

Chicago Fed Letter

High-technology in the Midwest—Biotech and beyond

by William A. Testa, vice president and senior economist

Industrial production long was the heartbeat of the Midwest economy. As that industry's role in the region diminishes, policymakers have explored new directions. At a series of conferences, local experts discussed the potential of the biotech industry as the Midwest's next frontier.

Although the Midwest is home to significant research and development (R&D) activity, this role has not led to an abundance of start-up companies or rapid growth of emerging technology industries. In 2005, the Economic Development Council of Chicago (EDC), the Federal Reserve Bank of Chicago, and other local organizations sponsored a series of meetings to analyze the potential in Chicago and the surrounding region to commercialize technology, along with attendant policy issues and possible economic development strategies.

This *Chicago Fed Letter* reports on those discussions.¹

At a conference at the Bank on April 26, 2005, Chicago Fed President Michael H. Moskowitz noted that Chicago must continually reinvent itself if it is to sus-

tain its high standard of living and its size and importance. No longer having industrial production as its dominant activity, Chicago is now a "learning city," a business meeting center for the nation and the world, a corporate headquarters for the mid-continent, and a business services city that sells to

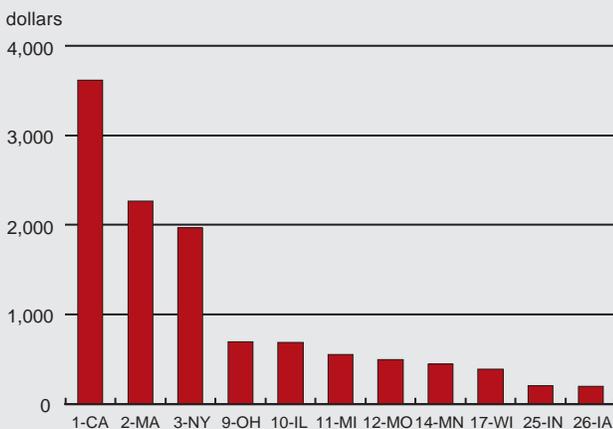
the broader Midwest region, to the nation, and to global markets. But are these economic strengths sufficient? How might emerging technologies and associated new firm creation contribute to Chicago's future?

For some cities, such as San Francisco, Seattle, Boston, and Austin, TX, industry sectors centered on emerging technologies have contributed significantly to revitalizing the local economy. However, in the Chicago area, these sectors—measured by commercial activity rather than R&D—are somewhat small relative to Chicago's economic size and R&D performance. Especially in biomedical science, Chicago's degree of new firm formation appears undersized, given the significant R&D dollars flowing to the region's universities, hospitals, and federal laboratories. If this spending implies a significant potential for technology-driven growth in Chicago, what types of efforts from the public and private sectors might help bring about its full development?

Experience from other regions indicates that technology companies tend to multiply and grow most rapidly in "economic clusters." Clusters are groups of like-minded and highly interrelated firms situated in proximity. Cluster firms' proximity, composition, and relationships are conducive to creating new firms and regenerating economic activity.

Once a high-tech cluster exists, it is somewhat resistant to competitive inducements from other locations. That is partly

1. NIH state funding, 2004



NOTE: Total funding from National Institutes of Health (NIH) to the Midwest was \$3.6 billion, representing 16% of the U.S. total.
SOURCE: National Institutes of Health.

because both firms and workers with specialized skills benefit from their proximity. By working in the cluster, the skilled worker gains a form of job security from the myriad employment opportunities at hand in the event of a job change, as well as a strong chance for career advancement at a number of nearby firms. Some of these workers go on to create new businesses of their own. Firms in a cluster benefit from the ability to hire skilled workers quickly and at a reasonable cost when a growth opportunity emerges. In addition, firms often choose to locate in a cluster because there are “ideas in the air.” Locating elsewhere might mean missing out on an emerging technology or key industry direction. Of course, the presence of key business service activities—especially a venture capital community and specialized legal services—are also important to firms.

What policies might support the development of a cluster? And if public investment is made, how is success to be measured?

Biotech landscape

Much of the March 22 conference discussion of Midwest performance and strategy centered on the biopharmaceutical industry, an emerging growth sector of small companies and innovative products that has expanded steadily in the U.S. in recent years. Although the Midwest is home to a number of large drug and medical device manufacturers, including Eli Lilly and Co. (headquartered in Indianapolis), Abbott Labs and Baxter (Chicago), and significant Pfizer research/production facilities (in Michigan), none of the nation’s most prominent biotech companies is based here. Still, policymakers are cautiously optimistic about this sector because the big pharmaceutical companies are increasingly looking to biotech companies as their pipeline to new and innovative products. Nationally, this younger breed of companies is only now coming to maturity after decades of development: Over the past two years, biotech firms have brought more new drugs to market than the earlier generation of pharmaceuticals.

Rising health care demand ensures that the global industry (and private sector financing of new companies) will remain robust. The U.S. government funding for basic R&D also has been growing strongly. The National Institutes of Health

(NIH), the largest government funding agency of its kind, has increased its research funding by more than 2.5 times since 1997, to more than \$26 billion for 2004.

Recent growth in the biopharmaceutical industry, along with its strong growth prospects, have made biotech firms coveted development prizes for local and state economies. Though still modest in size—an estimated 407,000 workers nationwide in 2003—the industry has been gaining job share, especially since the mid-1990s.² Moreover, studies such as those produced by the Milken Institute claim that these companies spur growth in other sectors of the local economy, including retail, wholesale, and business services. In addition, because they generally employ highly skilled workers, biopharmaceutical companies often pay more than those in other sectors.

So far in the Midwest, proximity to big pharmaceuticals has not been sufficient motivation to give rise to a crop of start-up companies or research alliances. A study by Joe Cortright of Impresa identified nine national centers of biotech activity—Boston; the San Francisco Bay Area; San Diego; Washington, DC; Raleigh-Durham, NC; Austin, TX; Seattle; Los Angeles; and Philadelphia.³ These nine centers dominated 51 large U.S. metropolitan area in the following criteria: NIH funding, patents filed, venture capital, R&D alliances, new firms, and large firms. The nine centers averaged over \$800 million in NIH research funding in 2000, versus an average of \$104 million for the remaining 42 metro areas (among them, Chicago), with ten times as many biotech-related patents filed and 35 times as much venture capital going to biotech companies. Clearly, biotech industry activity is marked by a high degree of spatial clustering.

Cortright further argued that the clustering tendency has been sharpening rather than diminishing in recent years in terms of venture capital, new firms, and alliances. Accordingly, many of the regions that are now chasing a share of the existing or future biotech are doomed to fail. Their efforts are “expensive, risky, and time-consuming.” A prominent example is Florida’s recent public subsidy package, reportedly worth between \$700 million and \$800 million to The Scripps Research Institute, to locate a research facility in the Palm Beach area.

Are all regions aside from the top nine destined to fail? One conference participant cited the San Diego area as a late entrant into the group of nine, so it may be quite logical for other regions with complementary characteristics to encourage biotech development. However, to be successful, those regions need to understand and possess many of the elements that are conducive to the development of industry clusters. One necessary condition for a thriving biotech industry is a strong local research base. Most of the nine biotech centers feature a strong academic R&D base in the biosciences, although Philadelphia and Los Angeles do not stand out in this regard. However, it is also true that a strong R&D base is not sufficient in itself to give rise to the development of new firms. Indeed, Cortright’s study identifies four U.S. metro areas as scoring very high as “research centers,” but lacking in commercial biotech activity. These four metro areas are St. Louis, Detroit, Chicago, and Houston.

Given this strong base, why aren’t midwestern states performing better in commercialization of research into new firms and alliances? Speaking at the Chicago Fed on April 26, 2005, Dan Broderick, principal at Mason-Wells Co., a Milwaukee-based venture capital firm, suggested that, taken as a whole, research activity in Midwest states is prodigious. For example, NIH funding in the Midwest equaled \$3.2 billion in 2003, which is 17% of the U.S. total (figure 1). However, this activity may be too geographically dispersed to easily generate the interactions among firms and with potential investors that ultimately lead to clusters. Accordingly, he argued, Midwest states should focus on policies that tie their activities together and otherwise encourage maximum effectiveness of existing biotech industry associations and government incentive programs. One important arena is venture capital flow, a measure in which the Midwest lags national benchmarks. Broderick suggested that greater cooperation or even consolidation among state venture capital associations would enable venture capitalists to review potential deals more quickly, thereby boosting Midwest inroads into the biopharmaceutical arena. As a private sector initiative toward the same end, Broderick directs the Mid-America Healthcare Investors Network (MHIN), a recently formed association of over 40 member firms to share expertise and

2. Technology indicators at Midwest university research consortium members

State	New disclosures	New U.S. patents filed	U.S. patents issued	Options and licenses executed	License revenue (\$000s)	New start-ups licensed
Illinois	570	310	183	124	15,399	9
Indiana	267	188	53	99	5,219	7
Iowa	209	94	53	231	14,473	2
Michigan	378	190	112	109	45,566	11
Minnesota	444	130	123	189	47,983	4
Missouri	150	95	63	43	15,476	3
Ohio	435	90	71	96	14,805	9
Wisconsin	446	165	90	184	38,318	2
Total	2,899	1,262	748	1,075	197,239	47

SOURCE: Midwest Research University Network.

promote deal syndication and health care investing opportunities in the Midwest.

Universities are often a major source of technology that can be commercialized. But the Midwest's flagship research universities are notably dispersed, not only from each other, but also in many cases from the major commercial cities in their home states—for example, the major research centers of the state university systems of Illinois, Indiana, and Wisconsin, respectively, are in Urbana-Champaign, Purdue, and Madison—not Chicago, Indianapolis, and Milwaukee. Locating university research centers in commercial hubs would facilitate companies' and venture capitalists' search for and review of technologies. Alternatively, Midwest universities might be more effective through cooperative activities and ventures.

Among key Midwest research universities, such cooperative efforts have already begun. At the May 19 conference, David Gulley, assistant vice chancellor for research at the University of Illinois, described the efforts of the Midwest Research University Network (MRUN). MRUN was established in 2002 as an alliance of university business development professionals to facilitate technology development, notably through start-up formation. Eighteen MRUN member institutions exchange information about financing, placement of management talent, and opportunities for collaboration. In all activities, not just bioscience, MRUN member organizations licensed 47 start-up companies in 2003 and accrued \$197 million in revenues from licensing agreements (figure 2).

The Midwest can also learn from the experiences of other places in the U.S. and

around the world. At the April 26 conference, Susan M. Walcott, professor of geography at Georgia State University, offered her perspectives on biotech cluster regions around Indianapolis, San Diego, Atlanta, and the research triangle in North Carolina, along with emerging centers in China and India. Walcott added several important conditions for successful commercialization of technology and research: a culture of encouraging effort and of trying again after failures, active local institutions for information exchange, a high quality of life to attract and retain knowledge workers, and a specialized business infrastructure such as programs to develop university research.

In addition, networking among local bioscientists and interested businesspeople can be critical. Often, a leading individual, corporation, or organization can be instrumental in promoting local biotech growth. For example, Indianapolis benefited from the commitment of Eli Lilly and Co., whose involvement supported a closely networked set of facilities, suppliers, university partnerships, and ultimately start-ups. In San Diego, networking efforts such as CONNECT (an early stage venture and seed capital network) and BIOCUM (the overall biotech community association) have encouraged joint ventures and start-ups alike.

Undoubtedly, the weather in San Diego has also helped the area to retain graduates of the University of San Diego, recruit star scientists, and encourage entrepreneurs to start new businesses. Many of these new business owners left existing local companies and chose to stay in San Diego. The lesson for the Midwest is that mentoring by the region's successful company leaders is to be encouraged, along with efforts to enhance

the quality of life and the development of local amenities.

While the U.S. continues to dominate biotech activity around the globe, many new clusters have developed overseas—for example, in Suzhou-Shanghai (China), Stockholm, Singapore, Hyderabad (India), Munich, and Jerusalem. The public and public-private efforts that have supported the growth of these clusters largely reflect local conditions, government structure, and culture.

Developing technology centers

At the May 19 meeting, Diane Palminteri, founder and president of Innovation Associates, Inc., discussed the specific actions and programs that regions can pursue in growing technology sectors. It is not sufficient for universities to provide the research base upon which clusters are built; they must also make a commitment to pursuing commercialization opportunities and provide rewards and incentives for those who succeed in transferring their research to the business sector. In this regard, the University of Wisconsin-Madison is a notable regional leader, having launched four start-up companies in 2003. National leaders MIT and Stanford launched 17 companies each that same year. Well-funded research activities are a huge starting point for any commercialization success. In this, private companies and industries represent an important source

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Chicago Fed Letter is published monthly by the Research Department of the Federal Reserve Bank of Chicago. The views expressed are the authors' and are not necessarily those of the Federal Reserve Bank of Chicago or the Federal Reserve System.

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ISSN 0895-0164

of funding to supplement that provided by government. Private support is particularly important to the development phase of commercial technology, such as licensing and very early stage product development. Successful universities often facilitate access to seed capital and also provide management services to their scientist-entrepreneurs. Mentoring of fledgling companies by successful scientist-entrepreneurs is also often helpful in university programs.

How do cities and states leverage university resources? Coordinated strategic efforts can be aimed at increasing federal and state funding and building university-centered initiatives. These include enlisting private industry and foundations to help promote and fund science and technology initiatives, encouraging the development of seed capital and investor networks, and seeking CEOs who have been successful in building businesses to mentor or champion new firm formation in the region. Funding “innovation centers” can also combine multiple components of needed resources so as to provide a central focus for university-based community activities. Such components are collaborative R&D, tech “scouting,” seed capital, mentoring, and, most importantly, networking among the many interests.

Beyond biotech

Biotech is perhaps foremost on the minds of Midwest economic development leaders these days, not only because the industry is growing and maturing, but because the nation’s leading biotech

conference, BIO2006, will be held in Chicago, which will highlight the entire Midwest’s biotech technological and economic base. However, biotech is but one of several promising technologies that could either create new industries here or revive the existing economic base. For example, Midwest policymakers are also excited about nanotechnology, which is “the creation and utilization of materials, devices, and systems through the control of matter at length scales less than 100 nanometers.” According to Nik Rokop, president of the Chicago Microtechnology & Nanotechnology Community, who spoke on May 19, the Midwest is unsurpassed in its nano-scientific base, having published more scientific papers in this field than any other U.S. region. On the commercial side, new materials being developed through nano-scientific methods are expected to help keep the region’s manufacturers competitive through new or better materials in production and new products. And while the whole nanotech area is relatively new, many start-ups in the Midwest are already generating revenues.

Importantly, technological areas are increasingly overlapping or “converging,” and interdisciplinary initiatives are common in achieving breakthrough results. For example, biotech tools are increasingly being applied outside of human health, such as in agriculture (e.g., genetically modified crops) and in industrial applications, such as ethanol and other biofuels. So too, advanced computational tools have spawned the research area of “infomatics” in biological applications,

whereby research avenues to drug and material discovery are being sought with computational tools rather than lab experimentation alone. Nano-scale research applications to human health, including diagnostics and drug delivery, are an increasingly important part of human health research. In view of these intersections, policymakers in some metro areas are beginning to develop broader tech promotion and support strategies. Minneapolis–St. Paul is already noted for its broadly diversified and cross-disciplinary success.

Conclusion

Participants in the EDC meetings were asked to volunteer to staff smaller task forces during the summer of 2005 to further explore more specific technology and policy directions and to make recommendations to policymakers and industry associations throughout the Midwest. Their reports will help guide policymakers as they seek to increase the level of development and commercialization of the Midwest’s significant research activity.

¹ Conferences were organized under the umbrella of the Economic Development Council of Chicago and co-sponsored by the Chicago Fed and other organizations. Meeting agendas and individual presentations can be found at the council’s website, www.edcchicago.com.

² See Milken Institute, 2004, *Biopharmaceutical Industry Contribution to State and U.S. Economies*, October.

³ See Joe Cortright and Heike Mayer, 2002, *Signs of Life: Clustering of Biotechnology in U.S. Metropolitan Areas*, Impressa.