the metro DC area. Howard Hughes Medical Institute recently completed and opened its Janelia Farm Research Campus, a 760,000-square-foot new scientific community.

Baltimore, Maryland

Metropolitan Baltimore's life science market continues to be driven by the area's dominant academic research centers – Johns Hopkins University and the University of Maryland, as well as the University of Maryland schools of medicine, pharmacy, and dentistry, the University of Maryland Biotechnology Institute, and VA Medical Center.

The continued growth of academic research has triggered the predictable proliferation of early stage start-ups, increasing demand for incubator and small suite bench space throughout the area. The Emerging Technology Center at Johns Hopkins Eastern, one of the city's three business incubators, provides a full range of business development and commercialization services to small companies. Demand for this space indicates interest from the private sector in collaborating with the academic centers in Baltimore.

Both Johns Hopkins and the University of Maryland have launched major real estate projects in the form of two new university parks.

The first building at the University of Maryland BioPark in downtown Baltimore, near the UMB campus, is now fully leased. The 120,000-square-foot, six-story building houses early-stage biotechnology companies, as well as SNBL Clinical Pharmacology, Japan's largest contract research organization. The second building at the research park, a 230,000-square-foot life science facility, is currently under construction.

The Science and Technology Park at Johns Hopkins also recently broke ground on its first building, a 280,000-square-foot, state-of-the-art life science building that will be anchored by the Johns Hopkins Institute for Basic Biomedical Sciences. The first phase of the Hopkins park will encompass 31 acres, and include 1.1 million square feet of life science space, 850 residential units, 40,000 square feet of retail space, parking garages, and parks/open green space. It will completely transform the entire East Baltimore area.

EXISTING LAB SPACE – BALTIMORE METROPOLITAN AREA

	Total SF	Available SF (Vacant/ Sublease)	Vacancy Rate
Total Baltimore City	1,483,100	479,500	32%
Total Baltimore County	355,500	3,000	0.8%
Total BWI	32,200	0	0%
Total Columbia	246,461	0	0%
Total Leased Space	**2,117,261**	**482,500**	**23%**
Total Owner Occupied	1,430,602		
Total Baltimore Metro Area	**3,547,863**		

MARKET ASKING RENTS		
Submarket	Asking Rent Shell Space (NNN)	Allowance Tenant Improvement (TI)
Baltimore City	$30 - $36 per sf	$0 - $50 per sf
Surrounding Counties	$20 - $25 per sf	$0

INCENTIVES (STATE OR CITY)

Major initiatives to spur further bioscience development currently include:

Maryland:

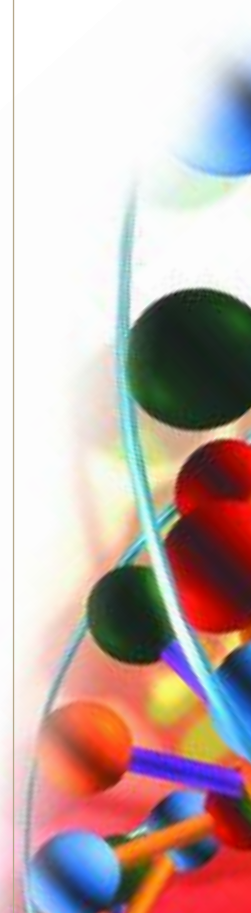
- The Maryland Bioscience Alliance
- MDBio
- Maryland Department of Business and Econ-omic Development
- Enterprise Zone Tax Abatement
- Job Creation Tax Credits
- Corporate Income Tax Credits
- Workforce Training Grants
- R&D Tax Credit
- R&D Property Tax Exemption
- Tenant Improvement Low-Interest Loans

Virginia:

- Virginia's Center for Innovative Technology
- The Virginia Department of Business Assistance
- The Virginia Economic Development Partnership
- The Virginia Biotechnology Research Park Authority
- Virginia Small Business Incubator Grant Program
- Commonwealth Technology Research Fund
- The Virginia Biotechnology Association

IN THE NEWS

- The newly formed Northern Virginia Bioscience Executives Group, a program of the Virginia Biotechnology Association, held its first meeting in 2006 in order to bring together the executives who provide leadership to the growing life science cluster in northern Virginia. Approximately 37% of Virginia's bioscience industry is based in Northern Virginia and nearly one million square feet of bioscience-related commercial development is underway there.
- United Therapeutics, one of the area's biggest biotechs, is moving to construct the next phase of a $205 million, three-building campus in downtown Silver Spring, Maryland, that makes room for at least 300 employees. The new headquarters complex for United Therapeutics will span 213,000 square feet. In addition to its Maryland campus plans, the company expects to take over a new $5.5 million, six-level brownstone next door to its DC legal and governmental affairs offices, and break ground on a nearly $100 million, 200,000-square-foot manufac-turing plant that will employ 160 people in North Carolina's Research Triangle Park.
- Shire Pharmaceutical agreed to acquire New River Pharaceuticals for $2.6 billion.



WASHINGTON DC/BALTIMORE

RECENT TRANSACTIONS

RECENT TRANSACTIONS			
Location	Tenant	Landlord	Size (SF)
UMB BioPark - Building One	Shin Nipon Biological Labs	Townsend Capital	40,000
UMB BioPark - Building One	American Red Cross - UMB	Townsend Capital	40,000
UMB BioPark - Building One	Alba Therapeutics	Townsend Capital	13,000
UMB BioPark - Building One	FASgen	Townsend Capital	6,500
Columbia	Osiris Therapeutics	Corvis	60,000
Montgomery County	Advanced Vision Therapies	Alexandria Real Estate Equities	19,000
Montgomery County	Cato Research	New Boston	12,000
Montgomery County	CoGenesys	Danac	6,000
Montgomery County	Novavax	Human Genome Sciences	51,000

MARKET OUTLOOK

Clearly, the Washington, DC/Baltimore market will remain institutionally driven. The stability of the federal and academic foundation that drives this market bodes well for continued growth and activity in the region. Historically, private biotech and pharmaceutical growth in the region has lagged some of the other major markets around the country. However, the completion of the FDA's new campus at White Oak, Janelia Farm at the Howard Hughes Medical Institute in Northern Virginia, the Johns Hopkins and University of Maryland expansions in Baltimore, and economic development efforts throughout the region will fuel private sector life science demand. Projections show the total size of the Baltimore life science market in terms of leased space will increase by more than 35% over the next two years alone.

One area that could particularly affect this region is the reduction in increases in the budget for the National Institutes of Health.

MAJOR FUTURE DEVELOPMENTS

FUTURE LAB SPACE					
Project Name/Address	Submarket	Total Size (SF)	Currently Under Construction (SF)	Delivery Date	Comments
Science + Technology Park at Johns Hopkins	Baltimore City	1,100,000	280,000	Spring 2008	First building, (280,000 SF) broke ground in April, 2006.
Bayview Technology Center	Baltimore City	80,000	Planned	TBD	
University of Maryland, Baltimore Biotech Park - Building Two	Baltimore City	900,000	230,000	Summer, 2007	Building One (120,000 SF) is fully leased. Second building (240,000 SF) broke ground in summer, 2006.
Total		**2,080,000**	**510,000**		

CASE STUDY

The Washington suburb of Loudoun County, Virginia, now boasts biomedical research facilities that until recently were limited to Montgomery County's Interstate 270 corridor, one of the indisputable biotech centers in the nation. In November of 2006, the 280-acre $500 million Janelia Farm Research Complex for the Howard Hughes Medical Institute was completed. The facility includes 760,000 square feet of space that will house 250 new researchers and up to 100 visiting scientists, including many Nobel Prize-winning researchers.

The complex consists of laboratory space, a conference facility, temporary housing for visiting scientists, and many amenities. The collaborative nature of the research will bring biologists, physicists, chemists, computer scientists, and engineers together to tackle the most difficult problems confronting science. It is a unique approach modeled after the successful collaborative science centers in Europe.

The Institute carries out research with its own scientific staff in Howard Hughes Medical Institute (HHMI) laboratories across the United States. Using the powerful new tools of molecular biology, these research teams seek to explain how the human body functions and why disease occurs. HHMI investigators have been involved in many recent advances, from the discovery of genes related to cancer, heart disease, obesity, cystic fibrosis, muscular dystrophy, and other diseases to new insights about how organisms develop, cells communicate, or learning occurs.

Credit:
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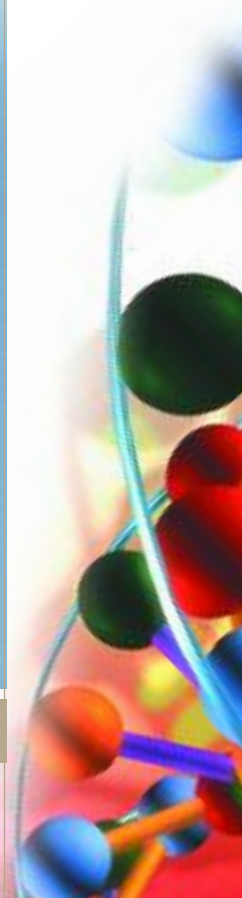


COLLIERS INTERNATIONAL

Raleigh-Durham and Emerging Winston-Salem

OVERALL MARKET PROFILE

- **Inventory (SF)**
  9,200,000
- **Availability – with Sub-lease (SF)**
  709,038
- **Availability Rate (%)**
  7.71
- **Asking Rents (NNN)**
  $12 - $32

MARKET OVERVIEW

North Carolina is home to a dynamic and growing life science community. According to the North Carolina Biotechnology Center, more than 357 bioscience companies are headquartered or have operations in North Carolina, employing more than 48,031 people. The life science market is made up of two main bioscience clusters – the Research Triangle (Raleigh/Durham/Chapel Hill), and the Piedmont Triad (Winston-Salem/ Greensboro/High Point regions).

Raleigh-Durham in North Carolina is known as the Research Triangle, an established life science hub of the South, particularly for manufacturing and biotechnology activities. North Carolina is the world's leader in agricultural biotechnology with three of the world's largest ag-chemical companies (Sygenta, Bayer Crop Science, and BASF), each having research facilities at the world-renowned 7,000-acre Research Triangle Park (RTP), the anchor of the Raleigh-Durham region's growth. The RTP also features the world's largest concentration of Contract Research Organizations (CROs) and numerous prominent life science companies as tenants.

The RTP is home to a strong base of biomanufacturing firms, led by GlaxoSmithKline and Biogen. "Big pharma" arrived in the '70s and '80s, with Burroughs Wellcome and Glaxo helping to pave the way for a new influx of research and development, and biomanufacturing companies such as Biogen, Diosynth and Eisai. The region lays claim to the world's largest biologics manufacturing facility (Biogen), and the largest vaccine facility (Wyeth) and plasma-based products facility (Talecris).

Of the 157 organizations in the RTP, 132 are research and development organizations specializing in therapeutics, diagnostics, genomics, bioinformatics, contract research, and manufacturing.

Also located in the RTP is the North Carolina Biotechnology Center, a state-supported initiative that has provided more than $174 million in life science infrastructure, including grants and creative services to support early stage life science companies and education training programs.

Winston-Salem, NC, is also experiencing economic revitalization in the life sciences, due to the development and expansion of the Piedmont Triad Research Park (PTRP), a growing master-planned, urban-based, life sciences research park with 36 emerging and established life sciences and technology organizations employing a diverse and highly skilled workforce. PTRP will ultimately encompass more than 200 acres of downtown Winston-Salem with a potential buildout of 5.7 million square feet of space. Today, PTRP includes five buildings providing close to 500,000 square feet of lab, office, meeting, and residential space. An additional 30,000-square-foot facility is scheduled for completion in 2007.

PTRP development is led and anchored by Wake Forest University Health Sciences (WFUHS) – consistently ranked among the nation's best medical schools. Core research capabilities include clinical trial design and oversight, imaging, structural biology, biomedical engineering (with Virginia Tech) and regenerative medicine.

Recently, PTRP opened its state-of-the-art Biotechnology Research Facility 1 consisting of 180,434 square feet of flexible wet lab and office space with approximately 43,000 square feet of leasable space. The five-story facility is home to the world-renowned Wake Forest University Institute for Regenerative Medicine, led by Dr. Anthony Atala and the WFUHS's Lipids Sciences Research Program.

INDUSTRY DRIVERS

Raleigh-Durham has a solid base of research universities, hospitals, and funding that provide fundamentals for a successful life science cluster, with $1.6 billion in annual research funding. In 2005, Duke University received $391 million in funding from the National Institutes of Health (NIH), and the University of North Carolina received $297 million, ranking sixth and 15th, respectively, among institutions receiving NIH funding that year. Wake Forest University Health

Sciences received $125 million. North Carolina's life science companies received $310 million in venture funding in 2006 and $435 million in both public and private funding.

The University of North Carolina is a 16-campus system headed by UNC Chapel Hill (UNC) and North Carolina State University (NCSU). Nationally recognized Duke University and Wake Forest University together offer more than 300 undergraduate and graduate degree programs, including life science PhD programs that annually provide a steady supply of well-educated graduates to the work force. About half of the state's 1,100 PhD recipients complete their study in biological and related sciences.

Each of these research universities are also home to cutting-edge life science research that produces new technologies and emerging companies. According to the US Patent and Trademark Office, universities, institutions and companies in North Carolina were awarded 154 biotech-related patents in 2006, up from an average of 152 over the last several years. Duke University and the University of North Carolina maintain nationally acclaimed hospitals on their campuses that are active in local life science studies and trials.

The North Carolina Community College System provides workforce training in biotechnology through its statewide BioNetwork program and BioWork course. These community colleges participate in the state's Biomanufacturing and Pharmaceutical Training Consortium, together with the UNC System, the industry trade group NCBIO, the Biotechnology Center, and five biomanufacturing companies. The coordinated effort includes a new $36 million Biomanufacturing Training Education Center at North Carolina State University in Raleigh and a new Bioprocess Research Institute at NCCU in Durham.

In 2004, US Secretary of Labor Elaine L. Chao announced a $5 million grant to Forsyth Technical Community College in Winston-Salem, which is partnering with four other community colleges around the nation to establish a National Center for the Biotechnology Workforce. This national effort was developed under the president's High Growth Job Training Initiative to address workforce challenges facing the biotech industry. Forsyth Community College offers a two-year associate's in applied science degree program in biotechnology and is constructing a new technology/student services building that will include approximately 17,000 square feet for biotechnology instruction in microbiology, molecular genetics, cell/tissue culture, biochemistry, analytical chemistry, organic chemistry, applied chemical processes, and laboratory techniques.

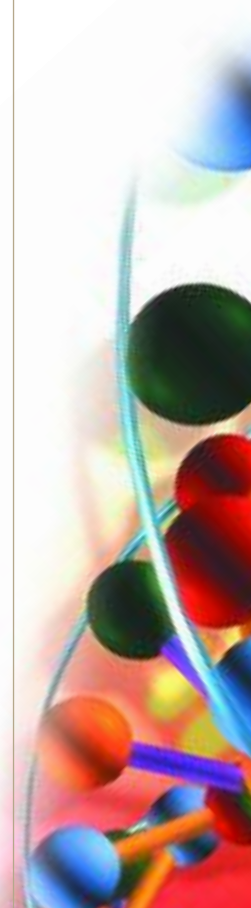
In addition, in 2003, the state completed a blueprint for biotechnology development titled New Jobs Across North Carolina: A Strategic Plan for Growing the Economy Statewide through Biotechnology. Early initiatives include: targeting biomanufacturing, creating and attracting biotechnology start-up companies, and developing biotechnology statewide.

MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Duke University	Duke University Medical Center	CIIT Centers for Health Research
North Carolina Central University	University of North Carolina Hospital	National Institute of Environmental and Health Studies
North Carolina State University		Research Triangle Institute
University of North Carolina at Chapel Hill		



Raleigh-Durham and Emerging Winston-Salem

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Eisai Pharmaceuticals	Biogen Idec	Johnson & Johnson
Inspire Pharmaceuticals	Talecris Biotherapeutics	Synacor
Gilead Sciences	Biolex	BD Technologies
GlaxoSmithKline		Advanced Liquid Logic

LAB MARKET SNAPSHOT

The Greater Raleigh-Durham lab market, inclusive of owned and leased R&D facilities, consists of approximately 9.2 million square feet of space. Research Triangle Park and the immediate area around RTP accounts for most of the region's total lab space supply. The remainder of the market's inventory is located in facilities dispersed throughout Wake, Durham, and Orange counties. Available inventory totals approximately 709,038 square feet.

Asking rents for lab space vary widely depending on the class of space, degree of laboratory improvements, length of lease term, and project scale. Newer, more modern and well-equipped multi-story facilities are leasing for up to $32 per square foot NNN. Older second-generation space leases for as little as $12 per square foot NNN. Tenant improvement allowances will vary significantly depending on lease term, credit worthiness of the tenant, and existing conditions of the space. Total operating expenses can vary from approximately $7.50 to $11 per square foot per annum depending on the intensity of laboratory fit-up and utility usage.

Given the expense and unique nature of most laboratory upfits, landlords are scrutinizing the credit worthiness of less established life science users. Most landlords will require small to mid-size companies to provide a letter of credit or other form of security deposit and may ask the tenants to fund some of their tenant improvements.

INCENTIVES (STATE OR CITY)

The state of North Carolina offers numerous incentives that are often available to life science companies, including tax credits, bonds, grants, and loans. Economic development agencies at the county, state, and regional levels have targeted biomanufacturing as a key industry segment, with the state earmarking more than $64 million in funds from the Federal Tobacco Settlement (now known as the Golden Leaf Foundation) to promote training of biomanufacturing workers across the state. Major initiatives to spur further bioscience development in North Carolina currently include:

- North Carolina Biotechnology Center
- North Carolina Bioscience Investment Fund
- Innovation Research Fund
- Collaborative Funding Assistance Grants Program
- North Carolina Biosciences Organization
- Council for Entrepreneurial Development

IN THE NEWS

- North Carolina retained its ranking as the nation's third leading state for biotechnology, trailing only California and Massachusetts in the number of biotechnology companies, according to "Beyond Borders," Ernst & Young's 2006 report on the industry.
- United Therapeutics will invest $53.4 million in a 125,000-square-foot facility in the RTP that will create 147 new jobs.
- Novartis Vaccines and Diagnostics will build a flu vaccine-manufacturing plant in Holly Springs and invest a minimum $267.5 million over the next five years in Wake County. The move will also bring 350 new jobs during that span.
- North Carolina State University in Raleigh will use a $700,000 federal grant to develop alternate fuel resources.
- Eisai Inc., a Teaneck, New Jersey-based pharmaceutical company, broke ground for a new

pharmaceutical production and formulation research and development facility for parenteral – or intravenous – oncology treatments in Research Triangle Park, North Carolina

- Quintiles Transnational Corp., the world's largest clinical research organization, will expand in Durham County, creating 1,000 jobs and investing $10.1 million during the next six years.
- Targacept is expanding the amount of office space it utilizes at the Piedmont Triad Research Park to 57,000 square feet, to continue its efforts to develop a potential Alzheimer's drug and to launch a clinical trial for a drug targeted to depression and anxiety.

MARKET OUTLOOK

The North Carolina life science real estate market is a steady but patient market. The RTP market absorbs about 120,000 to 150,000 square feet of lab space per year, typically involving one transaction of about 50,000 square feet and one or two 25,000-square-foot transactions. Most leases cover 2,000 square feet to 5,000 square feet. Tenant demand is primarily driven by three types of users: spin-outs from the universities or other start-ups, existing firms that are expanding, and new users looking to relocate from other markets or adding a branch facility.

In particular, technology transfer from the major academic institutions to young companies is occurring more efficiently than in the past and venture capital investment is on the upswing after a fall-off in 2001. This has created an ongoing demand for space by small companies, which may indicate a more robust growth climate in the future.

No new developments or major lease transactions are expected in the Raleigh-Durham market at this time.

The markets in Winston-Salem and Kannapolis (see below) are still developing.

CASE STUDY

North Carolina's biotech industry was Triangle-centric until billionaire philanthropist magnate David Murdock proposed the idea of creating a research park in Kannapolis, near Charlotte – an idea embraced by officials with the University of North Carolina system.

The former Cannon Mills textile plant in Kannapolis would be redeveloped into a research campus eventually totaling one million square feet. The first building, 330,000 square feet, will include core bioscience laboratories for the state of North Carolina, contract bio-manufacturing, multi-tenant wet-lab space, and a research institute sponsored by Dole Foods. The park will be paired with a venture capital fund of reportedly $200 million financed by David Murdock.

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COLLIERS INTERNATIONAL

SEATTLE

OVERALL MARKET PROFILE

- **Inventory (SF)**
  5,023,723
- **Availability – with Sub-lease (SF)**
  286,018
- **Availability Rate (%)**
  5.69
- **Sublease (SF)**
  295,879
- **Asking Rents (NNN)**
  $23 - $33

MARKET OVERVIEW

The Seattle region is a world-class center for life science and has been ranked as one of the largest biotechnology markets in the United States. Currently in the private sector, more than 62,000 people are employed by 190 life science companies within Washington state, 160 of which are in the greater Seattle area. One of the largest, Amgen, has announced plans to add 550,000 square feet to their existing research operation and double the 750-person staff.

Over the past two decades, the city of Seattle and its submarkets have seen an explosion in growth. The biotechnology and medical technology sectors have thrived along with this expansion. The Seattle area has over five million square feet of existing life science facilities, with over one million square feet planned in the biotechnology and medical technology industry. Spurring the continued growth, Vulcan Real Estate and Alexandria Real Estate Equities have invested tens of millions of dollars into the South Lake Union community of Seattle to nurture it as a hub for biotech activity, and the city of Seattle has approved special zoning and building codes to accommodate the needs of development for biotech facilities.

Seattle is home to 15 research organizations, three research hospitals, and one of the nation's leading public research universities. The University of Washington (UW) is awarded approximately $1 billion in externally funded, peer-reviewed research every year, and is second only to Harvard in total National Institutes of Health research funding and to Johns Hopkins among total federal research funding. UW is also on the cutting edge of new life science technologies, awarding the first PhD in nanotechnology, and holding the only National Science Foundation Center for Excellence award in photonics, which is already contributing to potential breakthroughs in pharmaceuticals.

The Fred Hutchinson Cancer Research Center, with 2,800 employees, 200 faculty members, and an annual research budget of more than $250 million, is the nation's premier private research institution; it receives more National Cancer Institute funding than any other private research institute.

Three of the eight leaders of the Human Genome Project now work in Seattle, and the city also now boasts six Nobel laureates.

Seattle is fast becoming a recognized world center for global health with a stable of leading non-profit organizations including the Bill and Melinda Gates Foundation, PATH, Seattle Biomedical Research Institute, and Infectious Disease Research Institute. Early findings from a University of Washington study assessing the economic impact of global health in Seattle have found:

- Global health programs based in Seattle are reaching people in 65 countries.
- More than 200 organizations in Washington state identified their work as having an impact on global health.
- About 30% of total US funding for HIV research is coming to the Seattle area.

For all the above reasons, plus an exceptional quality of life, Seattle ranks in the top tier of life science markets in the country, with a currently expanding array of competitive advantages.

INDUSTRY DRIVERS

A strong local economy, more readily available investment capital, new company formation, and the expansion of existing companies are the primary drivers powering Seattle's life science industry.

Access to capital has never been better. Venture capitalists poured $352 million into Washington life science businesses in 2006, according to the MoneyTree Report by PriceWaterhouseCoopers and the National Venture Capital Association. The last time lifescience investment here topped $300 million was in 2000, when it totaled $365 million.

Washington state is also offering unprecedented funds to life science research organizations and companies. The Washington State Life Science Discovery Fund has $350 million earmarked for grants that are expected to generate at least $1 billion in research investment through leveraging. The state also offers sales tax exemptions for facilities and tax credits on revenues for biotechnology and medical device firms.

There are many keys to the continuing success of the Seattle market: world class research that continues to produce results; great investment from the public, the private, and the educational sector; and a commitment from the community at large to the noble goals of the industry. This commitment is a key driver that is difficult to quantify, but keeps this market moving forward. This region is home to an unmatched collaborative community of researchers and entrepreneurs.

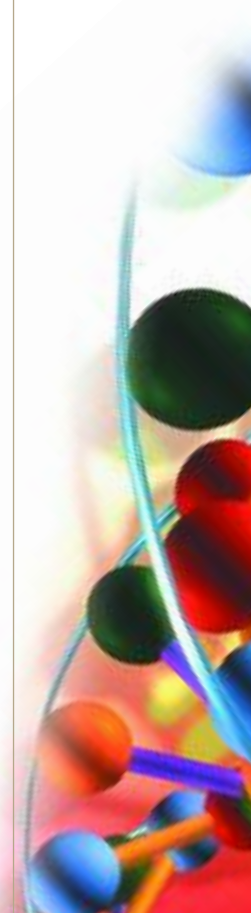
MAJOR PLAYERS

Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
University of Washington	Children's Hospital and Regional Medical Center University of Washington Harborview Medical Center	Fred Hutchinson Cancer Research Center Hope Heart Institute Pacific Northwest National Laboratory Seattle Biomedical Research Institute Benaroya Research Institute Allen Institute for Brain Science Institute for Systems Biology Infectious Disease Research Institute Puget Sound Blood Center Swedish Medical Center

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Merck/Rosetta Inpharmatics Hollister-Stier Laboratories	Amgen, Inc. Bayer HealthCare Pharmaceuticals Cell Therapeutics, Inc. Dendreon Corporation Eli Lilly/ ICOS Nastech Pharmaceutical Company Targeted Genetics Corporation ZymoGenetics, Inc.	Medtronic, Inc. Philips Medical Systems Siemens Medical Solutions Inc. SonoSite Spacelabs Healthcare



SEATTLE

LAB MARKET SNAPSHOT

The Seattle lab market has been slowly gaining momentum. The end of 2006 saw a substantial upswing in lab space movement. This follows nearly two years of little activity with a vacancy rate increasing to 15%, the highest in the market's history. This unprecedented rise was primarily due to the large number of new projects completed as well as several new subleases added to the market. For instance, when GlaxoSmithKline acquired Corixa, it layed off or transferred 150 employees and placed 140,000 square feet of space on the markets, and when Amgen moved into its new Helix Campus, additional space was in various buildings, bumping the vacancy rate. Similarly, in a neighboring Seattle submarket, a significant giveback of biotech space is expected, given Eli Lilly's Q1 2007 acquisition of ICOS.

At the same time, there has been continued expansion among the research institutes. The Bill and Melinda Gates Foundation is building an 800,000-square-foot corporate headquarters. In fall 2006, Children's Hospital and Regional Medical Center announced the creation of Seattle Children's Hospital Research Institute, which took 467,000 square feet of biotech space off the market with the acquisition of Corixa's former headquarters in the life sciences building at 1900 Ninth Ave. and the former Qwest Building at 1915 Terry Ave. Children's has said it plans eventually to take an additional 500,000 square feet of space in South Lake Union to advance its research mission. However, large users have very few options for existing space, given only four buildings have more than 50,000 square feet available. The lack of available space is spurring a wave of new development.

EXISTING LAB SPACE

	Total SF	Available SF (Vacant/Sublease)	Vacancy Rate
Seattle	3,976,826	191,122	4.81%
Eastside	1,046,897	94,896	9.06%
Total	**5,023,723**	**286,018**	**5.69%**

MARKET ASKING RENTS

Submarket	Asking Rent Shell Space (NNN)	Allowance Tenant Improvement (TI)	Operating Costs
Seattle	32.60	$30	7.75
Eastside	22.70	N/A	5.07

INCENTIVES

State Incentives:

B&O Tax Exemption for Federal and State Research Grants

A business and occupation (B&O) exemption is available for amounts received for research and development under the Federal Small Business Innovation Research Program, Federal Small Business Technology Transfer Program, and state Life Science Discovery Fund.

Life Science Discovery Fund

The Life Science Discovery Fund Authority was passed by the legislature and signed by the governor in 2005. The purpose is to "promote life science research to foster a preventive and predictive vision of the next generation of health-related innovations, to enhance the competitive position of Washington state in this vital sector of the economy, and to improve the quality and delivery of healthcare for the people of Washington." It is expected that these goals will

be achieved by making grants to research institutions in the state. The fund has $350 million garnered from tobacco settlement monies and is expected to attract another $100 million in private investment.

Sales/Use Tax Deferral/Exemption
A sales/use tax exemption is available for the construction of certain structures and acquisition of machinery and equipment used for research and development, and pilot scale manufacturing activities in advanced computing, advanced materials, biotechnology, electronic device technology or environmental technology. If the structures or machinery and equipment are used in qualifying activities for specific periods of time, a portion of the deferred sales tax may be waived.

Sales/Use Tax Deferral in Community Empowerment Zones (CEZ)
A sales/use tax deferral is available for the construction of certain structures as well as acquisition of machinery and equipment for businesses engaged in qualifying activities that locate in rural counties, CEZs or counties containing CEZs. Qualifying activities include manufacturing, research and development laboratories, commercial testing facilities, and computer-related businesses (excludes light and power businesses).

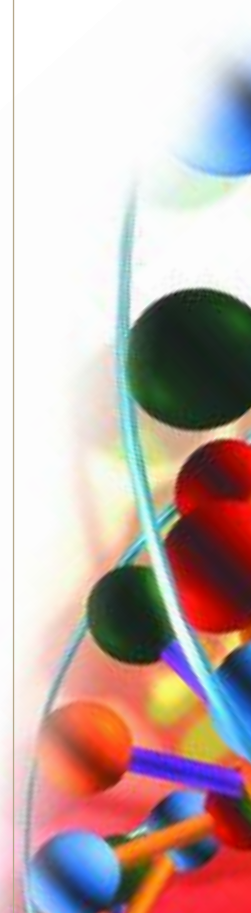
Job Credit for Manufacturing in Community Empowerment Zones
A B&O tax credit of either $2,000 or $4,000 is allowed for each new employment position filled and maintained by manufacturers and/or research and development businesses located in Community Empowerment Zones. The credit amount depends on annual wages and benefits.

IN THE NEWS

- Amgen, the world's largest biotech company, will be expanding their Helix Campus on Elliott Bay to make room for 750 additional researchers and staff. Amgen will tear down vacant warehouses on Pier 89 and build three laboratory buildings and one office building, adding 550,000 square feet as part of a global push to expand R&D. The company broke ground in 2006 and will complete construction in 2010.
- Washington's life sciences industry excels at early research and development of new medical products. But when it comes to commercialization and manufacturing—elements that could bring more employment and tax revenue—the state is losing ground to its peers. A new tax incentive signed into law by Governor Christine Gregoire may change that. Under the law that takes effect July 1, companies won't have to pay state and local sales and use taxes on their spending for new drug and medical device factories built in Washington. The tax break may help lure more investments, such as the $70 million that Bayer Healthcare Pharmaceuticals is spending to build a factory to manufacture a drug for Crohn's disease in South Snohomish County.

Top Six Private Life Science Financings from 8/13/2005 to 8/13/2006 (according to Thomson Venture Economics):

1) **Endogastric Solutions** – 2/21/2006: $32m Later Stage Investment
Develops an endoscopic device to treat gastroesophageal reflux disease (GERD). The company designs and manufactures single-use instruments that will enable incisionless solutions to gastroesophageal reflux disease and other functional upper gastrointestinal diseases.
2) **Archus Orthopedics** – 1/20/2006: $35m Expansion Stage Investment
Develops treatments for spine disorders. The company is a development-stage company developing a novel implantable medical device to treat degenerative diseases of the lumbar spine.
3) **Ekos Corporation** – 2/16/2006: $26m Later Stage Investment
Manufactures drug delivery catheters based on ultrasound technology. The company develops a method which applies low-energy, localized ultrasound. Ekos' focus is to enhance thrombolysis in stroke.
4) **Corus Pharmaceuticals** – 4/12/2006: $25m Other Stage Investment
Develops therapeutics to treat severe respiratory and infectious diseases.



The company's core competencies reside in the identification of drug candidates, rapid clinical development, and FDA approval for their products.

MARKET OUTLOOK

The outlook of the life science sector in the Seattle region is exceptional. The market continues to grow in this region as more grant money is awarded to researchers, as the universities and medical schools grow in reputation, as entrepreneurs build one successful company after another, and as members of the global life science industry learn about the amazing work underway here and seize opportunities to join their counterparts in an area that boasts one of the best qualities of life in the country.

In addition, the Seattle area is thriving from the economic impact of the influx of workers relocating to service the life science sector, as well as the growing technology, international trade, clean technology, and aerospace sectors.

Over the past decade, several life science companies were founded in the Seattle market, and since 2000, several more transactions as well as Nobel Prizes have solidified Seattle's presence in the life science sector. For example, PathoGenesis was acquired by Chiron, the Human Genome Project was published, and Leland Hartwell won the Nobel Prize for medicine.

There has been a rise in life science real estate development in the South Lake Union area and across the region to accommodate the expanding research centers, indicating the sector is clearly strengthening in the Seattle market. Vulcan Real Estate, a division of Paul Allen's Vulcan, Inc., is primarily focused on the development of more than 60 acres in the South Lake Union neighborhood of Seattle. The vision: to make this the future home of organizations on the forefront of vital life sciences research. The area is already home to Fred Hutchinson Cancer Research Center, Seattle Biomedical Research Center, the University of Washington biomedical campus, Zymogenetics and Rosetta. These land assets and biomedical office assets will stand by, ready for development when the life science cluster generates the future jobs triggering growth.

Seattle alone is targeted for biotech job growth of more than 8,000 new jobs by 2020. But this is only one area of the region; a significant number of life science companies are located throughout King County.

MAJOR FUTURE DEVELOPMENTS

New Construction

- The University of Washington completed Phase I of the 106,000-square-foot research lab known as the Blue Flame Building in early 2005. Phase II of the Blue Flame site is now underway. Phase II includes a 96,000-square-foot office building and an 188,000-square-foot lab building. Completion is set for mid-2008. Phase III of the Blue Flame's site can accommodate another 350,000 square feet.
- The Seattle Cancer Care Alliance expanded by 52,000 square feet in mid-2006.
- BioMed Realty Trust has a 93,000-square-foot laboratory facility currently under development with proposed completion in 2008.
- Amgen is planning a 550,000-square-foot expansion on their property. It will take place over the next three years.
- Vulcan and Schnitzer NW have plans for three to four buildings to be called Interurban Exchange, which will total approximately 350,000 square feet.
- Vulcan could add up to 800,000 square feet in a phased development project for the University of Washington in the 800 block of Mercer Street.
- Alexandria Real Estate Equities Inc., which owns a dozen biotech properties locally, is in permitting for a 110,000-square-foot biotech building at 199 E. Blaine Street that's expected to start construction this summer.
- Seattle-based Touchstone Corp. is planning to break ground on 240,000-square-foot Northlake Technology Center near Seattle's Gas Works Park and 400,000-square-foot Stewart & Boren Technology Center. Both projects are expected to break ground in 2008 with completion scheduled for 2010.

CASE STUDY

Children's Hospital

Corixa occupied approximately half of Touchstone's Ninth and Stewart building (216,000 square feet) when it finished construction in late 2004. After being acquired by GlaxoSmithKline, the company vacated the space in stages in 2005, making the building completely empty in early 2006. Children's Hospital and Regional Medical Center became interested once they decided to establish a downtown Seattle campus. They purchased the building in October 2006, and will move into it during 2007. As part of their expansion, they leased approximately 250,000 square feet next door at the former Qwest Building at 1915 Terry Avenue, with an option to buy.

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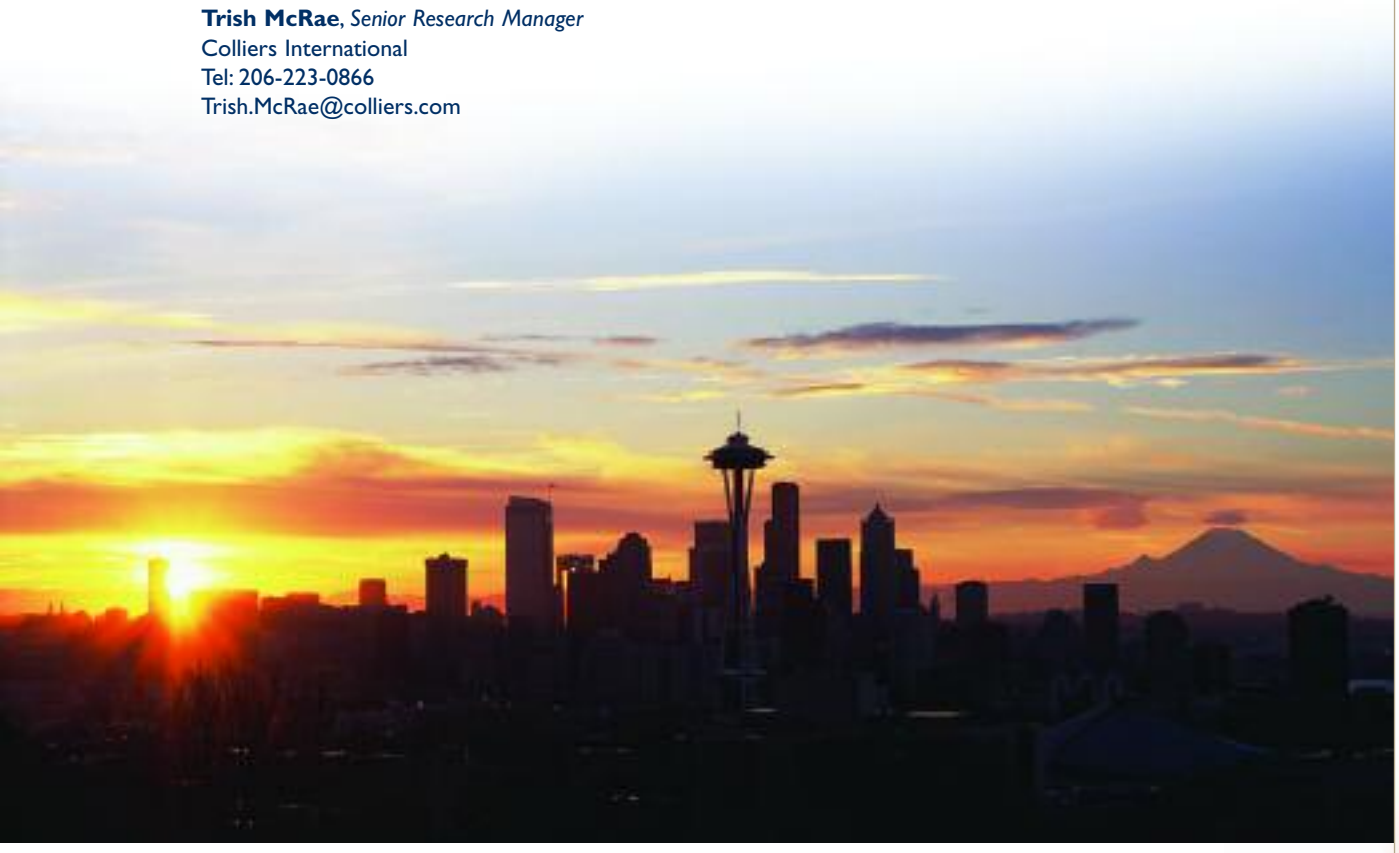


COLLIERS INTERNATIONAL

San Francisco

OVERALL MARKET PROFILE

- **Inventory (SF)**
  19,700,000
- **Availability – with Sub-lease (SF)**
  1,773,000
- **Availability rate (%)**
  9
- **Sublease (SF)**
  NA
- **Asking Rents (NNN)**
  $15 - $50
- **Total Owner Occupied – with Sublease (SF)**
  NA
- **Total Combined Available – with Sublease (SF)**
  NA

MARKET OVERVIEW

The modern US biotechnology industry was born in the Bay Area in 1973, and with the formation of Genentech in 1976, has been expanding ever since. The Bay Area also boasts the best venture capital network and some of the most notable research institutes in the world. The area also has the highest critical mass of business expertise, biotech trained labor force, collaborative academic and research institution network, and locally developed intellectual property in the world. Additionally, according to the Brookings Institution, the Bay Area is among the most entrepreneurial regions among the nine life science clusters it identified.

The San Francisco Bay Area is rich with academic and research facilities that are continually adding life and spinning off intellectual property into the commercial market. UC Berkeley unveiled its Life Science initiative, UCSF expanded into its Mission Bay Campus, and QB3 – a joint research program between UCSF Berkeley and UC Santa Cruz – and Stanford University have added facilities such as the Beckman Center and the multi-disciplinary Clark Center.

INDUSTRY DRIVES

The thriving biotech market in the Bay Area is fueled by a fertile supply of entrepreneurs with a balance of business experience and academic research credentials. The San Francisco Bay Area is home to more than half the US total—approximately 820 life science companies—and employs about 85,000 workers in the life science industry. More bioscience companies are located in Northern California than anywhere else, and an average of 30 more companies are founded each year in the Bay Area. More than 50% of all companies spun out from universities in California have come from Bay Area institutions.

The San Francisco Bay Area benefits from an impressive combination of intellectual and financial capital, and is home to 30% of all biotech venture capital firms in the US. With more than 40 active venture capital firms, Bay Area-based companies receive 34% of all biotech venture investment in the US. Funding of new companies has seen continuing strength, although in 2005 and 2006, there has been a shift in the balance of funding levels. Many investor groups started migrating to later stage or even mezzanine funding. Aggressive funding for pure startups and Series A become harder to obtain and dominated by fewer specialty investors. Most of the companies funded in 2006 were in the $5 million to $25 million range, although Nanosolar, Inc. in Palo Alto raised $75 million in 2006. Venture capital is not the only source of research funding for the biotech industry. Bay Area universities also receive significant funding from the National Institute of Health (NIH), including UCSF (fourth largest NIH grant recipient in the US), Stanford (ninth largest), and UC Berkeley (51st largest). Institutions in the Bay Area region received a total of $1.33 billion in NIH research grants in 2006.

A mix of both private firms and public institutions accounted for the majority of biotechnology patenting in the region during 2006. Genentech and Amgen Inc. held the most biotechnology patents in 2006, receiving more than 198 patents combined.

In addition to good science and an entrepreneurial spirit, a comprehensive bio-specific financial, legal, and accounting service infrastructure is locally available.

The Bay Area is also home to the world's largest concentration of research capacity, not only in biotech, but also in information technology. It has more nano technology companies than anywhere else except Germany.

MAJOR PLAYERS

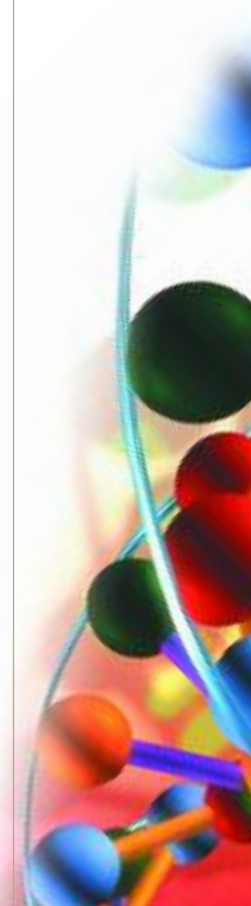
Major Players

MAJOR INSTITUTIONS

Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
Cal State University, Hayward	Stanford University Hospital	California Pacific Medical Center Research Institute
San Francisco State University	University of California, San Francisco Medical Center	Children's Hospital Oakland Research Institute
San Jose State University	California Pacific Medical Center, San Francisco	J. David Gladstone Institutes
Stanford University	Santa Clara Valley Medical Center, Santa Clara	Northern California Institute for Research and Education
University of California, Berkeley	Lucile Packard Children's Hospital, Stanford	Palo Alto Medical Foundation Research Institute
University of California, Davis		Smith-Kettlewell Eye Research Institute
University of California, San Francisco		

MAJOR SECTOR PLAYERS

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Alza Corporation, Mountain View	Abgenix, Fremont	Affymetrix, Inc., Santa Clara
Amgen, South San Francisco	Alza Corp., Mountain View	Agilent Technologies, Palo Alto
Bio-Rad Labratories, Hercules	ArthroCare Corp., Sunnyvale	Applied Biosystems, Foster City
Impax Laboratories, Hayward	BD Biosciences, San Jose	Avigen, Inc., Alameda
Roche, Palo Alto	BioMarin Pharmaceutical, Novato	Caliper Technologies, Mountain View
	Cell Genesys, Inc., South San Francisco	Ciphergen Biosystems, Fremont
	Chiron Corporation, Emeryville	
	CV Therapeutics, Palo Alto	
	Genencor International, Palo Alto	
	Genentech, Inc., South San Francisco	
	Gilead Sciences, Foster City	
	Maxygen Inc., Redwood City	
	Nektar Therapeutics, San Carlos	
	Protein Design Labs, Fremont	
	Roche Molecular System, Pleasanton	
	Scios, Inc., Fremont	
	Theravance Inc., South San Francisco	
	Thoratec Corp., Pleasanton	
	Tularik Inc., South San Francisco	
	Xoma Ltd., Berkeley	



LAB MARKET SNAPSHOT

MARKET ASKING RENTS			
Submarket	Asking Rent (NNN)	Tenant Improvement Allowance Existing Lab Space (PSF)	Tenant Improvement Allowance Shell Space (PSF)
Downtown San Francisco	$36-$50	$10-$60	$100-$175
South San Francisco	$36-$50	$0-$60	$100-$175
Peninsula/Silicon Valley	$21-$33	$0-$50	$100-$175
East Bay/North Bay	$15-$33	$0-$50	$100-$175

The San Francisco Bay Area lab market is comprised of four submarkets: Downtown San Francisco, South San Francisco, Peninsula/Silicon Valley and the East and North Bay region.

Downtown San Francisco

Mission Bay, the hub of San Francisco's life sciences industry, spans 303 acres in the central South of Market area. The neighborhood is home to UCSF's Mission Bay campus, the Quantitative Biomedical Research Building (QB3), the Gladstone Institutes, and the California Institute for Regenerative Medicine. The UCSF facilities alone will eventually house 9,000 faculty and staff. As the primary culmination of San Francisco's decade-long effort to create a biotech hub at Mission Bay, Alexandria Real Estate Equities has embarked on a program to build 2.1 million square feet of biotech space over the next 15 years.

Fibrogen's commitment to lease more than half of the 450,000-square-foot waterfront life science complex Shorenstein is building in Mission Bay is a major coup for the neighborhood's life science campus. Pharmion Corp. is another private biotech firm committing to Mission Bay's growing life science cluster. The company will relocate to 1700 Owens Street, a 165,000-square-foot speculative research building Alexandria Real Estate Equities completed in late 2006. The building's anchor tenant is Sirna Therapeutics. In addition, three life science venture capital companies have opened offices there.

The city of San Francisco has demonstrated its commitment to the biotech industry by offering a generous 7.5-year payroll-tax exemption to biotech companies establishing operations in San Francisco, as well as expedited permit processing procedures.

South San Francisco

South San Francisco is known as the birthplace of biotechnology. Anchored by the Genentech campus, this submarket is home to more than 80 life science firms and has the highest density of biotech facilities, many of which are modern and designed with infrastructure to meet specific biotech lab requirements. Demand for space continues to rise and giants such as Genentech and Amgen continue to expand. Genentech is planning to double its workforce to 16,000 in South San Francisco in the next decade. With the growth of demand in South San Francisco, developers are aggressively acquiring land to position themselves ahead of the demand curve. This is the main location where spec projects always have biotech in mind as the target tenant group. This charge could potentially add an additional three million square feet in the area for life science users.

Peninsula/Silicon Valley

The biotech industry has a substantial presence along the peninsula through San Mateo County and from Palo Alto to San Jose, although not of the density in South San Francisco. In the Peninsula/Silicon Valley submarket are Alza, Roche, Gilead Sciences, Genencor, CV Therapeutics, Abbott Laboratories, and others. There is a broad range of drug-development and medical device firms, most of which occupy generic R&D facilities. Many of the existing biotech facilities are older and not as modern as facilities in South San Francisco, and most were originally designed for general R&D use. Palo Alto

has an established biotech presence, primarily due to its close proximity to Stanford University. Mountain View has a growing biotech presence and has been a focus of facility investment by several developers. Everywhere in the submarket, biotech facilities are spread out and random, with no major clusters.

The East Bay and North Bay

The East Bay and North Bay lab submarket encloses the east side of the bay from Newark to the Alameda/Oakland area. To the north towards the Berkeley/Richmond area are additional pockets of biotech companies. Most biotech companies scattered throughout the area are privately funded. The presence of University of California, Berkeley, and its new, state-of-the-art lab facility, provides solid academic and research resources that attract a range of biotech firms. Stanley Hall, slated to open in 2007, will house California Institute for Quantitative Biomedical Research, as well as departments of molecular and cell biology and bioengineering. Lawrence Berkeley National Laboratory (LBNL) expects growth through 2025, with plans to add close to 700,000 square feet of occupied space. Recently, BP selected UC Berkeley to lead a $500 million energy research consortium. In partnership with LBNL, the grant will create the Energy Biosciences Institute, which will focus its research on biotechnology to produce biofuels. The submarket is filled with a mixture of new and old biotech facilities. Overall, lease rates will be similar to those in the Peninsula/Silicon Valley submarket.

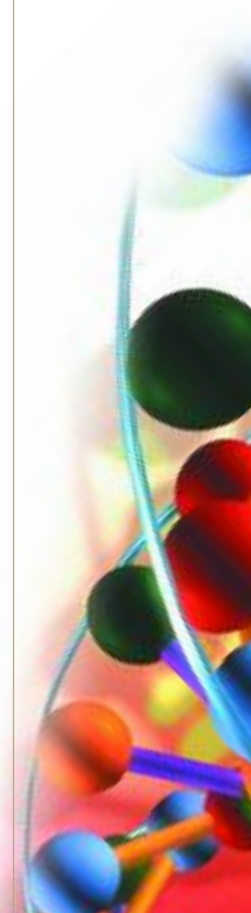
INCENTIVES

Below are some of the public and private organizations that provide support services, economic development and incentives:

- The California Institute for Regenerative Medicine (CIRM), with its $3 billion funding initiative for stem cell research.
- Institute for Bioengineering, Biotechnology and Quantitative Biomedical Research
- California Biotechnology Program
- The California Healthcare Institute
- Biotechnology Strategic Targets for Alliances in Research (BioStar) Program
- California Technology Investment Partnership

IN THE NEWS

- PDL BioPharma will move its headquarters from Fremont to Redwood City, expanding from 200,000 square feet to more than 450,000 square feet at Pacific Shores Center.
- BioMed Realty Trust acquired Sun Microsystems' Newark campus with the intentions of redeveloping the campus into a life science complex. The acquisition includes 10 buildings totaling 1.4 million square feet and 26.2 acres of undeveloped land. With plans to build an additional three buildings on the land, the complete buildout will total more than 1.8 million square feet.
- Big-time biotech landlord rivals Slough Estates and Alexandria Real Estate Equities have been going on a land-banking binge that could drive construction of another three million square feet of life science research and development space in South San Francisco and Brisbane.
- South San Francisco-based FibroGen has signed a lease for more than half of the 450,000-square-foot waterfront life science complex Shorenstein Properties is preparing to build in Mission Bay. Under the pending deal, FibroGen would take 239,000 square feet at 409 Illinois Street, and would have an option to expand into the adjacent 499 Illinois Street building.
- Genentech Inc. plans to nearly double its South San Francisco footprint and workforce over the next decade, adding 2.5 million square feet of building space that could accommodate an astonishing 16,000 workers, according to a draft of the company's 10-year master plan.
- Bayer Healthcare, an unheralded pioneer of biotech in the Bay Area and a large but quiet presence in Berkeley for more than 30 years is seeking to reposition itself as one of the world's leading specialty pharmaceutical companies.
- Vacaville is developing a new identity – as a biotech center. The city owes its new identity to Genentech Inc., which is creating the world's largest cell-culture biotechnology manufacturing plant, a $1.2 billion, 807,000-square-foot facility with a production capacity of 344,000 liters. The facility, located at Vaca Valley Business Park, will be completed by 2009.



RECENT TRANSACTIONS

RECENT TRANSACTIONS			
Location	Tenant/Buyer	Landlord/Seller	Size (SF)
7777 Gateway Blvd., Newark	BioMed Realty Trust	Sun Microsystems	1,444,927
Pacific Shores, Redwood City	PDL BioPharma	Starwood Capital Group	447,747
409 Illinois Street, San Francisco	FibroGen	Shorenstein	240,000
3625 Peterson Way, Santa Clara	Abbott Laboratories	DivcoWest Properties	218,366
Oak Creek Business Park, Milpitas	Advanced Medical Optics	iStar Financial	180,086

MARKET OUTLOOK

Depending on the criteria one uses, there is approximately 9% availability of facilities with pre-improved biotech space. However, there is not a lot of directly competitive space as to size and buildout in a given sub-market. Market rents have been on a fairly consistent upward pace over the last two years, as sublease vacancy gets lower. This vacancy rate is likely to remain consistent over the next one to two years. The main question is the rate at which rents will increase. Constructions costs are the hidden factor in the equation. Those costs are in the range of 30% higher than about two years ago, and are not likely to go down, although there are signs that at least the raw material costs may be flattening. New construction costs create a strong disposition by companies to try to work with pre-improved facilities when practical, since the cost savings can be dramatic. Also, unlike five years ago, investors are not predisposed to provide funds for expensive lab build-outs until absolutely justified by a company's actual progress in financial sales and profitability.

MAJOR FUTURE DEVELOPMENTS

FUTURE LAB SPACE					
Project Name/ Address	Submarket	Total Size (SF)	Currently Under Construction (SF)	Delivery Date	Comments
Britannia East Grand	South San Francisco	783,532	559,846	2007	9-building business park with biotech research & development facilities
Stanley Hall, UC Berkeley	East Bay	289,000	289,000	2007	The Berkeley home of the California Institute for Quantitative Biomedical Research
EmeryStation East	East Bay	245,000	245,000	2007	245,000 sf biotech lab facility
China Basin Landing	San Francisco	165,000	165,000	2007	Additional two floors to existing building
East Jamie Ct./ Haskins Way	South San Francisco	162,000	162,000	2007	2 R&D buildings on 6.13-acre site
Britannia Oyster Point I - Building E	South San Francisco	92,867	92,867	2007	Last building to be constructed in the Britannia Oyster Point I project
409-499 Illinois Street	San Francisco	465,000	465,000	2008	2 life science buildings
500 Terry Francoise Blvd.	San Francisco	300,000	300,000	2008	Incl. 9,000 sf of retail
Britannia Oyster Point II	South San Francisco	315,000	315,000	2008	3-building project with build-to-suit lab improvements
362-364 Lakeside Drive	Peninsula	63,260	63,260	2008	63,260-sf R&D building located in Gilead Sciences Vintage Park Campus

CASE STUDY

The California Institute for Regenerative Medicine (The Institute or CIRM) was established in early 2005 with the passage of Proposition 71, the California Stem Cell Research and Cures Initiative. The statewide ballot measure, which provided $3 billion in funding for stem cell research at California universities and research institutions, was approved by California voters on November 2, 2004, and called for the establishment of a new state agency to make grants and provide loans for stem cell research, research facilities, and other vital research opportunities.

Proposition 71 launched two experiments. The first is an experiment in a new field of biomedical investigation; the second is an experiment in politics and policy. Never before has a state so generously funded an emerging scientific field. And never before has a state been faced with the task of establishing a system of regulation and oversight for a field of biomedical research that combines the promise of medical advance with such significant social risks.

The CIRM is claimed to be the world's largest single backer of research in stem cells. However, the US federal government is the largest sponsor of grant money in the world, although a Bush policy announced in 2001 restricts the application of federal money to stem cell research for particular uses. CIRM awarded its first grants to train 169 stem cell researchers in April 2006. It will fund its first research grants, totaling more than $100 million, in the first quarter of 2007.

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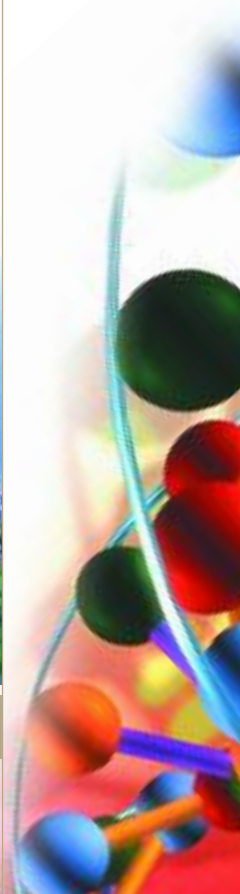


COLLIERS INTERNATIONAL

Los Angeles

OVERALL MARKET PROFILE

- **Inventory (SF)**
  5,644,200
- **Availability – with Sub-lease (SF)**
  510,800
- **Availability Rate (%)**
  9.0
- **Sublease (SF)**
  8,500
- **Asking Rents (NNN)**
  $23 - $33
- **Total Owner Occupied – with Sublease (SF) Total Inventory**
  2,060,100
- **Total Combined Available – with Sublease (SF)**
  510,800

MARKET OVERVIEW

The Los Angeles Basin is comprised of Los Angeles, Ventura, and Orange Counties covering a vast geographic area. The area has a significant life science presence with numerous premier universities, hospitals, and independent research institutions.

The Los Angeles life science industry has a general emphasis on medical device firms. Although there is not a large presence of major pharmaceutical firms, the area is also the headquarters for Amgen, the world's largest biotechnology firm, and has significant presence by firms such as Allergan, Abbott Laboratories, Baxter, and many other notable life science firms. There is also a large number of small start-up firms associated with the major universities, research institutions, and hospitals in the area. These firms are rapidly expanding and the outlook is for strong growth and increased diversification, particularly considering the potential infusion of research funding that will come from Proposition 71, the California Stem Cell Bond Initiative.

Rather than having one main cluster or area where life science firms locate, Los Angeles is a series of smaller clusters that congregate near universities, large biotech firms, or research institutes. They typically focus on business parks with inexpensive space that can be adapted to fit these companies' unique needs. These communities may seem like unlikely homes to biomedical companies, but these mini-clusters have sprung up around Los Angeles County over the past four decades in the shadow of the aerospace industry.

One of these notable mini-clusters which has been quite active in the life science industry is in Pasadena. Historically consisting of engineering and professional firms, Pasadena has evolved into a high-tech mini-cluster serving as home to more than 100 tech firms, many of which are in the life science field. It is no surprise that the California Institute of Technology (Cal Tech), one of the top research institutes in the world, is the main driver behind this evolution. The presence of Cal Tech, JPL, a highly educated labor pool, and a city with unsurpassed retail, cultural, and life style amenities, makes for a vibrant area where these life science firms can thrive.

INDUSTRY DRIVERS

The Los Angeles Basin clearly shows leadership in the medical device segment. It has an exceptional large pool of highly educated workers (more than 2.5 million individuals) including more than 95,000 PhDs and 3,500 of whom are in life sciences.

The LA Basin has numerous premiere academic and medical/research institutes that drive the local life science industry by creating numerous new start-up firms that then occupy space in the market.

In 2005, NIH and SBIR grants provided approximately $996.8 million in financial support to the Los Angeles Basin. This total ranks Los Angeles third in the nation in NIH grants, behind only Boston and New York. This is a positive trend for the area, since NIH funding of research is a good predictor of where new biocommerce-focused firms will be created in the future.

Major private firms in the area include Amgen, the largest independent biotechnology company in the world, and Allergan, a global specialty pharmaceutical company that provides eye care, skin care (including Botox), and specialty pharmaceutical products. More than 2,000 life science firms have been identified in the Los Angeles Basin, employing more than 62,100, the largest concentration in the nation. Approximately 350 of these firms are biotech firms; these include the 160 firms that are strictly involved in biotech research.

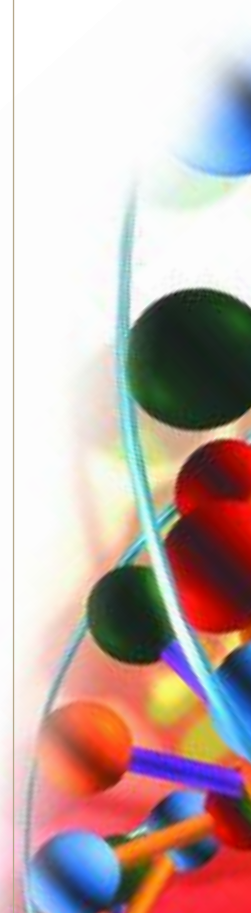
MAJOR PLAYERS

Major Players		
MAJOR INSTITUTIONS		
Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
California Institute of Technology	Cedars Sinai Medical Center	City of Hope Beckman Research Institute
University of California, Irvine	Children's Hospital of Los Angeles	Huntington Medical Research Institute
University of California, Los Angeles	Kaiser Foundation Hospital	Keck Graduate Institute
University of Southern California	Los Angeles County – Harbor-UCLA Medical Center	
	Los Angeles County – USC Medical Center	
	Rancho Los Amigos National Rehabilitation Center	
	UCLA Medical Center	
	UCLA Neuropsychiatric Hospital	
	USC University Hospital	

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Abbott Laboratories	American Pharmaceutical Partners	Baxter International, Inc.
Allergan, Inc.	Amgen, Inc. (biopharma)	Beckman Coulter, Inc.
ISTA Pharmaceuticals		BioSource International
Miravant Medical Technologies		Diagnostic Products Corporation
Sicor		Edwards Lifescience Corporation
Watson Pharmaceuticals		Hycor Biomedical

LAB MARKET SNAPSHOT

The Los Angeles Basin lab space is comprised of 5.6 million square feet, dispersed across 159 buildings. Approximately 40% of the space is located in Los Angeles County, primarily in the San Fernando, Conejo, Santa Clarita, and San Gabriel Valleys, all situated north of the downtown Los Angeles CBD market. An additional 15% of the space is located in the immediately adjacent Thousand Oaks portion of Ventura County. The remaining 45% of the space is in Orange County, primarily in the South County submarket, near Irvine.



Los Angeles

EXISTING LAB SPACE OVERVIEW
LOS ANGELES COUNTY | ORANGE COUNTY | VENTURA COUNTY

EXISTING PROPERTIES		AVAILABILITY				TI'S	RENTS
Submarket	Total Inventory SF	Direct Available SF	Sublease Available SF	Total Available SF	Total Availability Rate	TI[1] Allowance (PSF)	Asking Rent (NNN)
Los Angeles County	2,218,200	105,249	0	105,200	4.7%	$30 - $40	$23 - $30
Orange County	2,576,200	257,900	8,500	266,500	10.3%	$35 - $45	$27 - $33
Ventura County	849,800	139,100	0	139,100	16.4%	$36 - $40	$24 - $31
MARKET TOTAL							
Total	**5,644,200**	**502,249**	**8,500**	**510,800**	**9.0%**	**–**	**–**

1. Most lab space requires significantly more TI's which get amortized into the rent.

INCENTIVES (STATE OR CITY)

Major initiatives to spur further bioscience development in Los Angeles currently include:

- Institute of Bioengineering, Biotechnology and Quantitative Biomedical Research
- The California Biotechnology Program
- The California Healthcare Institute
- Biotechnology Strategic Targets for Alliances in Research (BioStar) Program
- California Technology Investment Partnership
- The Southern California Biomedical Council (SCBC)
- Proposition 71 – California Stem Cell Bond Initiative
- NIH Grants

IN THE NEWS

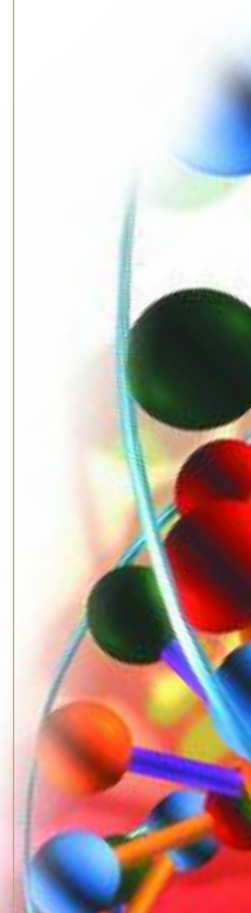
- The Eli Broad Foundation donated $25 million to USC in support of the proposed Institute for Integrative Biology and Stem Cell Research at USC's Health Sciences Campus located in East Los Angeles. The funds will be used for the construction of a 215,000-square-foot facility, bringing life to USC's biomedical research park project. The announcement came at a time when the constitutionality of California's Proposition 71 was challenged through litigation, impeding all efforts by research institutions to use Proposition 71 funds to support their stem cell capabilities. As a result of this setback, California's research institutions have been driven to tap alternative sources of funding.
- According to a study recently released by Battelle Technology Partnership Practice and SSTI, the Greater Los Angeles region is a leading center for bioscience industry development, technology specialization, and sector-wide employment growth. The study, "Growing the Nation's Bioscience Sector: State of Bioscience Initiatives 2006," was presented for the Southern California Biomedical Council's 46th Networking Forum held in Los Angeles. Specific findings from the Battelle analysis include:
  - In 2004, the Greater LA metro region boasted a 25% higher concentration of biosciences employment than found across the nation, with 66,158 jobs across 2,078 establishments.
  - Higher employment concentration was accompanied by a rate of employment growth that outpaced the nation.
  - The Greater LA metro region was first in employment in medical devices and 17th in industry specialization among large metro regions.
  - In research, testing, and medical labs, the Greater LA metro area ranked second in employment ant 22nd in industry specialization among large metro regions.
  - Strong growth in bioscience employment was driven by the research, testing, and medical labs sector.

- The top five companies that raised the most capital from institutional investors and other sources in 2006 are:
  1 Cougar Biotechnology (Westwood-based firm focused on novel oncology therapies) – $47.5 million raised in private placement funds
  2 Xencor Corporation (Monrovia-based protein therapeutics firm) – $45.0 million raised
  3 Calhoun Vision (developing a new type of intraocular lens with power that can be adjusted noninvasively after implantation) – $31.0 million raised from noninstitutional money
  4 Kythera Biopharmaceuticals (Woodland Hills-based firm focused on aesthetic and restorative dermatology) – $30.0 million raised in a Series B round of financing
  5 CytRx Corporation (Brentwood-based firm focused on the development of arimoclomal for the treatment of amyotrophic lateral sclerosis – ALS or Lou Gehrig's disease) – $24.5 million raised in a royalty agreement with the ALS Charitable Remainder Trust
- The biotech firm LifeCell Corp. announced its financial results for 2006. LifeCell's revenues —$140.6 million for the year, a 51% increase over 2005—are testament to its remarkable technologies, including a revolutionary skin graft for burn victims.
- Los Angeles Mayor Antonio Villaraigosa affirmed his administration's commitment to the life science industry during his speech at the eighth SoCalBio Investor Conference held in early 2006. A few of Mayor Villaraigosa's proposals include:
  – Tapping our vast reservoir of scientific assets for job creation.
  – Creating facilities, such as the planned USC research park, to accommodate new company formation.
  – Encouraging investment capital by tapping public employee pension funds.
  – Investing in workforce development.
- Dr. Matthew Croughan, PhD has been chosen by Keck Graduate Institute (KGI) to direct the new Amgen Bioprocessing Center. Dr. Croughan is an expert on biopharmaceutical process development and has been a consultant on bio-manufacturing projects for more than 30 firms. He was previously the chief scientist for Genentech's cell culture facility dedicated to the production of therapeutic antibodies.
- C3 Scientific leased a facility for its headquarters near LAX. C3 Scientific seeks to commercialize target-specific antimicrobial protein drugs based on research conducted by Dr. Wenyuan Shi at the UCLA School of Dentistry.
- For more than a decade, the Southern California Biomedical Council (SCBC) has continued to promote and support biomedical and biotechnology research, development, and manufacturing in the Greater Los Angeles Metro region for economic development and job creation.

RECENT TRANSACTIONS

RECENT TRANSACTIONS

Location	Tenant	Landlord	Size (SF)
Monrovia	Xencor, Inc.	Blum & Fox	50,000 SF
Pasadena	Nanostream, Inc.	Cogent	25,000 SF
Los Angeles (LAX Area)	C3 Scientific		



MARKET OUTLOOK

Given the strong market fundamentals, the outlook for the life science market is very optimistic for the Los Angeles Basin. The Basin offers premier educational and medical facilities, large numbers of early stage companies, a large pool of highly educated workers, majors biotech firms, and major research institutions. These factors combined with the stem cell initiative, will create an environment where the life science industry should continue to thrive. Given these dynamics and the general lack of existing lab space and/or lab developments, we believe the market will continue to evolve into a larger and more vibrant life science market.

MAJOR FUTURE DEVELOPMENTS

FUTURE LAB SPACE

Project Name/Address	Submarket	Total Size (SF)	Currently Under Construction (SF)	Delivery Date	Comments
USC Biomedical Research Park	Los Angeles	215,000	NO	TBD	Planning Phase
Alexandria Technology Center	Pasadena	50,000	NO	TBD	Planning Phase
City of Hope Life Science Campus	Duarte	TBD	NO	TBD	Planning Phase

CASE STUDY

Xencor, Inc.

Assignment/Challenge

Colliers Seeley initially began working with Xencor when the company had two employees. Colliers initially assisted the company with various small assignments (each around 2,000 square feet) culminating to a move into 7,000 square feet of short-term space. The next assignment was to either relocate Xencor from this space to approximately 30,000 square feet in a building with existing wet laboratory space, or into a building where such space could be built, and where a landlord would be willing to finance the costs. Xencor was located in second-generation space in Pasadena at the time. The space included a wet laboratory area that had been modified to suit their needs, but was not ideal.

The team's due diligence uncovered the fact that there was no existing laboratory space available in Pasadena which would fulfill Xencor's immediate needs. Colliers therefore implemented a plan which identified any existing lab space within a larger geographic search radius, identified all potential spaces which could be retrofitted into lab space, and identified preferred structures for financing such lab construction. The team was able to create leverage among the potential options, and after several months of difficult negotiations, successfully negotiated a deal for approximately 30,000 square feet which grew to 50,000 square feet in a building in Xencor's desired geographic location. Colliers was able to achieve a reasonable rental rate and convince the landlord to finance a large portion of the tenant improvements. Although Xencor contributed cash towards the build-out, they were not required to provide a letter of credit. Colliers recently negotiated a five-year renewal on this facility and achieved additional improvement dollars for further modifications to the lab facilities.

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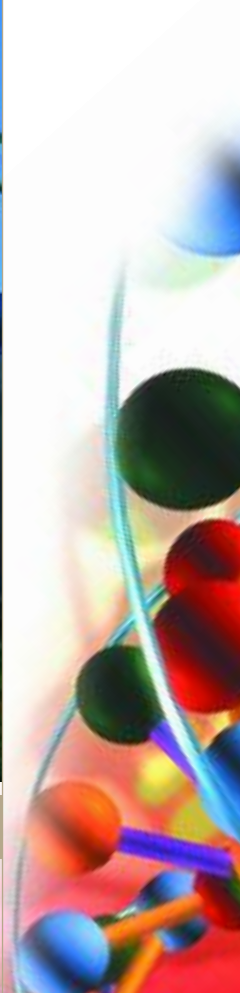
"Equipped with his five senses, man explores the universe around him and calls the adventure Science."

~Edwin Powell Hubble, *The Nature of Science*, 1954



COLLIERS INTERNATIONAL

San Diego

OVERALL MARKET PROFILE

(As of 4th quarter 2006)

- **Inventory (SF)**
  8,053,431
- **Availability – with Sub-lease (SF)**
  1,063,758
- **Availability Rate (%)**
  13.21
- **Sublease (SF)**
  284,611
- **Asking Rents (NNN)**
  $24.00
- **Total Owner Occupied – with Sublease (SF)**
  4,793,069
- **Total Combined Available – with Sublease (SF)**
  1,076,508

MARKET OVERVIEW

The life science industry in the San Diego region dates back to the 1960s when Torrey Pines Mesa was designated as an area for scientific research and development activities. Research institutes such as The Scripps Research Institute, The Salk Institute, and The University of California, San Diego were all founded between 1955 and 1965. The region's first biotech company – Hybritech – was started in the late 1970s by two researchers from UCSD. Eventually, Eli Lilly purchased Hybritech, and numerous scientists went on to form more than 40 companies in San Diego, including such industry leaders as Neurocrine Biosciences and Ligand Pharmaceuticals. In 1985, UCSD Connect was started to encourage networking and development of the industry in San Diego.

Today, San Diego is one of the nation's premier life science clusters, anchored by prominent nonprofit medical research institutions and R&D-oriented private companies. The region is home to more than 500 biomedical companies, which employ approximately 40,000 employees. San Diego companies and research institutes received $815 million in National Institutes of Health funding in 2005, or a quarter of the state's total funding of $3.3 billion. Research services is the largest of the six segments in San Diego County, indicating a substantial number of early-stage, research-intensive firms in the region. San Diego's strengths lie in in-vitro diagnostic substance manufacturing, along with surgical and medical instruments and appliances manufacturing.

INDUSTRY DRIVERS

The San Diego region life science industry benefits from its world-class research institutions, such as The Scripps Research Institute (TSRI), The Salk Institute, and The Burnham Institute, as well as its outstanding regional universities such as The University of California, San Diego (UCSD), which offers outstanding life science doctorate programs.

UCSD is one of the top scientific research and development universities in the county. In fact, it is one of the major catalysts of the region's life science industry. In 2006, the Milken Institute ranked the university sixth in the world and fourth in the nation – from a total ranking of 683 universities – in biotechnology development and transfer to the marketplace. UCSD obtained this high ranking through its longstanding commitment to entrepreneurship, innovation, and university- industry partnerships whereby new discoveries and research are transferred back to the private sector.

The local universities and research institutions have been the source of more than 192 biotech spin-off firms as researchers and scientists from these sources became entrepreneurs in the private sector. San Diego's research and development environment has attracted some of the largest commercial life science companies to the region – eight of the world's foremost pharmaceutical companies have established major operations in the area. Additionally, industry organizations such as BIOCOM and CONNECT focus on initiatives that foster growth in the life science industry.

MAJOR PLAYERS

Major Players		
MAJOR INSTITUTIONS		
Academic Research/Medical	Clinical Teaching Hospitals	Independent Research Institutions
University of California at San Diego	Scripps Mercy Hospital University of California at San Diego Medical Center	Burnham Institute Salk Institute for Biological Studies The Scripps Research Institute Torrey Pines Institute for Molecular Studies

Pharmaceutical Companies	Biotechnology Companies	Medical Device Companies
Biogen Idec	Ambrx, Inc.	ATI Medical
Elan Pharmaceuticals	Amylin Pharmaceuticals, Inc.	BD Biosciences – Pharmingen
Eli Lilly	Arena Pharmaceuticals, Inc.	Biosite, Inc.
Johnson & Johnson	Halozyme Therapeutics	Digirad Corporation
Merck Research Laboratories	Isis Pharmaceuticals	Gen-Probe Incorporated
Novartis Pharmaceuticals	Kalypsys, Inc.	Genetronics, Inc.
Pfizer, Inc.	Ligand Pharmaceuticals	Illumina, Inc.
	Neurocrine Biosciences	Invitrogen Corporation
	Sequenom, Inc.	LMA North America
		Smith & Nephew

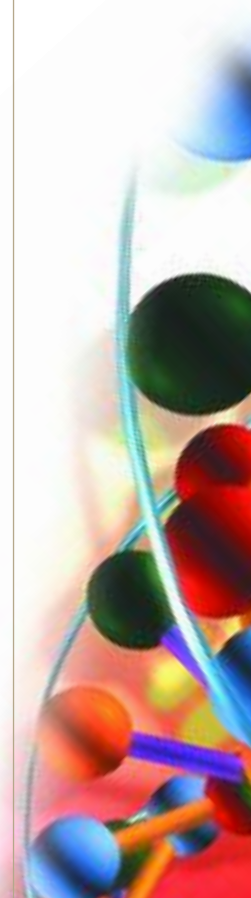
LAB MARKET SNAPSHOT

The size of the lab market in San Diego stands at approximately eight million square feet of specialized lab space, and another 4.7 million of owner-occupied lab space. Numerous firms have started to downsize due to acquisitions and mergers that have caused some layoffs as a result of space consolidations.

However, most merger and acquisition activity has subsided. Slowing M&A activity coupled with heavy demand by small-tier start-up companies – users of 3,000 to 15,000 square feet – should cause vacancy to drop throughout 2007 and well into 2009.

The surge in activity by smaller start-ups is due to the fact that they are capable of raising capital, which is relatively abundant. Researchers and scientists from the larger-tier firms are the entrepreneurs that are founders of these new start-ups. As these start-ups continue to grow, they will demand significantly more space. In addition, to fill new product pipelines in the pharmaceutical industry, large-tier pharmaceutical companies have chosen to buy mid-tier firms (such as Pfizer's purchase of IDUN). This is mainly because it is preferable to acquire a mid-sized company with good science in place rather than invest in the research from scratch.

With the exception of a few companies spread throughout the region, most of San Diego's life science companies are clustered within the submarkets of Torrey Pines, UTC, Sorrento Valley, and Sorrento Mesa – all within a few miles of each other.



San Diego

Torrey Pines is home to the San Diego region's largest concentration of lab space in the county, with more than 4.51 million square feet. Of this, nearly half the inventory – or 2.20 million square feet – is owner-user or research institute space such as TSRI, The Burnham Institute, and The Salk Institute. Life science companies in Torrey Pines tend to partner with large corporations or are publicly traded, and most are focusing on very late-stage clinical trials or marketed products. Some of the largest tenants in the area include The Scripps Research Institute, Johnson & Johnson, BD Biosciences, Pfizer, Novartis, SkyePharma, and Metabasis Therapeutics. Vacancy in this market had increased in 2006 due to down-sizing, and two major tenants – Biogen Idec and Pfizer – building their own new campuses and vacating leased space. While vacancy in investor-owned space stands at 18.08%, overall vacancy—including owner-user and research institution space—stands at 9.26%.

Like Torrey Pines, the **UTC submarket** is comprised of mature, publicly traded corporate tenants with well-advanced product development. This submarket is located in San Diego's Golden Triangle and offers numerous amenities. UTC is unique in that is home to large scientific research-based tenants as well as premier Class A office tenants. Some of the largest lab tenants include Biogen Idec, Amylin Pharmaceuticals, Illumina, Celgene, Senomyx, Covx Pharmaceuticals, and Discovery Partners International. UTC is home to 1.38 million square feet, of which nearly one million is leasable space and approximately 420,000 is owner-user space. Overall vacancy in this submarket stands at 6.43%, with 9.24% in leasable space.

The **Sorrento Mesa** submarket caters to early and mid-tier biotech companies, offering the most attractive build-to-suit opportunities to firms requiring high-image non-campus space. Several industrial/R&D buildings in the area have been converted to lab space, offering tenants from Torrey Pines or UTC submarkets more affordable alternatives. Some of the largest lab tenants include Biosite, Gen-Probe, Elan Pharmaceuticals, and Favrille. Sorrento Mesa is home to 3.39 million square feet of lab space, of which 2.16 million square feet is within leasable buildings and 1.23 million in owner-user buildings. Overall vacancy stands at 6.61% with 10.13% in leasable space.

Sorrento Valley is located west of Sorrento Mesa and north of UTC and Torrey Pines. Sorrento Valley was developed as an ancillary market to Torrey Pines and is home to many start-up operations. The market has the highest concentration of leasable lab space, at 98.8% of the total lab inventory. The market has the lowest vacancy at 6.51%, which is a complete reversal in demand considering this market had the highest vacancy just two years ago. With a base of older R&D buildings easily converted to lab space, this submarket provides an economical alternative for early-stage companies. Building retrofits will continue to be this submarket's greatest draw.

The North County submarket is composed of the lab space within the cities of Carlsbad and Oceanside. This market comprises 1.23 million

EXISTING LAB SPACE

Submarkets	Total SF	Available SF (Vacant/Sublease)	Availability Rate
Torrey Pines	2,309,856	417,551	18.08%
Sorrento Mesa	2,158,785	218,791	10.13%
Sorrento Valley	1,689,585	109,936	6.51%
UTC	962,377	88,904	9.24%
North County	448,781	102,675	22.88%
Other Areas	484,047	125,901	26.01%
Total	**8,053,431**	**1,063,758**	**13.21%**

MARKET ASKING RENTS		
Submarket	Asking Rent Shell Space (NNN)	Tenant Improvement (TI) Allowance
Torrey Pines	$32.80	$150.00
Sorrento Mesa	$27.00	$100.00
Sorrento Valley	$26.40	$75.00
UTC	$37.00	$150.00
North County	$19.40	$50.00
Other Areas	$21.20	$50.00
Total	$28.20	$125.00

square feet of lab space of which approximately 449,000 square feet is located within leasable space, with more than 784,000 square feet in owner-user space. Overall vacancy stands at 8.93%, with 22.88% vacancy in leasable space. Major tenants within North County include Genentech, Genopix, Invitrogen, Isis Pharmaceuticals, Autogenomics, Epeius Biotechnologies, and Syntron Bioresearch. This area of the county is one of the fastest growing areas.

Other areas of the county are home to more than 621,000 square feet of lab space, with nearly 449,000 square feet of leasable space and approximately 137,000 square feet of owner-user space. These buildings and their tenants are not clustered within specific lab-focused markets, but are a vital part of San Diego's bioscience market. These include tenants such as Scantibodies in the city of Santee, and Neurocrine Biosciences in Carmel Valley.

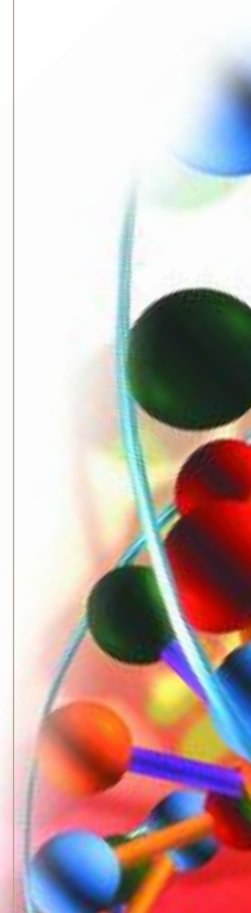
INCENTIVES (STATE OR CITY)

Major initiatives to spur further bioscience development in San Diego currently include:

- BIOCOM
- Institute of Bioengineering, Biotechnology and Quantitative Biomedical Research
- The California Biotechnology Program
- The California Healthcare Institute
- Biotechnology Strategic Targets for Alliances in Research (BioStar) Program
- California Technology Investment Partnership
- $37.3 million in state funding for stem cell research

IN THE NEWS

- The San Diego Consortium for Regenerative Medicine (SDCRM) – a consortium comprised of UCSD, The Burnham Institute, The Salk Institute, and TSRI – has received 29 state grants for stem cell research totaling more than $37.3 million dollars since March 2006. SDCRM leads the state in overall funding since California approved the comprehensive research grants program for stem cell research.
- Tanox, Inc. – a company that specializes in the discovery and development of biotherapeutics – merged with Genentech in first quarter 2007. As one of the largest and oldest biotech companies in the world, Genentech occupies more that half a million square feet in Oceanside. Tanox is located in Torrey Pines.
- Amylin Pharmaceuticals, Inc. and Eli Lilly and Company receive FDA approval in December 2006 for Byetta. The Byetta injection is an add-on therapy to improve blood sugar control in people with Type 2 diabetes. Amylin is located in UTC.
- Genetic analysis product manufacturer Illumina, Inc. acquired Solexa, Inc. in January 2007. Illumina's corporate headquarters is in UTC.
- Halozyme Therapeutics partners with Roche to share Halozyme's Enhanze drug delivery technology in a deal valued at up to $612 million plus royalties. Halozyme is located in Sorrento Valley.



San Diego

- The FDA approves Biogen Idec and Genentech's new Rituxan drug that treats non-Hodgkin's lymphoma and rheumatoid arthritis. Biogen Idec is located in UTC.
- Invitrogen Corp. acquires Sentigen for $25.9 million. Invitrogen is headquartered in Carlsbad.
- The FDA approves Pfizer's Sutent drug for the treatment of advanced forms of kidney cancer and stomach and intestinal cancer. Pfizer is located in Torrey Pines.
- Becton, Dickinson and Company (BD) acquired GeneOhm Sciences, Inc. for $230 million. BD is located in Torrey Pines.
- EpiCept merges with Maxim Pharmaceuticals. The company is located in Sorrento Mesa.

RECENT TRANSACTIONS

NEWSWORTHY DEALS

Recent Leases	Submarket	Size (SF)
Senomyx	UTC	64,000
Genoptics	North County	61,618
Epeius Biotechnology	North County	37,381
Ambrx	Torrey Pines	36,058
Discovery Partners, Inc.	UTC	34,612
NexBio	Sorrento Valley	27,048
BD Biosciences	Torrey Pines	21,987

MARKET OUTLOOK

Approximately one million square feet of future lab development is planned for the near future throughout the county. Nearly half of this is build-to-suit development. Currently, no space is under construction or will be completed in 2007. Until leasing picks up, no new development will break ground. Most of the long-term future growth will be in Sorrento Valley and Sorrento Mesa. Very little development will occur in Torrey Pines.

MAJOR FUTURE DEVELOPMENTS

MAJOR FUTURE DEVELOPMENTS					
Site	Submarket	Total Size (SF)	Currently Under Construction (SF)	Delivery Date	Notes
Biogen Idec Campus – Phase II	UTC	420,000	0	TBD	Future Phase II build-to-suit of Biogen's headquarters. When complete, entire site will total 767,000 sf.
Sorrento Gateway Business Park	Sorrento Mesa	200,000	0 (Construction to start in 2007)	2008	Three-building park being developed by Kilroy Realty.
University City Science Center	UTC	155,000	0	2008	Single biotech building being developed by Nexus Properties.
Pacific Corporate Center – Lot 8	Sorrento Mesa	95,000	0	2008	Single biotech building being developed by Kilroy Realty.
Genentech – Phase II	North County	55,000	0	TBD	Future expansion located in the Ocean Ranch Corporate Center in the city of Oceanside.
Sidney Kimmell Cancer Center – Bldg 4	Torrey Pines	54,000	0	TBD	Building will include a 6,600-sf underground vivarium.
Total		**979,000**	**0**		

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CHICAGO

The metropolitan Chicago area's life science industry is vast and is driven by a combination of private companies as well as public initiatives that support the industry. It is home to more than 440 corporate R&D facilities and more than 200 academic, government, and nonprofit research institutions. In 2005, *Business Facilities* magazine ranked Illinois as the top state for biotech growth, with companies in subsectors including agricultural feedstocks and chemicals, drugs and pharmaceuticals, medical devices and equipment, and research and testing.

Chicago is home to international pharmaceutical giants Abbott Laboratories and Baxter International, Inc., both located north of the city of Chicago in Lake County, Illinois. These firms are two of the area's significant economic drivers and have substantial real estate holdings in the Chicago metropolitan area.

Abbott Labs employs 65,000 people globally, of whom approximately 20% are employed within the Chicago area. In 2006, Abbott spent $2.3 billion on research and development and generated revenues of $22.5 billion. The company has several Research Centers of Excellence that are dedicated to scientific discovery and development, focusing on areas of greatest unmet medical need. Over the last several years, Abbott has made a number of acquisitions and completed other strategic transactions that have strengthened its medical and pharmaceutical portfolio and technology-driven businesses in therapeutic areas.

Baxter International, Inc., with headquarters in Deerfield, Illinois, has 48,000 employees worldwide, about 1,000 of whom are located in Illinois. In 2006, Baxter invested $614 million on research and development and generated sales of $10.4 billion. Of the three business units, bioscience posted sales of $4.4 billion, while medical deliveries came in second with $3.9 billion and renal garnered $2.2 billion.

Beyond these cornerstone commercial institutions, the Chicago life science engine is also fueled by a number of top research universities and national laboratories, including Fermi Laboratory, Argonne National Laboratory, Illinois Institute of Technology, Northwestern University, the University of Chicago, and the University of Illinois. The research universities undertake more than $1 billion of life science research annually, primarily funded by the National Institutes of Health and the National Science Foundation. This number represents one of the largest concentrations of life science research in the country.

Fermi Laboratory, with 2,000 employees and a budget of $316 million, lies in the heart of the I-88 corridor, sprawled over 6,800 acres. The Fermi Lab's primary research is particle physics. A consortium of 89 research universities collaborates at this facility though 2,300 scientists.

The Argonne National Laboratory is located along the I-55 corridor in Lemont, Illinois, amidst 1,500 wooded acres. The entire complex contains 2,900 employees, including about 1,000 scientists and engineers, with an annual budget of $475 million dollars. One of the US Department of Energy's largest research centers, it was also the nation's first national laboratory, chartered in 1946. Argonne operates the Advanced Photon Source, the world's most powerful X-ray machine, and one of the nation's leading tools for the development of new pharmaceuticals. In April 2006, The Center for Nanoscale Materials, a two-story, 83,000-square-foot structure that includes advanced research facilities for interdisciplinary nanoscience and nanotechnology research was completed.

While corporate and research giants remain the foundation of the Chicago marketplace, the life science landscape has evolved dramatically in the past year. Demand for wet lab, pharmaceutical, agricultural, and green house space is especially strong in downtown Chicago, driven primarily by entrepreneurial users who are drawn to the enormous talent pool as well as higher educational institutions such as the University of Chicago and Northwestern University.

In the city, the Chicago Technology Institute, established on 56 acres, is located within the Illinois Medical District on Chicago's West Side. It caters to companies needing incubator facilities for research in the medical field. The campus offers companies fully-equipped infrastructure, university resources, internship programs, and custom-designed business services, including the Chicago Technology Park Research Center, a 56,000-square-foot incubator facility for companies in early development, with an inventory of 400-, 600-, and 1,000-square-foot wet labs and 40,000 square feet of graduate space slated for completion in 2007. Current tenants number more than 30 companies representing a range of disciplines, including drug discovery and delivery, medical device testing, genomics, and nanotechnology.

The Chicago market has seen little speculative biotech development until recently. Forest City is now developing the Illinois Science and Technology Park, strategically located on 22 acres of land between downtown Chicago and Lake County, offering easy accessibility to Chicago's major universities, research institutions, and life science corporations. The park will offer up to two million square feet of life science laboratory, office, and conference space for lease in renovated or to-be-constructed buildings. With 750,000 square feet already built out, the park has 660,000 square feet available and 1.3 million square feet ready for build-to-suit needs. The park currently houses the Nanotech Business Alliance. The Illinois Department of Commerce and Economic Development projects that this property will generate 20,000 jobs and $3.6 billion annually for the Illinois economy.

Future developments will include the University Technology Park at IIT (UTP), covering 15 acres on the Illinois Institute of Technology main campus, across from US Cellular Field. UTP, when fully built out, will offer 1.5 million square feet of rentable space ranging from incubator and office spaces to build-to-suit wet labs. The park identifies companies needing state-of-the-art custom space and wanting to be on a university campus to facilitate their growth from start-up to maturity. Two incubators are planned as part of this development. Incubator I opened in January, 2006 and was 80% leased to four start-up companies. Incubator II can accommodate 30 start-up companies and will consist of 15 wet labs with adjacent office space and 15 dry labs as well as a common equipment room in nearly 30,000 square feet. Both Incubators I and II are feeders for the adjacent Business Center (TBC), which offers 126,000 rentable square feet on four floors, surrounding an open-air atrium and common space. The TBC combines wet and dry lab space as well as office space.

Northwestern University and the city of Evanston started developing the Northwestern University Evanston Research Park in 1985, which now has seven facilities, including two incubators, encompassing over 400,000 square feet of biotech space. Sixty companies are located with the park, employing approximately 1,000 people. The park has room to expand its life science community through three available land sites.

Among the other new developments in the area is DuPage Technology Park, a planned 800-acre development that DuPage County is looking to develop for technology use. The Illinois Coalition's feasibility study reported that once underway, this park will create in excess of 2,000 jobs and nearly a billion dollars in wages earned during the first phase of the project.

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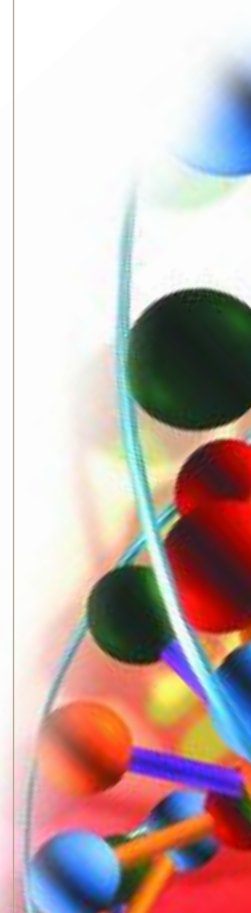

HOUSTON

Biotechnology and the life science industry continue expanding in the Houston region with more than 100 institutions and companies attracting over $1.5 billion in research and development funding annually. Leading ongoing research efforts in the area include the established and emerging industry sectors of nanotechnology, pharmaceuticals, nutraceuticals, genetics/genomics, biodefense and infectious diseases, stem cell research, and oncology. According to Colliers International's 2006 database, Houston has 116 life science companies with nearly 19,000 life science workers in the area. Continuous innovation and discovery in biotechnology and the life sciences draw from a strong knowledge base centered at the Texas Medical Center (TMC), the region's dynamic catalyst for growth among medical and medical-related industries.

The internationally renowned 800-acre TMC is recognized for its leading medical, academic, and research institutions, including 13 hospitals and two specialized patient facilities, as well as 11 academic and research institutions. Prominent academic institutions include the Albert B. Alkek Institute of Biosciences and Technology, Baylor College of Medicine, Rice University, Texas A&M University System, the University of Texas-Houston Health Science Center, and the University of Texas M.D. Anderson Cancer Center. Ongoing growth at TMC includes $8.2 billion in capital investments from 2002 to 2004, with $3.5 billion in research funding during 2000 to 2004.

Significant new developments at the TMC include the University of Texas Health Science Center at Houston's recently-announced plans to allocate $230 million in the development of four new facilities, including $62 million for the Biomedical Research and Education Center, which will focus on stem cell research. Construction of the new facilities will begin in early 2007 with completion scheduled for 2009, and will be located in the 100-acre UT Research Park at the TMC, a joint venture between the UT Health Science Center and M.D. Anderson Cancer Center. This project joins the recently opened M.D. Anderson Proton Therapy Center and the soon-to-be-completed Imaging Center, a collaborative effort between M.D. Anderson Cancer Center and General Electric Corporation.

In 2005, the Texas Enterprise Fund also awarded $50 million for start-up costs of a the Texas Institute for Genomic Medicine (TIGM), a new nonprofit involving the Texas A&M University Institute of Biosciences and Technology (IBT) in Houston. The TIGM will pioneer the development of life-changing medical breakthroughs, accelerate the pace of medical discoveries and foster the development of the biotechnology industry in Texas.

Long known for its research-centric TMC, the Houston region is slowly gaining momentum in the development and commercialization of products that would ensure its place as a major biotechnology and life sciences cluster. Creating the necessary infrastructure to allow for this growth involves garnering support from both the public and private sectors to facilitate the entrance of both established and start-up private companies, as well as entrepreneurs and venture capitalists to invest in these projects. Outside the TMC, the 1,000-acre Research Forest located in The Woodlands, approximately 30 miles north of downtown Houston, was designed specifically for scientific, research, and biotechnology companies. New business parks geared toward private biotechnology companies in the region include the Genesis Biotechnology Park, located near the intersection of Holly Hall and El Rio just south of the TMC, and Spectrum Commerce Center, the 150-acre life sciences and technology business park located in the city of Pearland at Highway 288 and Beltway 8, approximately 10 miles south of the TMC.

Genesis Biotechnology Park currently leases space to 16 life science companies in a six-building area, although final completion of the project is not expected for several years. BioHouston's Resource Center, the first incubator facility serving the

Houston life sciences community, will be housed at the Genesis Biotechnology Park, adding a key component to ongoing commercialization efforts. The center is specifically designed to serve start-up biotech and life sciences companies, including offering access to shared laboratory space and services, research resources, and networking opportunities with a community of biotech entrepreneurs. The lack of this type of facility has been a major setback to commercialization in the Houston life science community, contributing to the lack of venture capital funding in the Houston area. Genesis Biotechnology Park itself will go a long way toward supporting start-up companies by providing tenant options for shared office and wet laboratory space (including equipment), as well as flexible leases at competitive rates. Clearly, this new facility will help rejuvenate venture capital interests in the Houston biotechnology community.

Recently, the Colliers International Houston Biotechnology Initiative sold the 150-acre Spectrum Commerce Center in Pearland, Texas. The property was sold to an investor that has not yet announced its future intent for the property. It is hoped that the owner will make use of the Pearland Economic Development Corporation's (EDC) incentive package for biotechnology and life sciences.

Both Genesis Biotechnology Park and the Spectrum Commerce Center are meant to complement rather than compete with the nearby UT Research Park, which is also focused on biotechnology and life sciences. Upon completion, UT Research Park will total two million square feet of research, laboratory, office, and support space for both private and not-for-profit research institutions, although currently only the latter are represented. The new business parks are being marketed to biotech entrepreneurs as creative communities not available in primarily not-for-profit settings.

Two projects currently under construction in the Houston life sciences community are the Life Science Plaza and Rice University's Collaborative Research Center. The 300,000-square-foot Life Science Plaza office tower near the TMC is approximately 40% pre-leased to primarily health care tenants. The project has a total investment value in excess of $80 million with completion expected by early 2008.

The $200 million Collaborative Research Center is a joint venture between Rice University, a recognized leader in the nanotechnology and bio-engineering fields, and the Texas Medical Center, known for its expertise in every specialty of medicine. Located at the intersection of South Main Street and University Boulevard where the two campuses meet, this translational medical facility is designed to bring together biologists, physicists, mathematicians, computer scientists, clinicians, and bioengineers. Project construction will begin in November 2006.

Houston and the state of Texas have experienced significant growth in biotechnology and the life science industry over the past decade. In 2005, Texas' legislature introduced the $200 million Texas Emerging Technology Fund (TETF) designed to leverage state funding with communities, university systems, and investments from public and private industry. Since its inception, TETF has acted as a strong magnet in attracting emerging industries of the future, including nanotechnology, biotechnology, semiconductor, software technology, microelectromechanical systems (MEMS), and manufactured energy.

From its base of cutting-edge research, Houston has taken the next step in its evolution as a primary life science cluster by creating an environment conducive to private companies developing and marketing life science products. With key initiatives in place to bring together the public and private sectors, as well significant improvements to the scope of services and incentives available to private companies, the infrastructure is in place to capitalize on Houston's strong research base and convert it into commercialized product. Since this process is now in motion, the biotech future in Houston looks bright.

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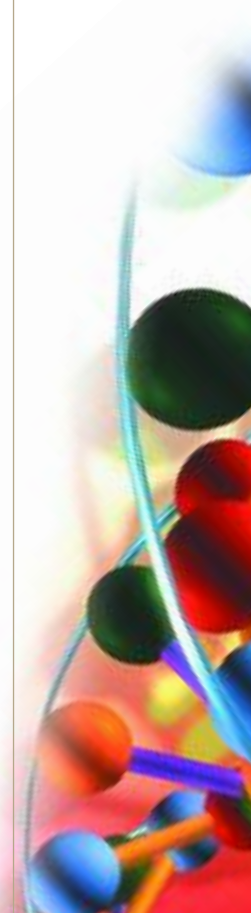

INDIANAPOLIS

Five years ago, the private sector, public and not-for-profit research and health entities, and government agencies in Indiana came together to study the resources of the Indianapolis region with respect to life science and to devise a strategy to grow the industry based on the unique competitive advantages of Indianapolis. An organization called BioCrossroads was formed to be a catalyst for the continued growth of Indiana's robust life science industry. Today, those efforts are bearing fruit. In a review of the growth and development of Indianapolis as a life science hub from 2002 to 2007, BioCrossroads reports:

- In 2002, consultants were hired to validate Indiana's place in the life science marketplace as the region continued to lose ground economically. Today Indiana's reputation as a national life science leader has been validated by outside experts, including the Biotechnology Industry Organization (BIO) and Battelle Memorial Institute, Deloitte and Touche, and the Milken Institute. Standard & Poor's raised Indiana's credit rating in 2006, based in part on central Indiana's $13.6 billion global life sciences hub bringing in $214 million of life sciences investments, creating 2,200 jobs.
- Indiana's workforce employed by the life science sector is deep and growing. In 2005, Deloitte and Touche reported that Indiana's life science sector employed 274,109 people, representing 9% of all jobs and 20% of the tax base in the state. The Milken Institute noted that Indiana gained jobs in life science at more than twice the national rate from 2001 to 2003, and Indiana's private industry council estimates that 9,500 new jobs in life science will be created in central Indiana and more than 40,000 statewide by 2012.
- University tech transfer licensing revenues have increased steadily, indicating that more innovations from university research are being utilized in the marketplace.
- In 2002, Indiana ranked in the bottom 10 states for all types and stages of venture capital investment, and Indiana's pension funds were in no venture investments of any kind. Today, Indiana ranks 21st in the nation for venture capital investments and more than 15 Indiana-based or Indiana-focused funds are actively exploring life science investments. Twenty-five Indiana-based life science companies received venture capital investment in the last five years. Also, for the first time, Burrill & Co. held the Indiana Life Sciences Forum, in Indianapolis in the fall of 2006, focusing on cluster building and working with the venture community.

These efforts were stimulated, in part, by Indiana's Future Fund, a $73 million fund of funds, formed in 2003 by BioCrossroads and managed by Credit Suisse. Under the fund of funds structure, investments were made in six local and national funds which have begun making direct investments in Indiana's life science businesses. These funds include venture capital funds, public pension funds, and corporate and academic institutions. Six Indiana-based companies have been funded as a result of these efforts, providing $50 million in venture investment to Indiana. These companies include CoLucid, BioStorage Technologies, Endocyte, CS-Keys, Inc. Quadraspec and SonarMed.

In addition to the Future Fund, BioCrossroads launched a $6 million Indiana Seed Fund in June 2005 to provide working capital to promising, start-up Indiana life science companies in amounts from $50,000 to $500,000. The Indiana Seed Fund anticipates making investments over a two- to three-year period; so far, investments have been made in two companies.

Large investments in life science research have also been made by the philanthropic sector, including Lilly Endowment, the Fairbanks Foundation, and the Lumina Foundation. Lilly Endowment provided a $53 million grant to Indiana University to establish the METACyt Initiative, aimed at building on the foundation of genomic and proteomic research already taking place at the university. In 2005, the endowment also provided a $25 million grant to Purdue University to support research centers in the newly opened interdisciplinary Discovery Park.

- The life science industry has invested more than $2 billion in new expansions and buildings since 2002, including:
  - A new biotechnology research lab and biotechnology pilot manufacturing plant by Eli Lilly and Company ($880 million)
  - Expansion of the Purdue Discovery Park ($110 million +)
  - A lab/training and development center by Clarion ($119 million)
  - A Cancer Center, Research and Information Sciences building by Indiana University ($275 million)
  - Several commercial buildings in expansion efforts by private companies: Biomet – Orthopedics manufacturing ($21 million), Cook Group – Device manufacturing ($12 million), Cook Pharmica – Contract biotech manufacturing ($70 million), Pfizer
  - Biotech manufacturing ($170 million), and Paragon Medical – Orthopedics manufacturing ($50 million), among others.
- BioCrossroads has also launched new businesses and collaborations that support the core business activities of Indiana's life sciences industry, such as the Indiana Health Information Exchange, the Fairbanks Institute, the Indiana Centers for Applied Protein Sciences, and Novus Sport.

Life science industry leaders such as Eli Lilly and Co., Cook Inc., Dow AgroSciences, Roche Diagnostics, and WellPoint have located their headquarters here. Due to this presence, Indiana University Medical School, and other growing activities, the 2006 Battelle report ranked Indiana in the top four states for bioscience subsectors. Indiana was one of only three states with specialization in three of four industry subsectors: agriculture feedstock and chemicals, drugs and pharmaceuticals, and medical devices and equipment. Its research strengths reside in cancer, proteomics, biomarkers, cardiovascular, neuroscience, and evidence-based medicine.

Laboratory and research space is currently abundant in private hands and is beginning to be brought into the public domain through growth in incubators and shared research facilities in the Indianapolis region's six certified technology parks.

It is in highest supply and demand in submarkets surrounding universities (Indianapolis, Bloomington and West Lafayette). Purdue recently invested $100 million in the construction of Discovery Park – a 40-acre interdisciplinary research park on Purdue's main campus in West Lafayette. Among its 10 research centers, the Birck Nanotechnology Center is considered the best of its kind in the nation. The $58 million center occupies 187,000 square feet, including a 25,000-square-foot nanofabrication clean room.

Indianapolis houses the Indiana University Research and Technology Center, a 65,000-square-foot incubator facility located in the Indianapolis downtown certified technology park. Construction will begin soon on a graduation facility.

In early 2007, Indiana University in Bloomington is scheduled to open the $55.7 million, 140,000-square-foot Simon Hall, a multidisciplinary building that facilitates collaboration between scientists from the fields of biology, physics, chemistry, mathematics, and psychology.

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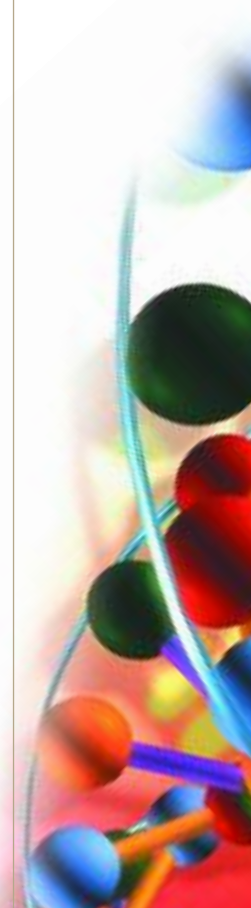


KANSAS CITY

Greater Kansas City's life science initiative is relatively young, but rich with impressive short-term results. Spanning the state lines of Missouri and Kansas, the Kansas City life science community stretches west to east from Manhattan to Columbia, and is bound on the north by Atchison, Kansas, and St. Joseph, Missouri, and on the south by Miami County, Kansas. This 23-county area is home to about 199 life science companies employing between 17,000 and 20,000 people. Five individual companies (Cerner, Quintiles, Bayer CropScience, REMEL and Boehringer Ingelheim Vetmedica) account for approximately 40% of related employment in the region. These companies expended approximately $638 million on sales and research in 2006. In addition, 44 universities actively contribute to the intellectual capital and research base of the life science industry.

The Kansas City Area Development Council (KCADC) is the region's umbrella economic development organization. According to the 2006 Kansas City Regional Life Sciences Industry Census, human health-related companies dominate the region's life science community, though a very significant animal health and nutrition industry also exists. Plant and crop science, though strongly represented by Bayer CropScience, comprises a relatively small percentage of the regional life science industry. Important facts about the animal health and nutrition industry in Kansas City are:

- Four of the 10 largest global animal health companies have their US or worldwide headquarters in Kansas City.
- 42 companies in the animal health and nutrition industries have US or global headquarters in the Kansas City area.
- The Kansas City area is home to more than 100 animal health and nutrition companies.
- In or within a short distance of Kansas City are five veterinary colleges, five trade associations, two major veterinary and livestock publishers, 14 ad agencies and market research firms with deep experience in animal health and nutrition, plus personnel search firms, CROs and many other resources.

The greatest concentration of life science firms is located in the urban and proximate suburban areas of Kansas City. However, a strong presence of animal health and nutrition companies has developed in St. Joseph, Missouri and a significant concentration exists in the region surrounding Columbia, Missouri.

Greater Kansas City is home to many mature, globally-recognized institutions, organizations and individuals at the forefront of health care and technology innovation. The area's concentration of health care information, clinical trial, market development, and specific research companies, coupled with a workforce with expertise in animal, cardiology, oncology, and neurological research and discovery creates the ideal climate for a burgeoning life science market. There are also several commercialization partners for life science entrepreneurs: University of Missouri Office of Technology and Special Projects, BioMed Valley, MRI Ventures, KTEC, and the University of Kansas Technology Transfer and IP.

In addition, the broader life sciences initiative benefits from the backing of two state governments and the collective community commitment to workforce development. These advantages were clearly apparent when 20 different organizations from both sides of the state line worked together on a Department of Labor Workforce Innovation in Regional Economic Development, or WIRED, proposal. The effort paid off. The Kansas City region was one of only 13 communities in the nation to receive a $15 million grant for career training. The funds are targeted specifically for high growth areas of the awardee's economy, including healthcare, biotechnology, and advanced manufacturing.

In 1999, Kansas City undertook an evaluation of how to build a significant life science presence in the region. The report published by the task force recommended the creation of a Kansas City Area

Life Sciences Institute to coordinate Kansas City's life science strategy. It also recommended that Kansas City build research capacity through the collaboration of its major institutions on neurological disease, cardiovascular disease, cancer, human development, and infectious disease. The task force concluded that with an infusion of $300 million over a 10 year period in genomics, proteomics, information technology, bioinformatics, and imaging, as well as additional equipment and facilities, the region could reach a research expenditure level of $500 million, which could propel the region into the top 10 regions for life science nationally.

Between 1999 and 2006, Kansas City has made great strides towards these goals. The Kansas City Area Life Sciences Institute was created with eight key stakeholder institutions: Children's Mercy Hospitals and Clinics, Midwest Research Institute, Saint Luke's Hospital, Stowers Institute for Medical Research, Kansas City University of Medicine and Biosciences, University of Kansas, University of Kansas Medical Center and the University of Missouri-Kansas City. Two additional stakeholders were added in 2005: Kansas State University and the University of Missouri-Columbia. Research expenditures among the original eight stakeholders more than doubled since its creation to $265 million in 2005. Collectively, all 10 stakeholders now make research expenditures that exceed $552 million. Private organizations and foundations, as well as the National Institutes of Health and the National Science Foundation, provide research funding. Research topics vary from disease origin and treatment to homeland security, animal health and nutrition, and male contraceptives.

The centerpiece of the area's life science initiative is the Stowers Institute for Medical Research. Since opening in 2000, it has built a $2 billion endowment fund. In 2006, the institute housed 24 independent research programs plus technology development programs in bioinformatics, proteomics, and imaging, representing more than 380 scientists, research associates, technicians, and support staff.

The Kansas City Area Life Sciences Institute also manages a research development grant program designed to facilitate inter-institutional research collaborations. Since the launch of the program in 2002, the institute has awarded 38 grants in an aggregate investment of $875,000 and secured an eight to one return in subsequent funding from other federal, public, and private sources.

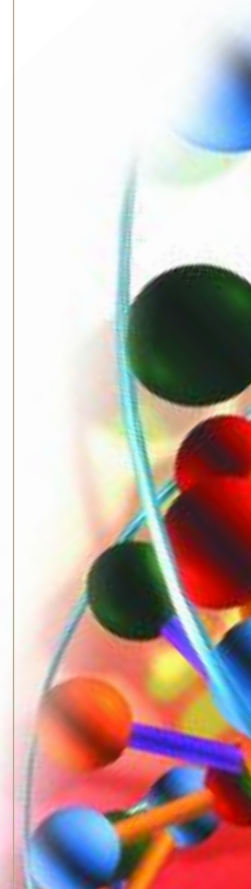
Several new activities have been undertaken to assist the creation and planning of incubator facilities to help early-stage and start-up companies develop and grow.

- A newly opened Kansas City Biotechnology Center, created through a $700,000 renovation of lab and office space, attracted its first tenant, Proteon Therapeutics.
- A 30,000-square-foot biosciences center is under construction in Manhattan, Kansas on land provided by Kansas State University to house 10 start-up companies.

More than $400 million has been invested by the institute's stakeholder institutions in new life science research facilities. Among these are a $54 million Bio-Security Institute at Kansas State University, a $60 million Christopher S. Bond Life Sciences Center, which houses the Proteomics Center, Molecular Cytology Core, and the DNA Core, and the $10 million International Institute for Nano and Molecular Medicine.

To capitalize on the area's growth, the Kansas legislature passed an Economic Growth Act, featuring the creation of the new Kansas Bioscience Authority. Through this organization, Kansas utilizes cash resources, tax credits, and other financing mechanisms to invest in research and life science companies and institutions, as well as to lure new companies evaluating the state for relocation. The authority will generate more than $580 million in revenue for the development of the biosciences sector over the next 15 years. The authority's top priority is to attract the $450 million National Bio-Agro-Defense Facility that will be funded by the Department of Homeland Security and could create an additional 1500 new jobs.

Credit:
Economic Development Corporation of Kansas City, Missouri
Tel: 800-889-0636
www.edckc.com



MEMPHIS

Memphis continues its quest to be recognized as a major life science cluster, touting its ability to not only manufacture but also distribute finished goods to anywhere in the world through its network of air, truck, train, and waterway distribution points. The city is building a diversified biosciences region with leading centers in orthopedics and medical implants, a thriving academic health community with strong clinical care and research institutions, and highly successful downtown medical center, as well as a growing presence in biologics testing, services, and production. Currently, 16% of the area's jobs are related to the biosciences, making the life sciences industry a major job engine in Memphis.

Memphis is an international center for musculoskeletal devices and orthopedics, with industry drivers such as Medtronic, Smith and Nephew, Wright Medical, Luminetx, and St. Jude Children's Research Hospital. The InMotion Musculoskeletal Institute, a Center of Excellence in musculoskeletal research housed at the UT-Baptist Research Park, opened its laboratories in 2006. The 6,000-square-foot facility will focus on musculoskeletal biomechanics. Work will include testing frames that place force on human bone, human bone replicas, or manufactured implant devices to mimic loading conditions and human movement so scientists can determine the amounts of activity implants can withstand before breaking. The laboratory also will serve as a central location of InMotion's clinical studies, including Phase II – IV clinical trials for pharmaceutical and implant treatments of orthopedic injury and disease, and other preclinical studies focused on a variety of orthopedic topics of interest.

Memphis' clinical and research institutions include the world-renowned St. Jude Children's Research Hospital, the University of Tennessee Medical School, several other hospitals, a nursing school, and an optometry school.

The Memphis Bioworks Foundation guides the development of life sciences in Memphis and encourages collaboration throughout the community. Its mission is to establish Memphis as an internationally recognized center for the development and commercialization of the biomedical technology by focusing on three areas: building infrastructure, growing the workforce, and promoting entrepreneurship.

The first of many projects, the UT-Baptist Research Park will be the heart of Memphis' bioscience sector. The 1.2-million-square-foot, $400 million campus will sit on 10 acres of land in the middle of the Memphis Medical Center. Baptist Memorial Health Care donated the land for the research park and the state of Tennessee provided funding to demolish existing facilities. The complete, 10-year, six-phase master plan will include a dedicated, six-story, 165,000-square-foot biotechnology research facility, state-of-the-art laboratory and office buildings, substantial vivarium space, training facilities, meeting space, and an entrepreneurial program to develop biotechnology businesses and foster the creation of new jobs. The economic impact of the completed research park is projected to be $2 billion per year, creating 5,000 new jobs and $250 million in annual salaries.

The first building, the University of Tennessee Health Sciences Regional Biocontainment Laboratory established with an $18 million grant from the National Institutes of Health, will be one of 13 such facilities in the nation for conducting research into bioterrorist agents and

infectious disease. It is expected to be completed in 2008. Construction of the next building, a 165,000-square-foot research facility, is expected to be completed in 2009.

Memphis Bioworks also strengthens the workforce through its innovative efforts with charter schools, the Memphis Academy of Science, and its programs with the community colleges.

In terms of venture investment, the number of deals is lower than in 2001, but the size of the transactions are increasing and there is a growing emphasis on starting new companies in the medical device field.

All of these developments will significantly impact Memphis' growing life science industry.

Credit:
Jeni Thompson, *Director of Marketing and Development*
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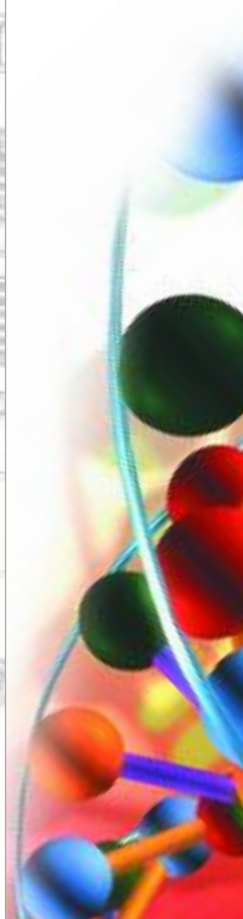

MINNESOTA

Minnesota's diverse mix of industrial, medical device, food, nutrition, bio-ag, veterinary/animal health, biotech, and health care companies, as well as leading research institutions, offers a broad life science platform that has already made it a leader in several areas of the bioscience sector: applied biologics, medical devices, and agricultural biotechnology.

Minnesota is home to more than 530 medical device companies and its leading medical technology industry is anchored by such industry leaders as Medtronic, Guidant, St. Jude Medical, 3M, and Boston Scientific. These companies supply a diverse range of products which include: cardiovascular technologies such as heart valves, pacemakers, defibrillators, and drug coated stents; catheter technologies; and drug delivery systems.

Medtronic is locating a new corporate headquarters for its Cardiac Rhythm Management Division on a 43-acre parcel in Mounds View. This project will proceed in several phases that will eventually include 1.2 million square feet of new office, R&D, and production space. This expansion is expected to provide 3,000 new jobs by 2010. Founded in 1902 as a manufacturer of sandpaper, 3M has subsequently grown into an enormously diverse company, including its 3M health care business of medical, pharmaceutical, and dental products, the largest of six major 3M businesses. Last year, Boston Scientific acquired Guidant in a merger transaction for $27 billion, creating one of the world's preeminent medical device companies, with total revenue in 2006 of nearly $9 billion. Boston Scientific now has more than 7,000 employees in Minnesota focused on cardiac rhythm management and vascular therapies on two major campuses.

In addition to these companies, Minnesota's remarkably diverse and innovative bioscience sector is home to such firms as MGI Pharma, Upsher-Smith, Paddock Laboratories, Gel-Del, Inc., Ecolab, Isurtec, Novartis Nutrition, Intervet, PDL Biopharma, Newport Laboratories, and many others. This unique crossroads of bioscience and medical devices makes Minnesota a leading location for bio businesses.

For example, in July 2006, executives at Denmark-based Coloplast, a world leader in the design and manufacture of high quality and innovative health care products and services, announced their decision to move their North American corporate headquarters to Minnesota from Atlanta, Georgia. Coloplast's recent acquisition of Mentor's urology division prompted them to choose a location for all of their US operations. Their commitment to move to Minnesota placed them squarely at the intersection of medical technology and biosciences and created a biobusiness revolution. The Minnesota Department of Employment and Economic Development together with the city of Minneapolis provided them with a financial package including a forgivable loan, tax credits, and workforce training, which is helping Coloplast double the size of its existing Minneapolis operations to more than 500,000 square feet and add 300 new employees in two years.

On the academic side, the Mayo Clinic and the University of Minnesota are world leaders in health sciences, genomics, biotechnology, and bioscience. In fact, Minnesota has been synonymous with health care since the Mayo Clinic was established in 1914. The University of Minnesota, located in the cities of Minneapolis and St. Paul, is among the top public research institutions in the country, receiving millions of dollars in new grants and contracts in recent years. Research at both the Mayo Clinic and the University of Minnesota have spun out new firms such as Blizzard Genomics, Discovery Genomics, R&D Systems, Islet Technology, and others.

In 2003, these two institutions formed a new Minnesota Biotechnology and Genomics Center designed to encourage joint research projects that will project scientific advances, identify and lead to improvements in health care, and provide stimulus for new jobs and an expanded tax base for Minnesota through the creation of start-up organizations. The state legislature and the governor supported these efforts by providing $2 million in matching funds to launch joint programs focused

on the diagnosis and treatment of cancer, heart disease, and neurological diseases. It was contemplated that a five year, state investment of $70 million would yield an expected overall economic impact returned to the state of $320 million, and 4,300 direct and indirect jobs in 2010.

In 2006, the partnership received $15 million in operational support from the Minnesota legislature. Legislative proposals for support in 2007 include an additional $15 million from the legislature, with the governor proposing an additional $38 million over two years. In addition, $21.7 million in state bonding financed the construction and build-out of three major partnership floors in a research building at the Mayo Clinic's Rochester campus, and $8 million in state funding was allocated to develop the BioBusiness Development Center adjacent to the partnership and Mayo Clinic facilities.

Various other publicly and privately funded initiatives are being directed toward the life science industry as well. In addition to the creation of the partnership, the state has created new bioscience zones to create new jobs, tax incentives, and refundable job and research credits. The Biozone Program, enacted in 2003, facilitates the development of research and development parks linked to higher education institutions. Three 500-acre developments have been identified for bioscience zones, one each in Rochester, St. Paul, and Minneapolis.

The state's public investment in biosciences over the past five years exceeds $450 million, and this year yielded important new investments. During the 2006 legislative session, lawmakers authorized nearly $170 million, including money for new science and research facilities at the University of Minnesota and several state universities, plus funds for bioscience development grants in Rochester and other parts of Minnesota.

Unlike other Midwestern states where the economy rests heavily on a single industry, Minnesota has both a robust agricultural sector and an exceptionally strong manufacturing backbone. Bioscience companies such as NatureWorks, Cargill, 3M, H.B. Fuller, SurModics, and Biothera Pharmaceuticals are an important growing area of the state's manufacturing sector. Cargill Dow is emerging in Minnesota as a global leader in the agrobio industry, using agricultural products to manufacture plastics, biosynthetic fabrics, packaging materials, and ethanol fuels from sugars. In value-added food, nutrition, and health industries, Minnesota's world leadership is long established through companies such as General Mills, Land O'Lakes and others. In addition, the University of Minnesota has made significant investments in industrial biotechnology, including:

- $40 million in facilities and equipment at Biodale, a consortium of university research service facilities
- A $20-million Cargill facility for microbial and plant genomics
- $5 million to help fund six new faculty members in the area of microbial genomics and metabolic engineering, as well as other staff
- Funding for major initiatives in renewable energy and biocatalysis

These combined corporate and academic resources, coupled with a well-educated workforce and a high quality of life, position Minnesota well as a national leader in industrial biotechnology. In fact, the state is already setting the pace with work being done in biomaterials. At NatureWorks, for example, resin made from corn becomes biodegradable plastic (NatureWorks), which, in turn, can be used to make everything from packaging, plastic wrap, and cups to containers and electronics cases, from fabrics, blankets, and bedding to upholstery and carpets.

As the world seeks alternatives to petroleum-based products, industrial biotechnology offers some truly tantalizing possibilities. While current cost factors still favor oil, the longer-term outlook for biologic feedstock is compelling, with raw material costs of $220 per ton for oil, $80 per ton for corn, and $30 per ton for corn stover. To make biologic feedstock economically viable, many Minnesota organizations are investing a great deal of time and money in the area of biocatalysis. Through biocatalysis, a wide variety of agricultural and forest products may become new sources of raw material, transforming traditional manufacturing processes and creating new and improved products along the way. Minnesota is well-positioned to lead this new industrial revolution.

Credit:
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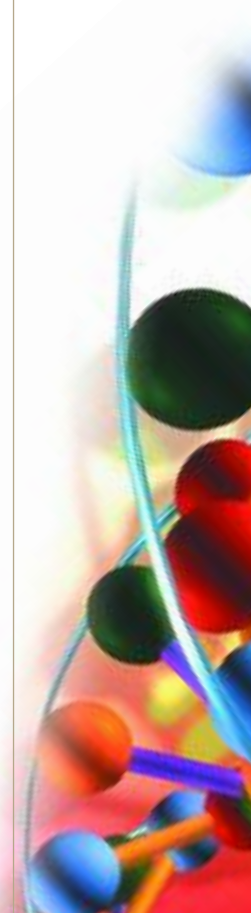

PHOENIX

Phoenix is a strong emerging market in comparison to other areas, largely driven by state and local government initiatives and aggressive university programs. The city of Phoenix has committed more than $100 million in bioscience funding from public and private sources. The Maricopa Community Colleges have earmarked $100 million for bioscience workforce training with the passing of bond issue in 2005. In addition, Arizona's three major universities, the University of Arizona (UA), Arizona State University (ASU), and Northern Arizona University (NAU), are pouring millions into various life science programs, including a downtown medical campus that will share in bioscience research and development efforts.

Phoenix has received national attention as the new home of both the Translational Genomic Research Institute (TGen) and the International Genomics Consortium (ICG).

TGen is on the cutting edge of translational genomics, a relatively new research field applying advances arising from the Human Genome Project to the development of diagnostics, prognostics, and therapies for cancer, neurological disorders, diabetes, and other complex diseases in order to rapidly translate discoveries to treatment tailored to individual patients. To accomplish this, TGen has established academic affiliations with the three state universities in Arizona – UA Tucson, ASU Tempe, and NAU Flagstaff, as well as research and clinical organizations in Arizona and nationally, including the Mayo Clinic, Banner Healthcare, Virginia Piper Cancer Center at Scottsdale Healthcare, St. Joseph's Hospital and Medical Center, and the Salt River Pima-Maricopa Indian Community, among others. TGen's activities are expected to generate $202 million in annual total economic impact for the state of Arizona by 2025, including 3,125 new jobs and $16.6 million in total tax revenue.

The International Genomics Consortium (IGC) is a non-profit medical research organization established to expand upon the discoveries of the Human Genome Project and other systematic sequencing efforts by combining world-class genomic research, bioinformatics, and diagnostic technologies in the fight against cancer and other complex diseases.

Both organizations are located in a six-story, 175,000-square-foot facility completed in 2004, along with Ameripath, Molecular Profiling Institute, and the National Institutes of Health. Construction for another tenant, St. Joseph's Hospital Research Laboratory, and was completed in 2006.

This six-story, $46 million building forms the cornerstone of the Phoenix Biomedical Center (PBC), a bioscience and medical research campus under development in downtown Phoenix. The 24-acre Phoenix Biomedical Center will eventually include six newly constructed buildings along with three renovated structures, representing the addition of one million square feet of bioscience space to the market in five years.

The biomedical campus is an integral piece of the statewide bioscience initiative and is expected to have a significant impact on biomedical discoveries, the quality of health care for Arizona's residents, and the expansion and diversification of the state's economy. One recent economic impact study estimated that the campus will generate $1.1 to $2.1 billion in annual economic impact for Arizona and provide employment for 14,000 to 24,000 people by 2025.

The city of Phoenix provided land to establish the Phoenix Biomedical Campus, which currently includes the expansion of the UA College of Medicine to a four year program in Phoenix, in collaboration with Arizona State University. The UA College of Medicine is the university's first entirely Phoenix-based medical school. Construction of this 65,000-square-foot, $27-million-project began with the renovation of

three historic former Phoenix Union High School buildings in the spring of 2005 and was completed in 2006. The first class of 24 medical students is scheduled to begin classes in 2007. Plans call for the program to grow to 150 students per year by 2015, more than doubling the number of MDs graduating in Arizona each year. The state legislature approved and the governor signed into law a $7 million appropriation to complete the first phase of the medical school expansion. The second phase, which will cost approximately $20 million, includes the renovation of about 666,000 square feet of various science and engineering labs.

The Arizona Biomedical Collaborative is also located on the Phoenix Biomedical Campus. The Arizona Biomedical Collaborative is an ambitious project uniting two of Arizona's major institutions: ASU and the UA. The 85,000-square-foot, $30 million project will house ASU's Biomedical Informatics Program and UA's cancer, heart disease, diabetes and neurological research programs. Construction began in 2005 and is due to be complete in 2007.

Northern Arizona University is looking to expand its allied health program to complement UA's medical school in Phoenix and is talking to UA and ASU about becoming part of the Arizona Biomedical Collaborative.

All of this has already resulted in commercialization activity from spinoff companies, the growth of which should eventually drive demand for speculative life science space.

Other areas of the valley have seen life science expansion as well. ASU's Biodesign Institute at the main Tempe campus location will contain 800,000 square feet of advanced research space in four connected buildings. Buildings A and B, containing 350,000 square feet, have already opened, and two new building of 220,000 square feet each are planned with total new investment of $200 million. The Biodesign Institute includes centers for nanotechnology, functional genomics and infectious disease and vaccinology, among others.

Also in Tempe, Chestnut Properties, a California-based real estate development company, announced plans to build office and laboratory space at Papago Park Center, which will include a 225,000-square-foot, six-story office building and a 35,000-square-foot speculative biotech laboratory facility. Construction on the $60 million project began in 2006 and is scheduled for completion in 2008.

In Scottsdale, the 37-acre ASU Center for New Technology and Innovation will include incubator space, along with programs focusing on technologies at the intersection of engineering, art, and bioscience. The center is expected to bring 4,000 jobs to the city of Scottsdale. In North Scottsdale, the Mayo Clinic completed its Collaborative Research Building in June, 2005. This $25-million, 110,000-square-foot biomedical research facility includes space for the Center for Translational Drug Development, the Mayo Clinic Cancer Center, and available space to accommodate other research applications. On the private side, developers are designing SkySong, a 1.2-million-square-foot mixed-use development that will include four-story, Class A office and research buildings.

Surprise, Arizona is planning a 40-acre Biotech Village campus that will house a $12.7-million, 44,000-square-foot incubator for start-up biotechnology companies.

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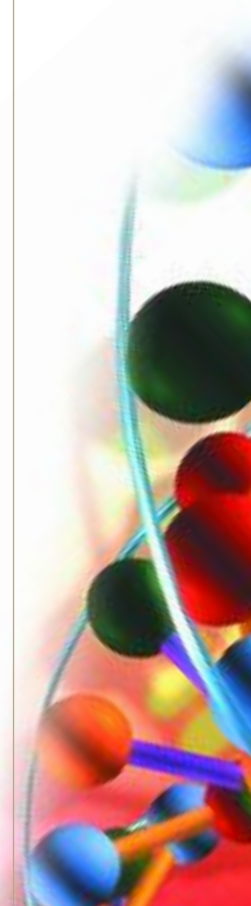

ST. LOUIS

The St. Louis region is on its way to becoming a major center for both the plant and life sciences industry. Its foundation includes strong academic institutions, technology transfer efforts, incubators nurturing new start-up companies, an active venture capital community, thriving life sciences companies, and a talented work force.

World class science and scientists are drawn to St. Louis by the numerous life science institutions that have made the area home. Washington University (WU), ranked fourth in medical research schools by "U.S. News & World Report" in 2006, is consistently among the top five in annual National Institutes of Health research awards, bringing in more than $400 million of NIH research grants annually. Saint Louis University (SLU) conducts noted research programs in microbiology and immunology and operates one of four US Centers for Excellence in biodefense and emerging infectious disease research. It is building a $66 million biomedical research building as part of a $80.5-million expenditure to upgrade research facilities at the medical school.

In addition to WU and SLU, the Siteman Cancer Center, the combined cancer research and treatment program of Barnes-Jewish Hospital and Washington University School of Medicine, is the only NCI-designated Comprehensive Cancer Center within a 200-mile radius of St. Louis.

All of these institutions have increased resources devoted to technology transfer and company creation, and are committed to supporting entrepreneurs. St. Louis has created BioGenerator to provide funding for start-up companies, with a $6 million seed investment from the Danforth Foundation, the Monsanto Fund, the McDonnell Family Foundation, and Bunge North America. BioGenerator is housed in the futuristic Nidus Center for Scientific Enterprise. BioGenerator recently invested $500,000 in start-up funding for Medros Inc., a company formed by two WU researchers in partnership with the university's office of technology management. The company will use fruit flies and novel drug screening techniques to discover and develop drugs for diabetes and cancer.

Several major academic centers and institutions anchor the St. Louis plant science industry.

The Donald Danforth Plant Science Center is home to over 130 scientists conducting fundamental research to efficiently deliver plant science solutions that meet the global needs of agriculture, human health, and nutrition. The Missouri Botanical Garden, located in the city of St. Louis, operates the world's most active research program in tropical botany. The new National Corn-to-Ethanol Research Center, located at Southern Illinois University Edwardsville's University Park, tests processes that could enhance the production of ethanol and related co-products. The University of Missouri and University of Illinois house capable and aggressive agricultural colleges. And finally, the St. Louis corporate sector includes one of the world's largest concentrations of plant biotech scientists at Monsanto and significant research facilities at Sigma-Aldrich and Pfizer.

Researchers at local institutions are leading the way in everything from finding new treatments for HIV/AIDS, avian flu, heart disease, and cancer to water pollution cleanup and developing drought-resistant plants.

Overall, St. Louis' growing biotech market is attracting the interest of venture capitalists from around the world. In fact, one recent survey found that the St. Louis area has one of the best reputations in the Midwest among health-care investors and ranks among the top cities in the country for biopharmaceutical-focused funds. The city already has more than $400 million of life-science-focused venture capital under local management in several funds, including the St. Louis based Vectis Life Sciences Fund raised in 2004. To complement the area's venture capital resources, the St. Louis Arch Angels were established in 2005. Arch Angel members provide seed and early-stage capital in the range of $250,000 to $2 million.

New robust business incubators aimed at fostering fledgling science companies help to bolster the venture capital interest.

- The Center for Emerging Technologies has a 92,000-square-foot facility. CET tenants have attracted more than $500 million in funding since 1998. The incubator was named one of the top 10 incubators in the country by the National Business Incubation Association and is part of the CORTEX life science district in midtown St. Louis.
- The Nidus Center for Scientific Enterprise is a 40,000-square-foot facility containing 24 labs with wet/dry capability that serves clients who are refining and preparing new biotechnology and healthcare-related technologies for market.

Long home to international corporate giants and major industry drivers such as Monsanto, Mallinckrodt Pharmaceutical Group, Sigma-Aldrich, and now the Pfizer St. Louis Laboratories, Johnson & Johnson's Centocor Biologics, and Solae Company, the St. Louis region has an active and growing commercial plant and medical sciences community. In total, nearly 400 plant and life science enterprises employing 15,220 people call the St. Louis region home.

The St. Louis market consists of several submarkets including and surrounding the city of St. Louis. In order to provide specialized facilities for the growing number of both new and existing biotech companies in and around St. Louis, a number of efforts are underway to develop biotech neighborhoods and research centers.

St. Louis submarkets:

- The Danforth Plant Science Center in Creve Coeur envisions an eight-acre development and up to 180,000 square feet of space in three buildings.
- CORTEX, a joint venture between five major research institutions, will develop a biotech neighborhood. CORTEX's first building, a speculative 170,000-square-foot, state-of-the-art office/laboratory facility which opened in 2005, is now home to Stereotaxis, Inc., a publicly traded company that makes surgical equipment for cardiac procedures. The Siteman Center of Cancer Nanotechnology Excellence is also a tenant.

The West St. Louis County Highway 40/I-64 submarket boasts Pfizer's laboratories. Pfizer's $200 million expansion of its Chesterfield campus will contain a 330,000-square-foot research building to hold 250 researchers focused on potential medicines to treat cardiovascular disease, respiratory diseases, pain and inflammation, and chronic obstructive pulmonary disease. When complete in 2008, more than 1,000 Pfizer employees will be located at the site.

The Missouri Research Park, 130 acres developed for high-technology research functions, is located within the St. Charles County Highway 40/I-64 submarket. AFB International, one of the world's largest suppliers of pet food flavors, is expanding into an 83,000-square-foot building in the park.

The Illinois submarket just opened a new 11,000-square-foot Biotechnology Laboratory Incubator inside the 330-acre University Park at Southern Illinois University Edwardsville. The incubator includes 12 biology and chemistry labs.

Elsewhere:

- KV Pharmaceutical Company, a manufacturer of generic pharmaceuticals, invested $135 million in three facilities in St. Louis County. The facilities involve both R&D and manufacturing functions.
- Mallinckrodt Pharmaceuticals opened a new state-of-the-art 72,000-square-foot research and development facility in Webster Groves in St. Louis County. Nearly 100 employees are formulating active pharmaceutical ingredients for generic pain relief products into tablets, capsules, or liquid at the new center.
- Sequoia Sciences, a San Diego start-up and emerging leader in drug discovery, relocated its headquarters to St. Louis County (I-170 corridor). Sequoia is developing drugs to treat chronic bacterial infections and other diseases in partnership with Washington University in St. Louis.

Credit:
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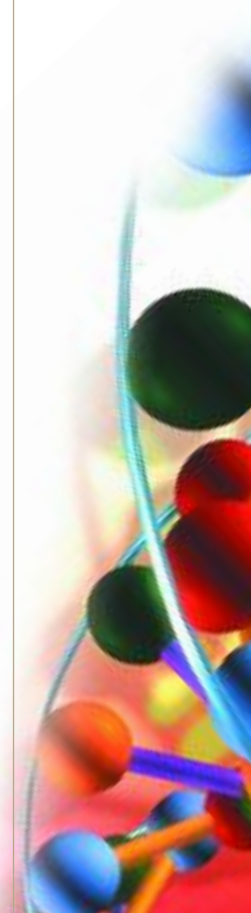


INTERNATIONAL LIFE SCIENCES MARKETS

As stated elsewhere in this report, the international environment is growing increasingly competitive, with foreign governments such as Japan, China, India, Dubai, and Singapore pouring millions of dollars into incentives and new facilities to grow their domestic industries. This section of the report highlights Canada and the European community, the two largest markets for the life sciences industry after the United States.

CANADA

Canada's biotechnology industry is the second largest in the world after the United States. The impressive gains made in Canadian biotech over the past 20 years have been hard to come by. Yet Canada has held its place in the sector and now boasts nearly 500 biotech companies, spending approximately $1.5 billion a year on research. Canada's 81 public biotech companies have a market capitalization of $15.3 billion and raised $160 million in initial public offerings in 2005. Also, Canada is ranked as the least costly jurisdiction among 67 nations in which to conduct research. Biotechnology has already created over 200,000 jobs across the country.

The fact that so many Canadian biotech companies succeed in raising capital and getting their products through the though US regulatory approval process is a testament to the local industry's resilience and determination to compete in the world market. 2005 was one of the best ever for Canadian biotech industry product approvals.

Apart from an impressive range of new and better drugs to fight and prevent disease, Canadian biotech discoveries have helped develop food crops that grow in arid soil and provide added nutrients to undernourished populations in developing regions of the world.

While many are confident that continued progress toward new and better treatments for disease, and more efficient methods of producing food will help address the needs of developing countries, the reality is that the development of new therapies is a long and costly process funded mainly by investors who expect a return on their investment. The challenge for Canadian biotech companies remains access to capital and adoption of innovation.

On average, it takes seven to 10 years, and more than $1 billion dollars to bring a product to market. Capital is scarce for early stage investments and the Canadian biotech industry still contains too many small and early-stage companies. The majority of Canada's biotech companies are small- to mid-sized enterprises, with fewer than 50 employees, and have fewer than two years of operating cash available to them.

While Ernst & Young's "Beyond Borders: Global Biotechnology Report 2006" reports that the industry is showing strong revenue growth, a reduction in losses and strong product approvals, the lack of seed funding, and consolidation is reducing the size of the industry in Canada.

Much of the current investment activity focuses on a few profitable companies with significant market caps. For example, the most significant transaction in 2005 was the acquisition of ID Biomedical by GlaxoSmithKline for $1.4 billion. ID Biomedical was one of the 10 largest market cap companies in Canada and had shown significant growth in recent years. In 2006, Sanofi Pasteur, the world's leading vaccine company, announced that a $30 million capital expansion project is underway at its Canadian global manufacturing site in north Toronto.

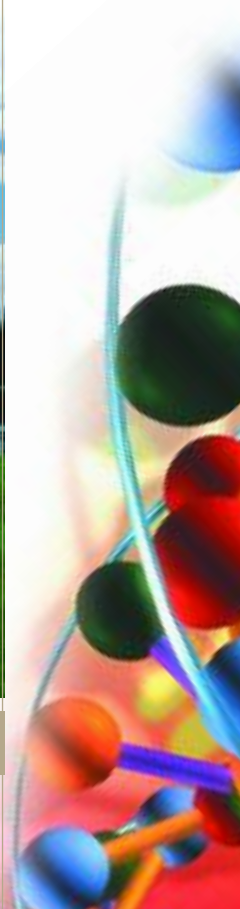
Continued support of the government is critical to ensuring the industry's continued growth. Efforts are ongoing to promote public awareness of the importance of this industry to Canada's economy in order to continue the current strong

public support. The Canadian government is working on an infrastructure that will accomplish three things: attract capital through targeted financial incentives; provide efficient and effective regulatory oversight; and enable the adoption of new products for Canadians. Recently, changes have been proposed to the Scientific Research and Experimental Development Program, a federal program that offers tax breaks to companies that conduct research and development.

The Canadian industry is centered around three major biotech clusters located in Toronto, Montreal, and Vancouver. In Toronto, the largest and most interesting real estate development is the MaRS Centre, located in the heart of the Discovery District. The Discovery District is a partnership of government, academic, and healthcare institutions coming together to form an integrated research environment, serving Canada's and the world's bio-medical discovery community. The Toronto's Discovery District is responsible for over $500 million of research annually, taking research and innovation from bench to bedside, from concept to final product.

MaRS Centre is intended to commercialize this research. Opened in 2005 with 700,000 square feet of space available, MaRS Centre already leases space to a strategic mix of more than 50 companies and organizations comprising leading researchers and technology transfer groups, growth businesses ranging from start-ups to mature companies, venture capital and professional services firms, and community organizations. Phase I of the development also houses the MaRS Incubator, a state-of-the-art incubation facility for young companies; the MaRS Entrepreneurship Centre, a resource center for entrepreneurs, technology start-ups, and emerging growth companies; and the MaRS Collaboration Centre, a high-tech auditorium for delivering MaRS programs and hosting community events. Phase II of the development will see MaRS Centre build out another 800,000 square feet, with a targeted completion date of 2008.

It is anticipated that the momentum of the MaRS project will attract multinational technology businesses and leading research organizations to this development.



EUROPE

The European Parliament's approval of the Seventh Framework Programme (FP7) provides the commitment required to continue the European community's quest to become "the most dynamic and competitive knowledge-based economy in the world." A continuation of the Framework Programme established in 1984, FP7 became active on January 1, 2007 at the expiration of FP6. The main focus of the current program is the creation of a European Research Area focusing on scientific excellence, improved competitiveness and innovation through the promotion of increased cooperation across nations at all levels of the life science industry. It also established a new European Research Council (ERC) comprised of 22 independent scientists, including seven life scientists who will oversee strategic efforts to develop the life science industry in Europe and award grants for basic research based on peer review. The ERC has 7.5 billion Euros ($9.9 billion US) to support it during its first seven years. The grants will provide each recipient with between 500,000 and 2 million Euros ($660,000 to $2.6 million US) to support their work for up to five years. Around 200 grants are expected to be awarded each year.

According to Ernst & Young's "Beyond Borders: Global Biotechnology Report 2006," the European life science industry is stronger than in past years, with more companies reporting higher revenues and investing more in research and development than ever before. The number of IPOs have increased, as have employment numbers. Areas of focus include therapeutics, followed by genomics, proteomics and enabling technologies. Investment is increasing as are the number of new products in clinical development. The distribution of the industry across Europe has not changed significantly, with Germany providing a strong presence and the UK having the largest number of public companies.

However, Ireland, more than any other European country, has been at the forefront and has taken the world as a major competitive force in the biotechnology market. Government investment in a number of strategic industries has been the main force behind this success, and the life sciences and IT industries are the leading drivers. As these industries have developed, so too has Ireland's offering, with the country continually looking at and addressing the emerging trends, thus ensuring a successful ongoing relationship with the overseas and indigenous companies that have been the anchor of Ireland's accomplishments.

Ireland has grown a globally significant life sciences industry. Today, there are more than 170 companies employing 35,000 people in the pharmaceutical/chemical, biopharmaceutical, medical devices, and diagnostics industries. Together, these sectors have generated more than $52 billion in exports in 2005. Nine of the world's top 10 pharmaceutical companies have major operations in Ireland. Great success continues to come out of Ireland, especially with the country's performance driven by operational excellence, strong infrastructure, government financial incentives, and free access to the large European Union market of 450 million people.

Significant biomanufacturing is taking place throughout Ireland in companies such as Allergan, Schering Plough, and Genzyme. There is strong activity also with the formation of a number of Irish companies including Biotrin, Archport, Trinity Biotech, and EiRx.

One of the most interesting developments in recent months is the pre-approval of a biopharma campus in Galway on the west coast of Ireland. This is a fully permitted biopharma campus with unparalleled flexibility. The 67-acre construction-ready site includes planning permission for water purification buildings, waste water treatment facilities, laboratory, fermentation, purification, and fill finish buildings, along with all the other ingredients necessary to implement a fully operational pharmaceutical and biopharmaceutical campus.

The activities of the world's top companies combined with research efforts of the universities and increasing involvement by the hospitals in clinical research coupled with proactive government support has created a major cluster with a vibrant networked professional community in Ireland.

Sources: "Ireland's Biotech Boom" by Samara McCarthy – 4/14/2006- www.bio-itworld.com
Sept. 2006 Milken Institute Report – "Mind to Market: A Global Analysis of University Biotechnology Transfer and Commercialization"

Colliers International extends its appreciation to our real estate professionals throughout the world who contributed their expertise and time to Elements 2007. Numerous Colliers International real estate professionals, partners and state and local economic development experts, credited in the individual sections, provided valuable insights on trends they see in the industry and specifically, in their life science markets, as well as authored the various articles contained in this publication. The generous contribution of their time, expertise and effort is greatly appreciated.

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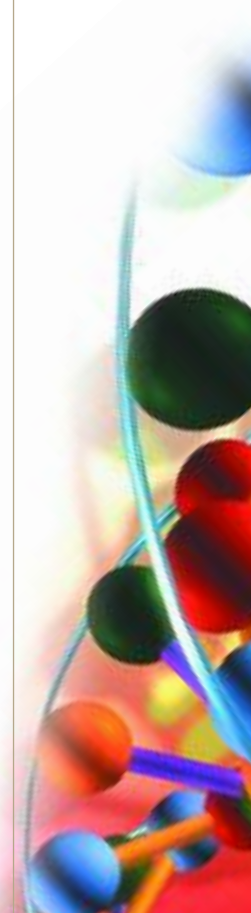

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