THE GREATER PHILADELPHIA LIFE SCIENCES CLUSTER 2009
An Economic and Comparative Assessment

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Executive Summary
Our analysis measures the relative strength of Greater Philadelphia’s life sciences cluster, comparing its performance to that of other leading metro areas around the country.

- Greater Philadelphia moves up to 2nd place in the Overall Composite Index with a score of 97.7, up from its 3rd-place ranking in our 2005 analysis.
- Greater Philadelphia claims the top spot in our Current Impact Composite Index, increasing its lead over Greater New York to 7 points, after holding a slim lead of only 0.3 point in 2005.
- In the Innovation Pipeline Index, Greater Philadelphia remains in 3rd place, maintaining its 2005 ranking but largely closing the gap with 2nd-ranked Greater San Francisco.
- Greater Philadelphia’s weakest performance was in the Small Business Vitality Index, where it placed 9th overall.
- After accounting for the ripple effects, the life sciences sector in Greater Philadelphia was responsible for generating 380,800 jobs, $20.2 billion in earnings, and $39.7 billion in output in 2007.
- Fifteen percent of all economic activity and one out of every six jobs in Greater Philadelphia can be traced back to the life sciences.
- Greater Philadelphia is a vibrant life sciences cluster with many advantages that can be further exploited to spur continued growth.

Executive Summary

Breakthroughs in the life sciences are changing the way we live and work. Advances in understanding of diseases, personalized medicine, stem-cell research, and many other areas promise major transformations by developing new therapies and modernizing the way health care is delivered.

Cutting-edge R&D, high-tech manufacturing, and medical services are not only providing new treatments; they’re creating millions of high-paying jobs along the way. As economic activity is increasingly based on intangible assets, life sciences clusters at the leading edge of innovation will exhibit more rapid growth—and will be less likely to see the benefits escape to other regions.

The growth of Greater Philadelphia’s life sciences cluster is primarily the result of its position as a major center for the U.S. pharmaceutical industry and its strong local research infrastructure, which includes some of the nation’s top-ranked universities. The region’s eclectic mix of university research, world-renowned teaching hospitals, technology spin-out companies, and other startups, all interacting in a network, encourages companies to establish operations and grow in Greater Philadelphia. Underpinning all this interconnected activity is an evolving support network for entrepreneurs, including venture capitalists, high-tech absorptive capacity, and providers of professional services.

In this study, we revise and extend our original 2005 analysis of the Greater Philadelphia life sciences cluster relative to ten other leading clusters in the United States. We begin by benchmarking where Greater Philadelphia stands in the current continuum. We analyze its ability to innovate, commercialize research, and sustain long-term competitiveness. We demonstrate the multiple economic contributions of the sector by calculating the direct, supply chain, and total ripple effects of the life sciences in Greater Philadelphia.
In this updated study, we have added a new Small Business Vitality Index that evaluates the success of each metro area in creating new entrepreneurial firms, which constitute the lifeblood of cluster sustainability. Lastly, we highlight case studies of firms that are illustrative of corporate social responsibility efforts in the region.

**Current Impact Assessment**

The Current Impact section analyzes the economic impact and growth of the life sciences industry in the Greater Philadelphia area, while offering a similar benchmarking assessment for ten other leading metropolitan regions. The life sciences encompass six major industries: pharmaceuticals, biotechnology, life sciences R&D, medical devices, health-care services, and supporting industries. The following four categories fall under the umbrella of **therapeutics and devices**:  
- pharmaceuticals  
- medical devices  
- biotechnology  
- R&D in the life sciences

We also measure the **health-care services industry** and the **life science–supporting industries**, since the growth of a cluster is fueled by its interaction with a metro's hospitals, medical practitioners, and other fast-growing, knowledge-intensive industries related to the sector. Health-care-related industries (including medical laboratories and diagnostic imaging centers) bolster the growth of life sciences clusters.

We analyze each industry using seven measurements, which together comprise the results of the current impact index:

- employment level in 2007  
- location quotient (LQ)\(^1\) in terms of employment in 2007  
- relative employment growth from 2002 to 2007  
- number of establishments in 2007  
- number of life sciences industries with location quotients greater than 2.0  
- number of life sciences industries with location quotients less than 0.5  
- number of life sciences industries growing faster than their U.S. counterparts from 2002 to 2007

Greater Philadelphia claims the top spot in our Current Impact Composite Index, followed closely by Greater New York and Boston (Boston has moved from 4th place in our 2005 study to take 3rd place). While the previous study saw Greater Philadelphia beating out Greater New York by only 0.3 index point, that lead has increased to 7.0 index points.

Greater Philadelphia has maintained its dominant position in pharmaceuticals, but its strengthened position in Current Impact is attributable to advances in biotechnology R&D (which boosted its position to 1st in therapeutics and devices from 3rd in our 2005 study) and continued top-tier performance in health-care services and life science–supporting industries. Improved access to pre-seed, seed, and early-stage risk capital is helping to elevate its status in biotechnology.

### Current Impact Composite Index

<table>
<thead>
<tr>
<th>Rank</th>
<th>Metro area</th>
<th>Therapeutics and devices</th>
<th>Supporting industries</th>
<th>Health-care industries</th>
<th>Composite score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Greater Philadelphia</td>
<td>100</td>
<td>100</td>
<td>81</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>Greater New York</td>
<td>88</td>
<td>76</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>Boston</td>
<td>99</td>
<td>67</td>
<td>61</td>
<td>91</td>
</tr>
<tr>
<td>4</td>
<td>Greater San Francisco</td>
<td>86</td>
<td>74</td>
<td>49</td>
<td>81</td>
</tr>
<tr>
<td>5</td>
<td>Greater Raleigh-Durham</td>
<td>88</td>
<td>63</td>
<td>44</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>Greater Los Angeles</td>
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<td>Minneapolis</td>
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<td>71</td>
<td>42</td>
<td>72</td>
</tr>
<tr>
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<td>San Diego</td>
<td>74</td>
<td>51</td>
<td>36</td>
<td>67</td>
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<tr>
<td>10</td>
<td>Washington, D.C.</td>
<td>62</td>
<td>39</td>
<td>68</td>
<td>63</td>
</tr>
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<td>11</td>
<td>Seattle</td>
<td>55</td>
<td>31</td>
<td>50</td>
<td>54</td>
</tr>
</tbody>
</table>


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1. The location quotient is an index for comparing a metro’s share of employment in a particular industry relative to that of the national share. A metro with a location quotient greater than 1.0 has a higher concentration of life sciences employment relative to the United States as a whole.
Innovation Pipeline

A vibrant and competitive life sciences industry must be supported by a strong and efficient innovation pipeline. The life sciences innovation pipeline is composed of economic elements that facilitate the industry’s technological advances and production. We analyzed the innovation pipeline of Greater Philadelphia with a view toward determining its capacities to generate and commercialize ideas, research, and health advances relative to other leading centers.

As in our previous study on Greater Philadelphia’s life sciences cluster, the innovation pipeline consists of five components:2

- research and development (R&D) capacity
- risk capital and entrepreneurial infrastructure
- human capital
- workforce
- innovation output

The results show that Greater Philadelphia retained its 2005 rank of 3rd place, just behind Boston and San Francisco. It is notable, however, that Greater Philadelphia largely closed the gap that previously existed with 2nd-place San Francisco. Remarkably, however, Greater Philadelphia sprung into the top percentile in this study, in contrast to the results of our 2005 analysis, in which only Boston and San Francisco posted scores above 90 points.

The foundation for Greater Philadelphia’s performance is firmly established in four of the five components. With the exception of research and development capacity, Greater Philadelphia performed substantially better than the eleven-metro average.

Small Business Vitality

The Small Business Vitality Index evaluates how successful regions are in creating new entrepreneurial firms, which are the lifeblood of cluster sustainability. Small firms often embody entrepreneurial values and cutting-edge ideas. The underlying importance of entrepreneurship can be illustrated by the value attributed to it by governments in different regions around the world. Engagement of entrepreneurs and small firms in supporting philanthropic and charitable activities can greatly support a community as well.

Entrepreneurs represent innovation and thus trigger heightened competition and higher expectations in a market.3 Entrepreneurial endeavors are a particularly critical element in the Greater Philadelphia area, given its dependence on the cutting-edge research and innovations of the life sciences industry. Our analysis focuses on small firms that have fewer than 20 employees in our comparisons.

Juxtaposed against the other ten leading metros, Greater Philadelphia showed moderate strength in the performance of its small life sciences firms. Despite strengths in its pharmaceutical industry, small firms in the therapeutics and devices field in the region showed only modest growth of 21 percent between 2002 and 2007.

Greater Philadelphia placed 9th overall in Small Business Vitality. It has yet to develop the entrepreneurial sophistication of such places as Greater San Francisco, San Diego, Boston, Greater Los Angeles, or Greater Raleigh-Durham.

3. Benjamin Yeo, Developing a Sustainable Knowledge Economy. The Influence of Contextual Factors (Germany: VDM Verlag, 2009).
Multiplier Impacts

The life sciences sector in Greater Philadelphia provides significant value to local residents and an enormous amount of wealth to the region overall. Its economic contribution to the region goes well beyond simply direct impacts, which include the jobs it generates, the earnings it provides to workers, and the output it creates. In order to capture the full contribution of the economic impacts stemming from the industry and its location, we apply unique coefficients, known as "multipliers," to the specific life sciences industries.

The extent of such an impact is typically determined by analyzing the length and characteristics of the supply chain throughout the region. Pharmaceutical and biotech manufacturing has one of the highest employment multipliers in the region and is high across the country. Supplier industries, outside contractors, and other businesses catering directly to the life sciences are part of this tightly knit network. Their presence is a key part of the industry’s indirect impacts. The supply chain activity generates yet more income for the region’s residents, who in turn recycle it back into the economy. These consumption effects are termed induced economic impacts.

In 2007, the life science sector in Greater Philadelphia employed 94,400 workers, including those who provide health-care services consumed by non-residents. Out of that total, nearly 60 percent (or 56,300 jobs) stem from therapeutics and devices. The remaining 40 percent consist of health-care service jobs that were generated through export-driven activity outside the region. In determining the portion of health-care services not consumed locally, we examine the relevant location quotients from our current impact assessment.

The region’s life sciences sector generated $7.7 billion in earnings and $17.5 billion in output or gross metro product (GMP) in 2007. In both cases, the therapeutics and devices segment accounts for the largest share of the earnings and output created by the overall life sciences sector.

After accounting for the multiplier impacts, the life sciences sector in Greater Philadelphia is responsible for 380,800 jobs, $20.2 billion in earnings, and $39.7 billion in output based upon 2007 information. In other words, the life sciences both directly and indirectly drive roughly 15 percent of all economic activity in the region. Furthermore, one out of every six jobs in Greater Philadelphia can be traced back to the life sciences. The chart below explains the breakdown of the total impacts in Greater Philadelphia once the multiplicative dynamics have been taken into account. On top of direct employment, an additional 286,400 total jobs are generated as a result of the life sciences; 158,700 are created indirectly and 127,700 more arise from induced impacts.

In other words, for every job created in the region’s life sciences sector, three additional jobs are created elsewhere. Similarly, in terms of earnings, an additional $12.6 billion dollars is created after filtering through other sectors.

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4. Through their RIMS II program, the Bureau of Economic Analysis (BEA) assigns multiplicative values to regional industries.

5. The existence of therapeutics and devices alone creates economic activity throughout the health-care services sector that would be consumed locally. Therefore, applying the multiplier to therapeutics and devices would result in jobs, earnings, and output created in health-care services. However, it would not account for the incremental activity brought on by demand from outside the region. To do this, we take the location quotient for the relevant health-care industries. If the LQ exceeds 1.0 for any given health-care industry in the region, we calculate only the portion that exceeds the national average. If we were to apply the entire health-care service employment in the region to its respective multiplier, we would be effectively double-counting.
Overall Composite Index for Life Sciences

<table>
<thead>
<tr>
<th>Rank</th>
<th>Metro area</th>
<th>Current Impact</th>
<th>Innovation Pipeline</th>
<th>Small Business Vitality</th>
<th>Overall Composite Index score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boston</td>
<td>91.3</td>
<td>100.0</td>
<td>87.4</td>
<td>100.0</td>
</tr>
<tr>
<td>2</td>
<td>Greater Philadelphia</td>
<td>100.0</td>
<td>91.7</td>
<td>63.9</td>
<td>97.7</td>
</tr>
<tr>
<td>3</td>
<td>Greater San Francisco</td>
<td>80.7</td>
<td>93.2</td>
<td>91.1</td>
<td>92.1</td>
</tr>
<tr>
<td>4</td>
<td>Greater New York</td>
<td>92.7</td>
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<td>72.2</td>
<td>92.0</td>
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<tr>
<td>5</td>
<td>Greater Raleigh-Durham</td>
<td>79.7</td>
<td>87.4</td>
<td>85.0</td>
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</tr>
<tr>
<td>6</td>
<td>Greater Los Angeles</td>
<td>79.0</td>
<td>61.7</td>
<td>100.0</td>
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<tr>
<td>7</td>
<td>Chicago</td>
<td>76.4</td>
<td>77.0</td>
<td>69.5</td>
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</tr>
<tr>
<td>8</td>
<td>San Diego</td>
<td>66.9</td>
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<td>9</td>
<td>Minneapolis</td>
<td>72.2</td>
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<tr>
<td>10</td>
<td>Washington, D.C.</td>
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<td>Seattle</td>
<td>53.5</td>
<td>80.2</td>
<td>54.5</td>
<td>69.2</td>
</tr>
</tbody>
</table>

Weights: 0.45, 0.45, 0.10

**Overall Composite Index**

Our Overall Composite Index of the life sciences provides a single comprehensive measure of how Greater Philadelphia is positioned against the elite clusters in the United States. We utilize the Current Impact, the Innovation Pipeline and the Small Business Vitality indices created in our earlier detailed assessment to arrive at an overall result. This combination produces a powerful assessment tool in analyzing how life sciences clusters compare.

Greater Philadelphia moves up to 2nd place in the overall composite with a score of 97.7, up from its 3rd-place finish in our 2005 analysis. It achieved this, in part, by increasing its 1st-place advantage in the Current Impact Assessment to 7.0 index points, from a margin of just 0.3 in 2005. Despite remaining in 3rd place in the Innovation Pipeline Index, Greater Philadelphia largely closed the gap with 2nd-place Greater San Francisco. Once lagging by 4.4 points, Greater Philadelphia is now only 1.5 point behind in this year’s analysis. Its weakest performance was in Small Business Vitality. Among establishments with twenty or fewer employees, it came in at only 9th place.

**Conclusion**

Greater Philadelphia is a vibrant life sciences cluster with many distinct advantages. Boston remains in 1st place in our overall results, but it now leads by a slimmer margin. Boston has higher concentrations of medical devices and biotechnology than Greater Philadelphia, which has its historical roots in the pharmaceutical industry. Boston’s leading universities are scientific research stalwarts with a long history of active participation in the commercialization ecosystem. University-based startups in Greater Philadelphia are just above the eleven-metro average, indicating that its extensive strengths in research have yet to be fully captured in the region’s economy.

While it is closing the risk capital gap with Boston and Greater San Francisco, Greater Philadelphia does not have the extensive network of collaborating agents in place that these other metros have developed. Greater Philadelphia has been able to offset this disadvantage with massive amounts of industry R&D in the life sciences, principally at its pharmaceutical firms.

A broader view of the future direction of the life sciences in Greater Philadelphia reveals both challenges and opportunities. It is a reality that market forces are causing consolidation in the pharmaceutical industry, and many jobs will be eliminated in the process. On the other hand, if its rich human capital base can be quickly redeployed—by attracting biotech firms, starting more of its own, and growing them to maturity—Greater Philadelphia could evolve into the top life sciences cluster in the world. Enhanced research collaboration between biotech and pharmaceutical firms, leveraging the pharmaceutical industry’s knowledge of stewarding compounds through FDA clinical trials procedures, along with the excellent clinical trials management capabilities resident in the region, provides Greater Philadelphia a unique opportunity for future growth.