

HEALTH & BIOSCIENCE AS AN ENGINE OF ECONOMIC GROWTH

**SELECTED CASE STUDIES, AND THE
IMPLICATIONS FOR ROCHESTER, NY**

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September, 2002
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SUMMARY

The market for health services and bioscience products (particularly pharmaceuticals) is exploding. New drugs and therapies make it possible to address physical conditions that would have been left untreated only a few years before; dramatic new discoveries have increased lifespan and improved quality of life. Furthermore, the pace of innovation in life science continues to accelerate.

This industry can contribute significantly to the economic growth and prosperity of metropolitan economies. CGR examines the experience of six communities with large and expanding life science clusters—Houston, Raleigh-Durham-Chapel Hill, Rochester (MN), Pittsburgh, Cleveland and Birmingham.

Although each community has its own unique story to tell, CGR identified five themes common to the foundation of successful bioscience clusters:

- ❖ **Leadership**
- ❖ **Assistance to Bridge the Gap Between Lab & Market**
- ❖ **Support for Start-up Companies**
- ❖ **Quality of Life**
- ❖ **Timely Public Sector Support**

Catalyzed by the University of Rochester Medical Center (URMC), Rochester has an opportunity to expand the Rochester economy by capitalizing on the potential of this new market. CGR explores the relative advantages of Rochester as a center of bioscience innovation and how the five themes apply to community economic development.

Contributing Staff

Sarah Boyce, Senior Research Associate conducted much of the primary research for this study and drafted the initial report.

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INTRODUCTION

Communities around the world have entered a vigorous competition over the vast and expanding bioscience marketplace. Just as physics led science in the twentieth century, biology's dominance of the twenty-first seems assured. By marrying market muscle to need, the prosperous, aging baby boom generation is fueling astounding achievements in bioscience, ranging from the decoding of the human genome to dramatic new surgical techniques.

Economic Impact of URM & Affiliates

Catalyzed by the University of Rochester Medical Center, Rochester has an opportunity to capitalize on the potential of this new market. The Medical Center is already a major contributor to the regional economy (see CGR's *Building a New Foundation: The University of Rochester Medical Center in the Regional Economy*):

- ❖ The direct payroll of the medical center and its affiliates exceeds half of a billion dollars (one third of all health services payroll); another quarter of a billion dollars in indirect payroll is stimulated by URM & affiliates.
- ❖ About 20,000 jobs can be attributed either directly or indirectly to URM & its affiliates.
- ❖ Health services now contributes as much to direct RMSA payroll as Eastman Kodak; Health services is *twice* the size of the finance, insurance and real estate sector; In economic terms, URM & its affiliates are roughly equivalent to the entire construction industry.
- ❖ Through its research efforts and provision of sophisticated medical services not otherwise available in the community, URM acts as an "exporter," bringing money into the economy from outside sources and preventing Rochester dollars from leaking to Cleveland or New York City. CGR estimates that this kind of activity at the medical center is equivalent to a manufacturing firm with nearly 3,000 employees generating one-quarter of a billion dollars in direct and indirect payroll.

URMC's Vision & Rochester's Future

URMC has acted on its vision of the future by establishing the Aab Institute of Biomedical Sciences in the Arthur Kornberg Medical Research Building. This report studies health and biosciences sector growth in other communities nationwide to:

- ❖ Demonstrate that a successful health and bioscience sector can serve as an engine for economic growth,
- ❖ Identify the common important factors that must be in place to enable a economy to maximize its growth potential, and
- ❖ Assess the readiness of the Rochester community to build on lessons learned in other U.S. metro economies.

HEALTH AS ECONOMIC ENGINE

The business of health *can* transform an economy. Houston, Raleigh-Durham-Chapel Hill and Rochester, MN are well-established concentrations of health care innovation. Over a number of decades, the health services sector in these communities has propelled their economies by attracting substantial external financial resources and by creating opportunity for local entrepreneurs.

More recent achievements are found in Birmingham, Cleveland and Pittsburgh. In all six cases, specific strategic decisions influenced the ability of the health sectors to prosper and catalyze growth in the rest of the economy.

Metro Comparisons, Selected Indicators

Metropolitan Statistical Area	Population	Health Sector Employment, 2000*	Health Employment per 1,000 population	Employment Change (1990-2000)	NIH Funding in 2001	NIH Rank in 2001	NIH Funding per Health Care Worker
Raleigh-Durham-Chapel Hill, NC	1,187,941	45,853	39	183%	\$499,555,167	7	\$10,895
Houston, TX	4,177,646	130,032	31	34%	\$435,250,804	9	\$3,347
Pittsburgh, PA	2,358,695	118,391	50	20%	\$340,007,405	12	\$2,872
Cleveland, OH	2,250,871	112,180	50	40%	\$223,430,746	20	\$1,992
Birmingham, AL	921,106	42,119	46	21%	\$211,630,624	21	\$5,025
Rochester, NY	1,098,201	49,694	45	33%	\$124,358,724	32	\$2,502
Rochester, MN	124,277	26,419**	213	NA	\$115,729,246	37	\$4,381

*Source: Current Employment Survey, Bureau of Labor Statistics, SIC 80 "Health Services"

**Source: 1999 *County Business Patterns*, NAICS 62 "Health Care & Social Assistance"

Houston, Texas

Home to two academic medical centers (Baylor College of Medicine and the University of Texas—Houston Health Science Center) and many other medical facilities, Houston received \$435 million dollars in National Institutes of Health (NIH) research funds in 2001, placing it ninth in the nation. Among national medical centers, Baylor placed seventh with \$221 million in grants.

Houston's achievement can be attributed to its "City of Medicine," the Texas Medical Center (TMC). Generously financed by the MD Anderson Foundation (established in 1936 by cotton industrialist MD Anderson), TMC is a 700 acre, 22 million square foot medical complex housing 42 not-for-profit institutions. In addition to the two medical schools, TMC includes 13 hospitals, two specialty institutions, four nursing schools, and academic programs in virtually all health-related fields. Begun with the equivalent of \$141 million in today's dollars, the MD Anderson Foundation encourages institutions to relocate to Houston by offering free land and city-like services. Baylor College of Medicine relocated from Dallas in 1943 on the strength of Anderson Foundation inducements (Texas Medical Center, 2002).

TMC Economic Impact The Texas Medical Center is a major contributor to the Houston economy. As a unit, TMC institutions employ over 60,000, making the combined entity the community's largest employer. The University of Houston Center for Economic Development and Research estimates \$5.8 billion in direct and indirect spending by the TMC in 2000, with 142,000 direct and indirect jobs adding \$3.8 billion in personal income to the region. TMC institutions recorded 5.4 million patient visits in 2000; nearly 20,000 patients came to TMC institutions from foreign countries.

TMC has a \$9.6 billion economic impact; planned expansion expected to boost employment by 50% over next eight years.

With Rice University, Texas Southern University and the University of Houston in close proximity, Houston's Texas Medical Center exemplifies the economic value of concentration. The result of a focused, well-funded and long-lasting initiative, Houston is poised for continued growth as expansion of the bioscience market continues to accelerate.

Raleigh-Durham-Chapel Hill, North Carolina

Recipient of half a billion dollars in NIH research grants in 2001, the Raleigh-Durham-Chapel Hill MSA ranks seventh in the nation. Attracting nearly \$11,000 from NIH for every health care worker, its focus on research leads the top ten NIH metros, as well as our list of comparison metros. The Raleigh-Durham-Chapel Hill bioscience concentration is anchored by the Duke Medical Center (10th in NIH funds) and the University of North Carolina-Chapel Hill Medical Center (14th in NIH funds).

Similar to Houston, the success of the Raleigh-Durham-Chapel Hill economy can partly be attributed to a real estate initiative, the Research Triangle Park. By creating a climate that fosters innovation and facilitates the establishment of new firms, the Research Triangle Park is able to capture the business development potential of research being conducted at Duke, UNC-Chapel Hill and North Carolina State University.

Within the Pharmaceutical/Biotechnology Cluster, the *Clusters of Innovation Initiative* of the Council on Innovation reports about 7,000 workers in research institutions, nearly 5,000 in pharmaceutical projects and an additional 1,500 in biological goods. A related industry, consumer health and beauty products, employs 31,500. The average wage in the cluster was \$55,800 in 1999, third highest among the twenty largest economic areas studied by the Council.

Rochester, Minnesota

The Research Triangle was a sleepy agricultural community until the 1960s; its success is built on fundamentals: Investments in primary and secondary education plus support to the region's three major universities were combined with the development of a world-class business park. High quality of life combined with a supportive public sector have made the region a natural location for new and relocating firms to grow and prosper.

The Mayo Clinic in Rochester, MN is the largest employer in the Rochester, MN MSA. Begun in the late 19th century as a partnership between Dr. William Mayo and his two sons, it was one of the first multi-specialty group practices in the nation. In 1986, the Mayo Clinic opened Mayo Clinic Jacksonville, and in 1998, Mayo Clinic Hospital opened in Phoenix AZ (Mayo Clinic, 2002).

A dominant player in our nation's health care for decades, the Mayo Clinic employs about 45,500 in its three national locations, about 21,000 in Rochester with about 30,000 in Minnesota (Tripp Umbach, 2001). As the population of the Rochester MSA is only 124,000, Rochester is very much a one company town.

While its reputation is driven by its clinical care services, the Mayo Clinic has expanded its research focus in the decade ending in 2001. NIH funds flowing to the Clinic totaled \$116 million in 2001, up from \$36 million in 1990.

Mayo Clinic Economic Impact

Economic impact of \$4 billion on state, \$1.6 billion on local economy

A study by consultancy Tripp Umbach found the economic impact of Mayo Clinic on the State of Minnesota to be nearly \$4 billion, including both primary and secondary impacts, more than one percent of the economy of the entire state. The effect on its local economy is estimated at \$1.6 billion (Tripp Umbach, 2001).

Forty percent of Mayo Clinic patients come from outside the State of Minnesota and three percent from outside the country. Tripp Umbach estimates that aggregate employment driven by Mayo totals nearly 70,000 for the State of Minnesota.

Birmingham, Alabama

Traditionally the South's largest manufacturing and steel producing center, in recent decades Birmingham's health care sector has moved to the center of the economy and now employs more than 42,000 people. Six of the area's 25 largest employers

are in the health care sector. The University of Alabama at Birmingham (UAB) is the health care anchor in Birmingham (Shattuck, 2002). UAB's NIH funding rank increased from 23 in 1990 to 17 in 2001.

The beginning of the Birmingham health cluster can be traced to 1948 when the Birmingham Chamber of Commerce brought a medical school from Tuscaloosa to Birmingham. The University quickly began securing outside funds, with the help and leadership of a selected number of nationally recognized faculty who brought recognition to the University. The University developed an internal platform for economic development, at a time when the community's focus for the economy was still on the steel industry.

Steel Gives Way to Health

Only as the steel industry began to decline did the public sector recognize the significance of Birmingham's growing bioscience cluster. Leadership at the medical center was responsible for its early success; the State of Alabama and local governments began to provide funding once UAB's economic potential was apparent. For example, a joint state and local government effort recently provided funding for the new \$90 million Interdisciplinary Biomedical Research Institute. The City of Birmingham now asserts, "we have to do whatever is necessary to make [UAB expansions] work" (Shattuk, 2002)

Health Sector Vitality Boosts Economy

The expansion of the bioscience cluster is partly responsible for median household income growth of 16% between 1989 and 1999, twice the national average. Bioscience industry growth has also spurred an increase in in-migration, as many of the skilled workers needed are not available in the local economy. Population growth of just under ten percent nonetheless lags regional competitors Raleigh-Durham-Chapel Hill (39%) and Atlanta (38%).

UAB had an estimated \$2.5 billion direct and indirect economic impact on the Birmingham MSA in 1998. The study, authored by the UAB Economics Department's Business and Economic Services Unit indicates that the University provides 53,000 FTE jobs (one in every 10 non-agriculture jobs). Direct payroll to UAB faculty and staff exceeds \$700 million. Revenue to local governments from university-related influences is estimated at

\$102 million annually (Lee, 2002). A separate estimate for the medical center is not available.

Cleveland, Ohio

Cleveland's renowned renaissance owes much to its bioscience sector. The quintessential "Rustbelt" city, Cleveland successfully shifted its economic dependence from heavy industry, particularly steel, to a focus on the service sector, particularly health. Case Western Reserve University, the Cleveland Clinic, and University Hospitals of Cleveland form the center of this cluster in Cleveland (Boczek, 2002).

New Investments in Research

NIH funding to Case Western Reserve School of Medicine was \$174 million in 2001, placing Case Western Reserve fifteenth in the nation. The Cleveland Clinic received \$39 million in 2000. Total NIH funds to Cleveland institutions totaled \$223 million in 2001.

All three institutions have invested in new research facilities. The Cleveland Clinic recently completed the Lerner Research Institute, a \$100 million facility housing 120 laboratories and more than 800 researchers. University Hospitals will complete a 309,000 square foot Research Institute in 2003, housing more than 100 laboratories. Case Western recently completed a \$70 million biomedical research building. Case Western Reserve's investments partly explain its ability to move up 12 positions in the NIH ranking—from 27 in 1990 to 15 in 2001.

Private Sector Leadership

Private sector leadership distinguishes the Cleveland experience. Cleveland Tomorrow and the Greater Cleveland Growth Association (now in an operating partnership called Team Northeast Ohio) drove economic development policy when Cleveland's future was very much in doubt. In 1969 the Cuyahoga River infamously caught fire; a decade later, the City of Cleveland declared bankruptcy. Key leaders chose to save the city, rather than flee to more prosperous communities.

Major private sector investments (carried out in partnership with the City of Cleveland and the State of Ohio) are responsible for restoring community character and maintaining Cleveland's quality of life. These include the entertainment centers like the Flats and the Warehouse District plus the Rock & Roll Hall of Fame & Museum and the Great Lakes Science Center. Health sector

leaders point to the community quality of life as a key factor enabling their continued expansion.

Fertile Soil for New Business Growth

Cleveland has made new bioscience business development a priority. Four business incubators, including BioEnterprise Corporation and the Edison BioTechnology Center, encourage the commercialization of discoveries at the three major research centers.

Formed in December 2000 to accelerate the growth of the bioscience industry in Northeast Ohio (BioEnterprise, 2002), BioEnterprise is “committed to building a strong, private-sector led entrepreneurial environment for bioscience commercialization in Northeast Ohio.” BioEnterprise was co-founded by Case Western Reserve University, the Cleveland Clinic Foundation, and University Hospitals of Cleveland. While the three research institutions are very competitive, all recognize a need for incubators to nurture the ideas and concepts generated in their facilities (Boczek, 2002).

BioEnterprise has 25,000 square feet of space, including lab space outfitted with benches, fume hoods, deionized water, and emergency eye wash and showers. Tenants share common conference rooms and kitchenette facilities, and receive the benefit of 24-hour security and complete utilities, along with subsidized rent. (EBTC, 2002; Nichols, 2002). BioEnterprise has a goal of attracting \$20 million in private investment for its companies in the next year, and \$500 million in five years.

The Edison BioTechnology Center has graduated 32 companies since 1986.

Business Recruitment

Quality incubator and business park space also enables Cleveland to recruit firms from other locations. Cleveland representatives have traveled to Israel to recruit start-up companies. A physician-entrepreneur with extensive contacts in Israel organized the trip, which resulted in two start-ups coming to BioEnterprise. A future trip is planned for additional Israeli scientists to visit the city (Boczek, 2002).

Another emerging company moved its offices from California to Cleveland to be close to the lab of a prominent genetics

researcher. In another recruiting success, a Chicago firm moved to Cleveland to take advantage of access to the Cleveland Clinic.

Recruiting “Star” Researchers

“Star” researchers are a key element of Cleveland’s strategy. Cleveland has been able to attract more than a dozen scientists with \$1 million or more in NIH grants. These stars attract additional funding and serve as mentors and teachers to students and young professionals (BioEnterprise, 2002).

Tech Transfer

Case Western Reserve has identified technology transfer as a “key strategic element for the university’s success.” The University has tripled its technology transfer staff in recent years, and is streamlining its patent and licensing process (BioEnterprise 2002). Similarly, University Hospitals of Cleveland has formed a Research Institute to enhance its commercialization capabilities. The Cleveland Clinic Foundation has a technology-commercialization arm.

Pittsburgh, Pennsylvania

The Pittsburgh Technology Council, a trade association established in 1983, identifies bioscience as one of Pittsburgh’s five key industry clusters. Including medical instruments and devices and pharmaceuticals as “core” bioscience and biomedical research and selected health services as “supporting” bioscience, the Council reports that the entire cluster employs more than 100,000 in the Pittsburgh MSA and that direct aggregate payroll is more than \$4 billion (2000).

With \$340 million in NIH funds, the Pittsburgh metro area ranks 12th in the nation. University of Pittsburgh Medical Center also ranks 12th among medical centers with 2001 NIH funds of just under \$200 million after having ranked 21st in 1990 and 33rd in 1980.

Technology Transfer

The University of Pittsburgh and Carnegie Mellon University (CMU) are poised to take advantage of the connection between private companies and university research. Both Universities have fully staffed technology transfer offices.

The Office of Technology Transfer at the University of Pittsburgh has seven professional and four support staff. The University formed the Office of Technology Management (OTM) in 1996 to increase new company formation in support of University

technologies, and also to increase technology license revenue. Further, the OTM was charged with increasing faculty participation in the entrepreneurial processes, and aimed to use the University's research as a regional economic force through technology transfer (University of Pittsburgh, 2002).

Carnegie Mellon opened its Technology Transfer Office in 1993 to help researchers take their innovations to the market, and start new companies. Since its inception, the office has helped to spin off about 50 companies and has produced intellectual property licensing agreements with about 65 commercial firms (CMU, 2002).

The Council on Competitiveness's recently-released report on Pittsburgh's bioscience cluster cautions that biotech/pharma patents in the Pittsburgh area are below expectations (68 in 1998 v. 635 in Boston and 379 in Philadelphia). Pittsburgh's patent ranking fell from 21st in 1990 to 31st.

Promoting Cluster Growth

The Pittsburgh Technology Council serves as a primary point of connection between four technology clusters: Information Technology, BioMedical Technology, Advanced Manufacturing/Materials, and Environmental Technology. The Council provides guidance on business development, industry advocates in state and federal government, workforce placement and development initiatives, and other services. Membership includes over 1,800 companies.

BioBurgh.com is a bio-specific web portal developed by the Jewish Healthcare Foundation and others to serve as a one-stop interactive clearinghouse of information for the Pittsburgh region's biotechnology assets. The main purpose of the site is to provide easy access for biotechnology professionals and potential investor and partners outside of Pittsburgh. The site's creators believe foreign companies and researchers will use the Internet to learn about locations where they might like to set up a lab, clinical trials, or their companies.

The Institute for Competitiveness report found cluster ties and collaboration among firms to be weak, however. Continued expansion of this cluster may depend on addressing the issue.

Promoting Bioscience Spin-offs

Pittsburgh Technology Center serves as a home to new biotech stars such as Cellomics, which is developing and commercializing cellular bioinformatics and other products. The company planned to complete a 153,000 square foot, five-story, \$22 million building, and is a state-of-the-art facility (Pittsburgh Technology Council, 2002).

Pittsburgh Life Sciences Greenhouse is one of three in Pennsylvania funded by a state commitment of \$100 million in 2002. The state used its tobacco funding to fund this effort. The \$33.3 million allocated to Pittsburgh's Life Sciences Greenhouse is expected to generate \$2 billion in additional investment and could create 4,400 jobs in the biotechnology and biomedical industry over the next five years. A medical device and health care services firm, Renal Solutions, Inc., based in Fort Wayne, IN has already announced a decision to relocate to the Pittsburgh Greenhouse.

The Greenhouse plan is a collaborative effort of the University of Pittsburgh and Carnegie Mellon University, along with local economic development officials, life sciences industry leaders, and government officials. In September 2002, the Greenhouse CEO stated that he had received 16 proposals to develop the Greenhouse, and had narrowed the group down to five finalists. The finalists each propose to outfit the incubator facility with lab and office space, and personnel to run the facility. The incubator will be located close to the university research community in Oakland. The Greenhouse is expected to be up and running in Fall 2002 (Bizjournals.com, Tribune-Review).

Attracting Venture Capital

Bruce Mehlman, Assistant Secretary for Technology Policy for the U.S. Department of Commerce stated that "in Pittsburgh, over \$458 million of R&D at regional universities and federal government facilities helped attract \$741 million in venture capital to the region in 2000" (Mehlman, 2002). Mehlman also argued that local leaders must support entrepreneurship and support business incubators.

The Pittsburgh Greenhouse is forming two venture capital funds, the University Development Fund, and the Industry/University Collaborative Research Fund. The first fund will provide funding to encourage startups from University of Pittsburgh and Carnegie Mellon to develop biotech-related products and technologies. The

second fund will distribute funding to companies for joint product development between them and local universities (Bizjournals.com).

THEMES IN BIOSCIENCE SUCCESS STORIES

Each of these communities is unique and has its own story to tell, its own institutions and leaders, its own advantages and disadvantages. Common themes emerge from the six cases, however:

- ❖ Leadership
- ❖ Bridging the Gap Between Lab & Market
- ❖ Support for Start-up Companies
- ❖ Quality of Life
- ❖ Timely Public Sector Support

Taking the Lead

There is no substitute for leadership. The vision of an industrialist, MD Anderson, made it possible for Houston to get an early start on its bioscience cluster. Without the Anderson Foundation, the Baylor School of Medicine would probably still be in Dallas. And without the Birmingham Chamber of Commerce, the story of Birmingham might, instead, be told of Tuscaloosa.

Nor was it the bankrupt City of Cleveland or the State of Ohio that took firm measures to restore Cleveland to stability. In Cleveland, health sector leadership came from Case Western, Cleveland Clinic and University Hospitals—yet continued stagnation and decline of Cleveland proper would have doomed their efforts had Cleveland Tomorrow and the Greater Cleveland Growth Association not taken bold steps to reverse the city's decline. Cleveland's BioEnterprise, the link between medical center research and business development in Cleveland, was also the vision of a single retired business leader, although he inspired the three institutions to support it.

In Pittsburgh, the Pittsburgh Technology Council takes the lead in promoting programs supportive of technology businesses and provides training programs.

Outstanding success is rarely accidental: In each of our case study communities, individual institutions—sometimes single individuals—accepted the risk of leadership. Supportive institutions are also important. Visionaries cannot succeed without institutions willing to share the risk and facilitate the vision.

Scaling the Ivory Tower

Even in a sphere of endeavor as fecund as bioscience, innovation in the laboratory does not automatically translate into community benefits. Community prosperity is only enhanced by new ideas when they leave the university and are transformed into payroll.

Commercialization in the “Publish or Perish” Culture

The university as “ivory tower,” sequestered from commerce and the prosaic pressures of the economy, satisfies many institutions and researchers. The “coin of the realm” in academic circles is discovery itself and the recognition of peers, codified by publication in academic journals. Traditional academic models of reward and promotion, best exemplified in the process of conferring academic tenure, either ignore commercial achievement or treat it as debased currency.

Yet medical researchers have never had the luxury of isolation enjoyed by their academic brethren in the humanities. In bioscience, the practical application of science is more than desirable; it is expected. Congress directs billions of tax dollars to bioscience research in anticipation of discoveries that will improve quality of life, not just our knowledge of human biology.

In the Bayh-Dole Act of 1980¹, Congress asserts:

It is the policy and objective of the Congress to use the patent system to promote the utilization of inventions arising from federally-supported research and development.

Prior to Bayh-Dole, the ownership of inventions resulting from federal grants varied by agency and program, limiting the ability of institutions to receive clear patent protection for discoveries. In keeping with Bayh-Dole, universities have engaged the profit motive to stimulate researchers to identify and secure patent protection for innovations. The University of Rochester, for example, allows researchers to retain one half of royalties earned.

¹ P.L. 96-517, Patent and Trademark Act Amendments of 1980.

Supportive Institutions for Tech Transfer

Expectation of financial reward is the engine that attracts the risk capital that makes it possible for new ideas to become tangible products.

Institutions that wish to capitalize on the success of their researchers have learned that they need to provide assistance in the complex process of securing patents on new discoveries. Even well motivated scientists do not wish to spend their spare time learning patent law.

Technology transfer is a “key strategic element for the university’s success,” states Case Western Reserve. By tripling the size of its technology transfer staff, they hope to help scientists bridge the chasm between the laboratory and the marketplace.

While University of Pittsburgh has had an Office of Technology Management for over five years, last year the University established the Technology Commercialization Alliance, whose mission is to make the technology transfer process easier for faculty. The Alliance will provide market research, business planning, prototype development, mentoring, and networking opportunities for faculty. The University’s faculty was indifferent to tech transfer ten years ago, but the younger generation is more interested, according to the University’s Provost. While Pitt has been criticized for being a late entry into the Tech Transfer game, Carnegie Mellon developed companies out of university research in the early 1980s (Pittsburgh Business Times, 2001).

The Pittsburgh Technology Council provides assistance to start-up firms and networking opportunities and mentoring programs.

Proper incentives coupled with supportive institutions enable the discoveries to leave the lab and navigate the difficult path to the market. Successful communities reward success and create institutions whose mission is to support tech transfer.

Providing a Favorable Environment for Bioscience Entrepreneurship

If a community expects innovation to be commercialized locally and bear fruit in the form of new income and employment, a supportive environment for small business creation and growth is essential. The university and the inventor care more that the idea come to market. The location of the commercialization activity is a secondary consideration. If the community wants new ventures

in the community, it must take an active interest in preparing its own garden—and it may need to provide some gardeners.

The climate for bioscience entrepreneurship is determined by a number of different considerations. Just as with any other business, the list includes the quality, quantity and cost of labor, telecommunications infrastructure, transportation network, taxes, energy quality and cost, and so on. Our case studies point to the particular importance of physical space and business assistance as an element of business climate affecting bioscience start-ups.

The Greenhouse

The business park and business incubator is the link between the research institution and the community. While a healthy research facility has important spill-over benefits for the community, new business start-ups are even more beneficial. Most of the case study communities recognize the role of incubator space. In some cases the incubator is owned and operated by the medical center; in others, the incubator is a project of local business interests, or the public sector.

Pennsylvania has adopted the “greenhouse” analogy for state-initiated business incubators. Pittsburgh’s greenhouse will focus on life science innovation.

The case of Houston is instructive: Despite Houston’s success as a center of bioscience research, its record of planting and growing bioscience start-ups is poor. The McKinsey consultancy reports that the number of bioscience start-ups in Houston was much smaller than would be expected given the size of the medical center. Boston sees 50 new bioscience startups annually, San Diego sprouts 70 and San Francisco stimulates nearly 100; yet Houston creates only four or five. The Texas Medical Center has highly successful member institutions—but Houston is not capturing the potential spillover benefits. In response to the McKinsey findings, the Southeast Texas BioTechnology Park was begun in 2001. It is planned to eventually occupy a 64 acre campus with two million square feet of space. Ninety percent of the funding is private.

Tending the Plants

The University of Alabama at Birmingham, through its Office for the Advancement of Developing Industry (OADI) encourages business start-ups, clustering them at the UAB Research Park.

OADI provides clients with marketing strategies, business seminars, networking opportunities and other services. OADI also provides facilities, services, equipment, and lab space at below market rates. The National Business Incubator Association has recognized OADI as one of the outstanding incubator programs in the country.

While not one of the centers studied for this report, one of the stars of bioscience startup assistance is the University of California at San Diego's USCD Connect. Since being established in 1985, USCD Connect has assisted 800 biotech & information technology firms. Connect demonstrates that business start-up assistance can be effective outside the confines of a traditional incubator.

Strength in Numbers

Business start-ups in any industry benefit from proximity to other new firms and successful entrepreneurs. This is particularly important in technology fields as supporting institutions—specialized labor, unique capital needs and access to university expertise—are more easily achieved when the need is concentrated.

The lesson of Silicon Valley is that a concentration of firms with similar needs and complementary resources can improve the rate of new firm formation and increase chances of success. A business “cluster” can be defined around any concentration of interest, whether the need for a particular set of skills, a common product market, or dependence on unique support services. A successful cluster not only possesses the concentration but also the institutional infrastructure that turns this concentration to advantage.

Both Raleigh-Durham-Chapel Hill and Pittsburgh are singled out by the Competitiveness Council as communities in which this institutional infrastructure—networking institutions, training services, support services—are particularly effective in the bioscience field. The cross-fertilization that is encouraged by these institutions helps all firms prosper. San Diego demonstrates that physical co-location in an identifiable “incubator” building is not necessary. Supportive institutions for new firms are, however, critically important.

Support for spin-off firms is the responsibility of the local community. As Houston illustrates, medical centers can be successful even if new ideas are licensed to firms in other regions. A successful economy will ensure that prospective new firms find fertile local soil and support structures that facilitate growth and development.

But Do I Want to Live There?

Separate from the *business* climate is the quality of the community as a place to live. Success in the highly competitive bioscience industry is achieved by attracting and retaining talent, both star researchers and prospective entrepreneurs.

Despite the attempts of publications like *Places Rated Almanac*, quality of life is not easily measured. Each community builds on its particular mix of assets and liabilities—climate, recreational opportunities, cultural assets, educational institutions, housing stock, and transportation infrastructure. The Greater Cleveland Growth Association’s Michelle Boczek asserts that quality of life is “very, very important” when recruiting researchers, scientists, and start-ups. Cleveland promotes outstanding cultural institutions and professional sports teams, easy commuting and active entertainment districts.

Community image is also part of the attraction equation—not simply what *is*, but what is *perceived*. Birmingham works to overcome historic images of racial unrest and discrimination. Houston struggles with its image as a brash oil town. Pittsburgh and Cleveland have had to overcome the “rustbelt city” image. Pittsburgh has gone to great lengths to explain that it is no longer a smoky “City of Steel,” but is a community with three clean rivers, considerable physical beauty, a low cost of living, and a family-friendly environment.

Though less tangible than the cost of electricity or the rate of taxation on real property, quality of life is an element of business climate whose importance continues to grow. While communities cannot change their climate or location, they can take steps to maximize their unique set of advantages.

I'm From the Government and I'm Here to Help You

Private initiative has been the catalyst driving successful bioscience clusters. Yet public sector involvement has been critical at various points in the history of each of these communities. The role of the public sector is to facilitate private sector growth and to provide resources to bridge private and community benefit.

In Raleigh-Durham-Chapel Hill, the governor identified K-12 education as a barrier to economic development statewide. Supporting initiative at the MSA level, the State of North Carolina has provided important support to businesses seeking to locate in Research Triangle Park and has provided pivotal support for NC State and University of North Carolina at Chapel Hill. The direction, leadership and energy have been driven at the institution level, not from the Governor's Office.

States are becoming very involved in promoting bioscience, as Pennsylvania's example demonstrates. A survey of 47 states conducted in 2001 by the Biotechnology Industry Organization (BIO) found that many states are organizing to link their financial, regulatory, and tax policies together to better meet biotech firm needs (Plosila, 2001). Several states, including Ohio and Minnesota, reported hiring dedicated professional biosciences staff, with in-depth knowledge and understanding of the industry.

- ❖ Ohio has a \$20 to \$25 million per year Biomedical Research and Technology Transfer fund.
- ❖ Pennsylvania provides \$60 million annually for basic research and \$160 million in one-time funds for bio-science related venture funds.
- ❖ The Texas Legislature appropriated \$800 million to fund seven new or expanded health science research centers.
- ❖ North Carolina has a Bioscience Investment Fund with a \$10 million state appropriation.
- ❖ In 1999, Michigan began a \$1 billion, 20 year investment in its Life Sciences Corridor. The state reports the establishment of 22 new companies in 2001 as a consequence of this endeavor.

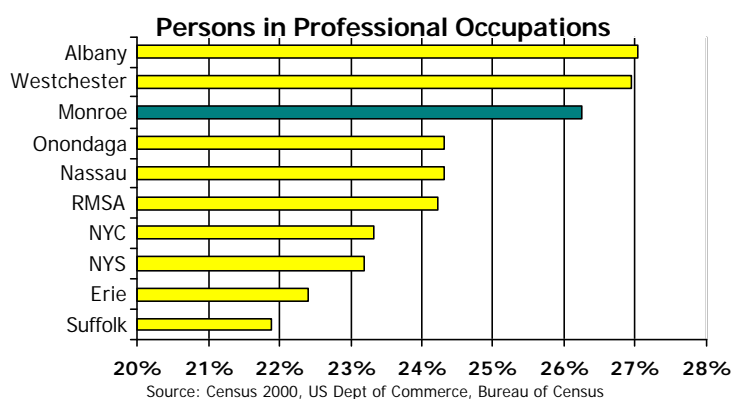
Public sector investment is rarely the catalyst for new business creation and can never replace private sector leadership and commitment. Local and state governments

must recognize the role they play in facilitating the development of this key economic sector, however. Timely public investment can propel a new initiative forward more quickly or span a crucial gap in a promising plan.

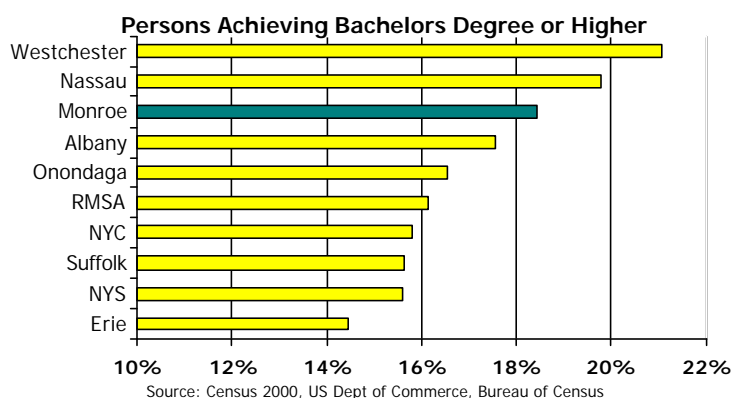
PROSPECTS FOR ROCHESTER

Rochester has a head start on many of the communities seeking the “biotown” label. Like Pittsburgh, Cleveland and Birmingham, Rochester’s economy has long relied on manufacturing, yet

manufacturing in Rochester has been weighted more toward R&D and white-collar headquarters functions than production. A high level of educational attainment and an unusual concentration of higher education institutions bespeaks the quality of the local workforce.



concentration of workers in professional occupations. Of NYS’s



Figures released from Census 2002 show Monroe County as having a high concentration of workers in professional occupations. Of NYS’s metro counties, Monroe is the highest ranked on other technical occupations, including the top ranking in “computer and math” occupations and “architecture and engineering.” Monroe County is ranked #2 in “life, physical and social science” occupations.

Nor is Rochester new to bioscience research. Led by the University of

Rochester Medical Center (URMC), the Rochester area received \$124 million in NIH funds in 2001, placing it 32nd among US metro areas, much higher than its population rank of 47.

URMC’s 1996 Strategic Plan was based on the proposition that competition for bioscience research funding would become ever more vigorous, which has proven to be the case. Without decisive

Leadership

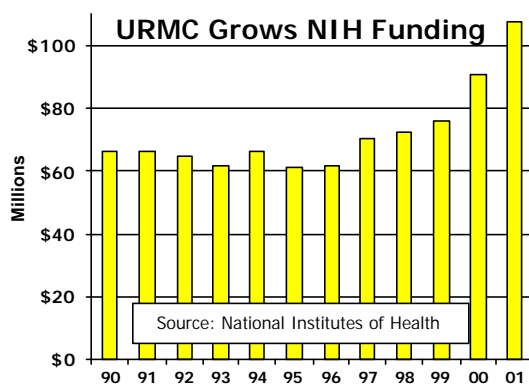
action the medical center would continue to slip inexorably behind its peers.

Rochester's challenge is also daunting. In an increasingly competitive world economy, the community must take a more active role in planning for its future. Rochester leads the competition in many respects—particularly in bioscience area—but it cannot expect its lead to persist in the face of the competitive threat posed by other metropolitan areas, states, even nations.

The list of Rochester's visionary leaders begins with George Eastman. Eastman's vision and Eastman's money created the University of Rochester School of Medicine & Dentistry. His legacy lives on.

No amount of public initiative can substitute for continued leadership at URM. The purpose of its Strategic Plan is to recruit star scientists to Rochester to serve as research leaders in their own specialties. The success to date of the university's \$230 million investment in new facilities and staffing demonstrates that the Medical Center has a vision and the managerial ability to carry it out.

The University and Medical Center, both the executive leadership and boards, deserve the community's appreciation and support. For unlike the medical centers in our case study, URM's ranking had been *falling* since 1990. Ranked 19th in 1980, URM's ranking rose to 14th by 1990 then began to decline. NIH funding growth of 19% in each of fiscal years 2000 and 2001 demonstrates a reversal of the trend. Although URM's 2001 ranking has risen only to 28th, it has set its sights far higher and has recruited new leaders committed to achieving its goals.



Community leadership is critically important, both to aid continued success at the medical center and to achieve abundant new firm formation in Rochester. Support from established business organizations such as the Chamber of Commerce, IMC, High Technology of Rochester and others has been forthcoming and should continue. The public sector has also done its part by

providing funding for HTR, the Lennox Tech Center, and seed capital for the URM-RTC collaboration.

The creation of Greater Rochester Enterprise is a major achievement. A business-led public/private coalition whose sole focus will be economic development, GRE has the potential to provide leadership on a range of issues supporting the expansion of Rochester's bioscience cluster. GRE has the potential to overcome the tendency of Rochester area economic development to be fragmented and unfocused.

- ❖ The URM leadership must continue to advocate and publicize its vision for growth.
- ❖ Leadership at established business organizations plus government at the local and state levels will help determine the extent to which success at URM translates into a growing industrial cluster for Rochester.
- ❖ The newly-formed GRE provides an excellent opportunity for individuals in this community to pursue a coordinated growth agenda.

Technology Transfer

Technology transfer is principally the responsibility of the university. URM's investment in tech transfer has vastly increased over the previous five years. In 1996 a single professional whose responsibilities covered the entire university staffed the technology transfer office. Now the university's office includes four professionals and the medical center has established its own tech transfer office with six professionals.

- ❖ URM's move to bolster its technology transfer capacity is laudable. RIT, too, has staff dedicated to tech transfer.
- ❖ High Technology of Rochester has some capacity to aid in the tech transfer process and to improve support for new technology ventures. The High Technology Business Council Bioscience Cluster (now chaired by Marjorie Hunter, head of the URM tech transfer office) can assume increasing responsibility on behalf of the community.

Support for Start-Ups: Space & Assistance

Bringing new ideas to market is expensive and complicated; it may be less risky for URM to simply license innovations to large

pharmaceutical companies than to take a chance on a small start-up company.

Improving the connection between new ideas and new companies will vastly amplify the local impact of the Medical Center's activity. The Rochester community must take responsibility for creating an environment that is conducive to the planting and nurturing of start-up firms.

Physical Space

Rochester lacks a business incubator with wet lab space. Some space is available at the University itself, but this is limited. The NYS Senate's Gen*NY*sis proposal supports URMC's Rochester Technology Transfer Corporation, the entity charged with creation and development of new bioscience jobs at Rochester Technology Park. While this partnership between the medical center and Rochester Technology Park is promising, the funding is not yet in place. Furthermore, RTC would have to retrofit existing buildings to accommodate the needs of bioscience firms. Other alternatives deserve consideration such as an expansion of the Lennox Tech Center or new construction near the medical center.

Encouraging Existing Firms

Rochester has the beginning of a bioscience business cluster. The total numbers are still too small, however, to stimulate the growth of all-important cluster synergies such as specialized ancillary services and venture capital. Using a broad definition of biotech,² Rochester has about 5,500 employees in bioscience *outside* the university medical center.

Major firms in the cluster include pharmaceutical firms Genencor (which recently announced an expansion in Rochester), Medeva Pharmaceuticals, Wyeth Lederle Vaccines (although it still plans to relocate within the next couple of years); Celltech, medical instruments firms such as Burleigh Instruments (an EXFO company), which makes life sciences positioning systems; and ACM Laboratories, a firm engaged in clinical trials

Supporting this nascent cluster of firms, Rochester has many colleges and universities (besides the University of Rochester itself) with complementary academic programs. On a per capita

² Defined as including SIC codes 283 (drugs), 384 (medical instruments & supplies) and 873 (commercial physical research).

basis, Rochester is third in the nation (of major metropolitan areas) in biological science graduates. The Rochester Institute of Technology boasts the oldest biotechnology curriculum in the nation. Monroe Community College graduates a steady stream of skilled medical technologists.

Other bioscience centers have benefited from multiple medical centers. Rochester General Hospital, while not a research institution, can still provide important synergies, particularly where it is undisputably strong, e.g. cardiac care. A healthily competitive, but not adversarial relationship between ViaHealth and URMC is in the interest of the local economy and the future of Rochester's bioscience cluster.

Tending the Young Plants

Rochester has two organizations working to promote synergies within bioscience. High Technology of Rochester and its Lennox Tech Center have established working groups in a variety of industries, including a Bioscience Cluster group with about 15 members.

Digital Rochester, founded as an informal networking institution for all technology firms, is assuming more formal responsibilities, including a focus on particular clusters, bioscience being one.

Venture capital is also key to the growth of bioscience business in Rochester. While the public sector has taken important leadership in this area through creation of the Monroe Fund, the only long term solution to the scarcity of venture capital is enhanced deal flow. Venture capitalists will come to Rochester only when there are enough deals to get their attention. "Technology . . . invites reinforcing cycles of innovation and investment" (Mehlman, 2002).

Finally, support for bioscience firms in the form of networking opportunities, mentoring programs and small business assistance (whether inside or outside incubators) has proven essential. An expansion of assistance already provided through High Technology of Rochester and other entities is important.

- ❖ Rochester must develop appropriate physical space to accommodate bioscience start-up companies. Many communities

have had success with bioscience-specific incubators while others have used more generic business incubators.

- ❖ As San Diego illustrates, the physical building is not the strategy. Physical space is often part of the program (particularly when, as in this case, unique space is required by start-up firms), but the essence of the incubator concept is creating synergies among new firms and providing a supportive business climate. HTR, Digital Rochester and other community institutions should continue to expand their capacity to support new firm development.

Quality of Life

Like Birmingham, Raleigh, Cleveland, Pittsburgh, Houston and the other Rochester, Rochester NY has its own unique qualities that recommend it to outsiders. Outstanding cultural institutions, five professional sports teams, inexpensive quality housing and diverse recreational opportunities place Rochester ahead of many potential competitors.

Both Rochester's image of itself and the image it presents outside the community are weaker than is justified by the reality. This internal "image deficit" can be addressed by tackling some of the more visible challenges—Midtown Plaza, for example, is often cited as evidence of downtown's weakness, despite clear evidence of downtown's overall good health (as seen in the steady increase in occupied office square footage over the past decade).

The community spirit would also be buoyed by more effective cooperation on project priorities. Major initiatives—the ferry, performing arts center, soccer stadium and others—are discussed at length, yet the process setting priorities and acting upon them is weak.

Timely Public Sector Support

New York State understands the importance of technology in the future of the state's economy. Under the current administration, funds for technology flow through the New York State Office of Science, Technology and Academic Research (NYSTAR), established by legislation passed in 1999.

NYSTAR has established Strategically Targeted Academic Research (STAR) Centers at eight NYS universities and Advanced Research Centers (ARCs) at five. Of these, STAR centers at SUNY Stony Brook, SUNY Buffalo, and Cornell University plus ARCs at Albany Medical College and Mt Sinai School of Medicine

are in the bioscience area. In addition, SUNY Stonybrook has a long-established (and successful) Center for Advanced Technology in Biotechnology.

The Rochester community needs to work to support URMC's interest in the Gen*NY*sis proposal and to support funding of the RIT biotechnology training initiative. Public sector support for the establishment of appropriate space for spin-off companies is critical.

- ❖ Local leaders should continue to encourage the state to provide funding for the health and bioscience industry.
- ❖ Local government officials should identify an appropriate role for themselves in helping the health and bioscience sector in Rochester to grow and contribute to economic development in this community.

CONCLUSION

The experience of our six case study communities—Houston, Raleigh-Durham-Chapel Hill, Rochester (MN), Pittsburgh, Cleveland and Birmingham—demonstrates that bioscience can be a major part of a community's economic development program. Success in the increasingly competitive market for bioscience starts with the core institution: URMC, through its recent investments in people and facilities, has shown its ability to compete for federal life science research funding. The ultimate impact of URMC's expansion on the Rochester economy will be based on the vigor of the University's technology transfer efforts and the community's ability to create an environment that is conducive to bioscience start-ups and the continued growth of major bioscience firms already in the area.

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