Immigrant Learning Center

Giving the Gift of Language
Promoting Immigrants as Assets to America

Immigrant Entrepreneurs

in the Massachusetts Biotechnology Industry

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About The Immigrant Learning Center, Inc. (ILC) And The ILC Public Education Program

The ILC is a not-for-profit adult learning center located in Malden, Massachussetts. Founded in 1992, the mission of The ILC is to provide foreign-born adults with the English proficiency necessary to lead productive lives in the United States. As a way of continuing to help ILC students become successful workers, parents and community members, the school expanded its mission to include promoting immigrants as assets to America. This expanded mission is known as the Public Education Program.

The Public Education Program has four major initiatives to support the goal of promoting immigrants as contributors to America's economic, social and cultural vibrancy.

- Business Sector Studies to examine the impact of immigrants as entrepreneurs, customers and workers.
- Professional Development for K-12 teachers on teaching immigration across the curriculum.
- Briefing book with researched statistics on immigrant issues such as immigrants and taxes, immigrants and jobs and immigrant entrepreneurship.
- The Immigrant Theater Group.

The Public Education Program is under the direction of Marcia Drew Hohn who holds a doctorate in Human and Organizational Systems and has over 20 years of experience in adult learning and systems development. Dr. Hohn has published extensively about organizational systems in adult basic education and developing health literacy among low-literate populations.

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Immigrant Entrepreneurs in the Massachusetts Biotechnology Industry

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The Immigrant Learning Center, Inc.

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Preface

In 2003, The Immigrant Learning Center, Inc. (ILC) launched a public education initiative to raise the visibility of immigrants as assets to America. Spurred by certain anti-immigrant sentiments that were increasingly voiced since September 11, The ILC set forth to credibly document current economic and social contributions of immigrants.

Central to this effort are ILC sponsored research studies about immigrants as entrepreneurs, customers and workers. To provide thoughtful and substantive evidence that immigrants are vital contributors to our nation, The ILC commissioned university researchers to examine contributions of immigrants in their various roles and present those contributions within larger economic and social frameworks. The research approach included interviewing immigrants and community informants and gathering relevant statistical data.

To date, five studies have been undertaken. "Immigrant Entrepreneurs and Neighborhood Revitalization" and "Immigrant Homebuyers in Lawrence and Lowell, Massachusetts: Keys to the Revitalization of the Cities" were published in December 2005. "Immigrant Entrepreneurs in the Massachusetts Biotechnology Industry" is the subject of this report. "The Rise of Asian-Owned Businesses in Massachusetts" is a companion study to the biotechnology research report. A fifth study is underway about "Immigrant Workers in the Massachusetts Health Care Industry" and will be ready fall 2007. Research team members were drawn from Boston University, Massachusetts Institute of Technology, Tufts University and the University of Massachusetts Boston.

Collectively, these studies have reinforcing commonalities. They highlight unnoticed contributions of immigrants to the economic development of communities. They identify immigrant businesses as engines for economic growth in vital business sectors such as biotechnology and health care. Overall, immigrants are shown to be critical to the growth and development of Massachusetts.

The ILC hopes that these studies will raise the visibility of immigrants as contributors to our nation's economic and social development. We also hope they will inform policy and promote thoughtful dialogue about key roles played by immigrants in Massachusetts communities and in the overall economic development of the Commonwealth.

Diane Portnoy, Co-Founder and Director
The Immigrant Learning Center, Inc.

Marcia Drew Hohn, Director of Public Education
The Immigrant Learning Center, Inc.

June 2007

Author Biographies

Dr. Daniel J. Monti

Dr. Daniel Monti is Professor and Associate Chairman in the Sociology Department of Boston University. He has written six books and is the recipient of a Woodrow Wilson Fellowship. His most recent book, *The American City: A Social and Cultural History*, spans 300 years of American history and touches on cities in all 50 states. It is a detailed description of American civic culture. His current book, *Civic Capitalists: How Everyday People Make America Work,* explores the role of businesses as America's first and foremost civic associations. He has served as a consultant to government agencies, for-profit and non-profit organizations. He was a member of the Missouri State Advisory Board to the United States Commission on Civil Rights. He is founder of InnerCity Entrepreneurs, a technical assistance program for existing urban and minority small businesses that want to grow.

Dr. Laurel Smith-Doerr

Dr. Laurel Smith-Doerr is Assistant Professor of Sociology at Boston University. She holds a BA from Pomona College and a PhD from the University of Arizona. She has published many articles and book chapters on the biotechnology industry and its collaborative nature. A couple of these publications have been translated into Chinese and Italian. Her book, *Women's Work: Gender Equality vs. Hierarchy in the Life Sciences,* (Lynne Rienner Publishers, 2004) explains how the flexibility of the network form of organization found in the biotechnology industry is more conducive to gender equity in science than is rule-bound hierarchy.

James McQuaid

James McQuaid is a lecturer at the University of Massachusetts Boston and Boston University. He holds a BA from the University of Massachusetts Lowell and is a doctoral candidate at Boston University in Sociology.

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Executive Summary

Purpose and Background of this Study

Immigration and developments in biotechnology are two of the more prominent domestic issues facing Americans in the early 21st Century. They are issues that require understanding of the far-reaching demographic changes in the United States and developments in scientific and technical knowledge relevant to human health. Massachusetts is a setting particularly well-suited to the study of the impact of both these phenomena. The state has a well-deserved reputation for being one of the preeminent locales for biomedical research and product development in the United States. It also has had the good fortune to become home for many immigrants in the last two decades. These immigrants are often highly educated and carry well-honed entrepreneurial instincts. In this report we offer a preliminary look into the very real and congenial connection between these two important developments —immigration and biotechnology.

One of the most significant demographic changes in the United States at the end of the 20th Century and early 21st Century has been the influx of new immigrants from Africa, Central and South America, and the Far East. The number of foreign-born U.S. residents increased by 57 percent between 1990 and 2000.[1] The result is that by 2005, 12.4 percent of the U.S. resident population was foreign-born.

The vigorous and ongoing debate over immigration and its consequences for the United States has parallels with a debate within the sciences related to federal policies dealing with the nationality of persons employed in the U.S. scientific workforce. Specifically, this debate is about who should have access to scientific resources from higher education scholarships to multimillion dollar federal grants. The data that speak to this debate are clear. Immigrants contribute to science in large numbers and in high-quality research. About one in four scientists in the U.S. workforce today is foreign-born. Furthermore, scientists in the U.S. who are making exceptional contributions to their fields are disproportionately foreign-born.[2]

But are immigrants with advanced scientific backgrounds also likely to be the entrepreneurs starting up the life science-based firms that constitute the U.S. biotechnology industry? This is the question that drove The Immigrant Learning Center, Inc. (ILC) to commission this report.

Current research suggests that immigrants are indeed significant contributors to the founding of high technology firms in the U.S. Two major studies on the role of immigrant entrepreneurs in U.S. high technology industries were released while this project was in process. A study commissioned by Duke University and the University of California at Berkeley found that 25.3 percent of U.S. science and engineering firms founded between 1995-2005 had at least one foreign-born founder. In Massachusetts, 29 percent of science and engineering firms were founded by the foreign-born.[3] A second study, commissioned by the National Venture Capital Association, found that one-fourth of high technology firms are founded by immigrants. Even more dramatically, the study found that publicly traded venture-backed firms founded by immigrants have current market capitalization exceeding $500 billion.[4] These two recent studies cover the national level and a broader spectrum of high technology firms than those considered in the present report. This report focuses more narrowly and deeply on the role of immigrant founders in Massachusetts and New England biotechnology firms.

Major Findings

The findings suggest that the nationwide trend of skilled immigrants creating high tech businesses is also affecting the Massachusetts biotechnology industry. Among the more striking conclusions found about biotechnology firms founded in New England are:

- In 25.7 percent of these companies, at least one founder was foreign-born.
- Biotechnology companies in New England with at least one immigrant founder produced over $7.6 billion in sales and employed over 4,000 workers in 2006.
- Like the nationwide results for immigrant entrepreneurs in the biosciences, the founders of biotechnology firms in Massachusetts and New England come from nations across the globe.
- However, foreign-born founders of biotechnology firms in Massachusetts, like high technology immigrant entrepreneurs nationwide, are more likely to come from Europe, Canada or Asia.
- About 12 percent of founders of Massachusetts biotechnology firms are women.
- Immigrant-founded biotechnology firms in Massachusetts are focused in Human Therapeutics and Genomics/Protemics. Human Therapeutics are treatments of disease. Genomics/Proteomics study the "map" of the human genome, which is our gene sequence, and the proteins that constitute genes to look for health applications.
- Immigrant entrepreneurs, therefore, specialize in the most complex, risky, life science-intensive aspects of biotechnology to seek knowledge directly applicable to human health.

This evidence strongly suggests that immigrants have been key contributors to the creation of new businesses and intellectual capital in the Massachusetts biotechnology industry and the economic growth of the Commonwealth.

Background and Setting

The Biotechnology Industry in Massachusetts and New England

The development of the life sciences has been heralded as one of the most important human achievements during the last half of the 20th Century. In June 2000, Craig Venter, then CEO of the biotechnology firm Celera Genomics, made a joint announcement with U.S. Human Genome Project Director Frances Collins that all 30,000 or so genes of our human DNA had been mapped. With this and many other breakthroughs, the life sciences have garnered increasing attention. Rapid scientific advances have shown a promise for addressing some of our long-standing and most challenging health problems. The development of an innovative biotechnology industry has brought the promise to help us live longer and better. These innovations have captured our attention and a great deal of investment capital along the way.

The emergence of the biotechnology industry is a result of the applications of life science discoveries like the mapping of the human genome and the formation of firms reliant on extensive collaboration for most of their research and manufacturing breakthroughs. The biotechnology industry is populated by small firms which for the most part have not been acquired by larger corporations as has happened in the pharmaceutical industry. As befits an industry where organizations rely on partnerships to succeed, many new start-ups trace their origins to other biotechnology firms. Genentech in South San Francisco and Millennium Pharmaceuticals in Cambridge, Massachusetts, have been virtual incubators for the geographic agglomeration of firms in these two metropolitan areas with the largest concentration of biotechnology companies.

Although the promise of new science coming from biotechnology sometimes leads to disappointing delays and corresponding dips in stock market prices, small knowledge-producing biotechnology firms have become the model for larger pharmaceutical conglomerates to emulate. This has become so much the case that biotechnology has been publicly pursued by 41 governors attempting to inject new life into their states. Massachusetts has been a model to other states trying to grow a similar thriving biotechnology industry. Biotechnology as a for-profit enterprise has been located in the United States generally and within California and Massachusetts specifically. These states are home to the greatest number of biotechnology firms in the world. The Massachusetts Biotechnology Council lists 272 member biotechnology firms that are located in New England. These companies form the population of firms for this study.

Immigrants in Massachusetts

In addition to the biotechnology industry, Massachusetts is also home to many recent immigrants. In 2005, 14.4 percent of Massachusetts residents were born outside of the U.S., placing Massachusetts in the top ten states for highest percentage of foreign-born residents.[5] Of the foreign-born residents in Massachusetts, 25.8 percent were born in Europe, 27.2 percent were born in Asia and 37.6 percent were born in Latin America and Mexico.

The purpose of this study is to research the connection between these two growing communities in Massachusetts: recent immigrants and the biotechnology industry. Are immigrants in Massachusetts helping to found new biotechnology firms or are these two trends largely separate phenomena?

Experiences of Immigrant Entrepreneurs in Biotechnology

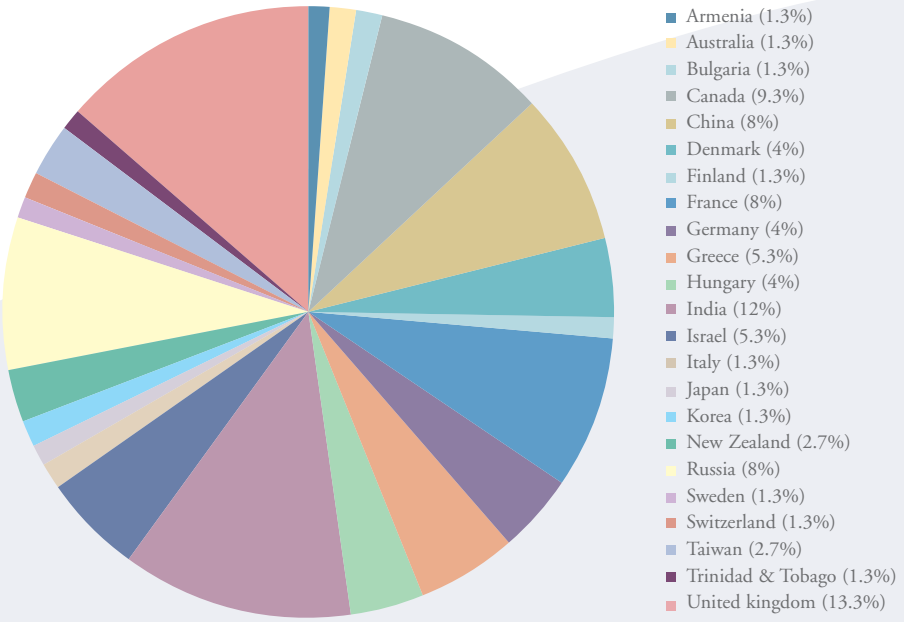
Successes of Immigrant Entrepreneurs

Both immigrants and entrepreneurs are risk-takers. But are immigrants in the United States also more likely to start a new business in the high-risk world of biotechnology? What we have found thus far suggests that immigrants make a disproportionate contribution to biotechnology entrepreneurship in Massachusetts. According to the U.S. Census, foreign-born residents of Massachusetts are 14.4 percent of the total population. But we find that 25.7 percent of biotechnology firms have foreign-born founders. These immigrant entrepreneurs hail from 23 different countries but most frequently from the United Kingdom, India, Canada, China, Russia, Greece and Israel.

Figure 1 shows prominently that there is a mixture of immigrants from many countries. Slightly more immigrant founders come from other English-speaking countries, primarily the United Kingdom and Canada. Adding Australia, New Zealand, Trinidad and Tobago brings the percentage of foreign-born entrepreneurs from Anglophone nations to only 27.9 percent of the total immigrant founders. It is important to note that the majority of entrepreneurs come from countries where English is not the first language. Two of the world's most populous and fastest developing countries, India and China, are well represented at 12 percent and eight percent of the immigrant founders respectively. France, Greece, Israel and Russia combined make up another 26 percent.

This study also gathered data on founder gender. About 12 percent of the founders of biotechnology industry firms in Massachusetts are women. Information on the gender of founders is not available from the two previously mentioned national studies conducted on high technology entrepreneurs, probably because of the small numbers of women. However, based on the proportion of women PhDs in the different fields (nearly half in the biological sciences compared to less than 20 percent in engineering fields), we suspect that the number of female founders in Massachusetts biotechnology is higher than in information technology and software firms. We found no significant difference in the percent of women founders between biotechnology firms with at least one immigrant founder and those without immigrant founders.

Figure 1 below shows the percentages of immigrant founders by country of origin.



What we have learned from interviewing several founders of Massachusetts biotechnology companies is that the concentration of biotechnology companies here is no more an accident than is the presence of so many immigrants in these companies, both as founders and as employees. Both are the happy consequence of having several excellent universities and research hospitals in and around Boston. These institutions drew in scientists who were already accomplished and went on to grow several generations of new scientists and practitioners. These men and women invented the biotechnology industry in Massachusetts. Higher educational institutions and major hospitals provided the excuse and resources for assembling them in the first place. Like all good entrepreneurs, the young men and women attending these institutions took it from there.

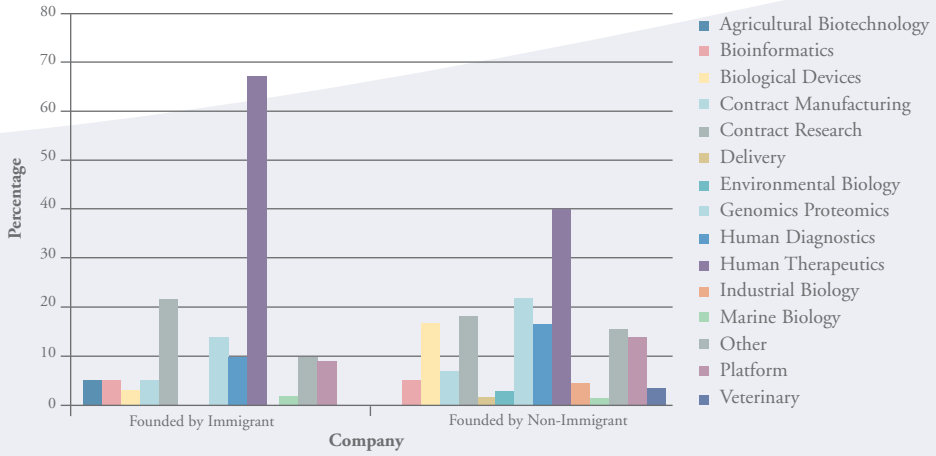
The firms founded by immigrant entrepreneurs are likely to be small, employing fewer than 50 people and having annual sales of under $20 million. This is true of the biotechnology industry in general. An interesting difference is that immigrant founders in Massachusetts are more likely to have started biotechnology companies that are in the most "science–intensive" category: human therapeutics. These companies are working on discovering the ways that genetic configurations can give clues about therapies to treat human disease. For example, Biogen Idec, a Massachusetts biotechnology company, has been involved in developing Rituxan which is a therapy that selectively depletes a particular kind of cell that is related to non-Hodgkins lymphoma and rheumatoid arthritis. Thus far, we have determined that two-thirds of the firms with an immigrant founder have pursued knowledge that would lead to therapies to treat human disease. Less than half of other Massachusetts biotechnology firms claim human therapeutics as a main pursuit.

Hurdles to Entrepreneurship

The mere fact that one is a member of a minority population in the United States is often equated with having difficulties in getting ahead and especially with becoming a successful businessman or woman. Whether one is talking about finding mentors, proper technical assistance, access to capital or customers, minorities often have a rougher time starting a business or growing their enterprise.

None of the persons interviewed for this report indicated that starting their biotechnology firm had been easy. Indeed, they made it very clear that they had worked hard, sacrificed a great deal to get their firm up and running and had no reason to imagine that they would

Figure 2 below shows the distribution of knowledge areas in which biotechnology firms specialize. Immigrant-founded firms are compared to others.



Note: Total percentage is greater than one-hundred percent as many biotechnology firms specialize in multiple areas.

be successful. At the same time, their status as immigrants or the children of immigrants had actually given them several advantages in starting their venture that one does not usually associate with minority businessmen and women.

They spoke of the obligation they felt to friends and family members almost as if it were an integral part of their business plan. And always, these obligations were put in the context of "the immigrant experience." Hard work, sacrifice on behalf of some greater good, a sense of duty to people close to you and, importantly, frugality were all part of a larger picture that brought them to become entrepreneurs and carried them through hard times.

These "cultural" attributes found a congenial fit inside universities where people just like them from a number of different countries were encouraged to build on these expressions of cultural capital in order to develop their intellectual capital. The personal and professional networks they developed while attending local universities proved invaluable in helping them identify problems, potential products, investors, partners and employees. Having access to smart people was important. But what they brought to this experience was every bit as important as the training they got and the opportunities they were afforded by area institutions.

The immigrant and minority status of these would-be inventors and business people ended up benefiting them rather than serving as a distraction or impediment. The promise of substantial returns on investment dollars may have "colored" the views of would-be backers much more than the color of the skin of the young men and women who would become biotechnology entrepreneurs. But these immigrant and second-generation minority scientists were able to "bank" on the personal networks they established while attending school here, every bit as much as 19th Century merchant princes had banked on their personal contacts and ties to important local institutions.

Three Case Studies

This section of the report tells the stories of three companies in the Massachusetts and New England biotechnology field through the eyes of five founders (three first-generation immigrants and two second-generation).

1. Sridhar Iyengar and Sonny Vu, Co-Founders of AgaMatrix

AgaMatrix recently began to distribute what its co-founders Sonny Vu and Dr. Sridhar Iyengar call the "next generation" of blood glucose monitoring products for diabetes. They were instrumental in developing these products and are now manufacturing them in Salem, New Hampshire. The origins of their company can be traced to a summer science program sponsored by the Department of Energy more than 15 years ago.

Sonny and Sridhar didn't meet at the summer science program camp. That would have to wait until both young men matriculated at the University of Illinois at Champaign Urbana the following year. But, as Sridhar recalls, a boyhood friend of his had attended the same camp as Sonny and later told his friend about a really bright and hardworking Vietnamese kid he'd met in Oregon. Sridhar, a child of Indian immigrants, filed the information away. He'd grown up in Knoxville,

Tennessee, where his father worked for the Tennessee Valley Authority. Sonny, himself an immigrant, had lived in Oklahoma after arriving with his parents and many other "boat people" who fled North Vietnam in the late-1970s. Their chance meeting at a party and subsequent friendship eventually led to the creation of AgaMatrix more than a decade later.

They took separate paths after undergraduate school. Sonny stopped working on his doctorate at Massachusetts Institute of Technology in order to start a software company. Sridhar, in the meantime, had attended Cambridge University and finished his research on biosensors. He joined Sonny's company for a year before it was sold. Following the sale of that company, and instead of returning to finish his doctorate, Sonny decided to work on a biosensor product line and the company that Sridhar had in mind. This is the company that eventually became AgaMatrix.

Founded in 2001, both men described it as a particularly difficult time to be a start-up but, ironically, a great time to begin a start-up. That's because raising a second wave of investment capital back then was a lot harder than raising the initial capital. In their case, much of that early financing came from contacts Sridhar had made while studying in England and from one of the persons that had invested in Sonny's software venture. Furthermore, with so many existing start-ups tanking, there were a lot of good people looking for work who were willing to take less pay than they'd been accustomed to earning. With their complementary skills, Sonny handles the business development side of AgaMatrix and Sridhar the science and product side. With the discipline born of an immigrant upbringing, AgaMatrix began to take shape.

Of course, the early shape was fashioned or confined by the fact that both men set up shop and lived out of a cramped Somerville, Massachusetts apartment. You don't splurge on fancy gadgetry, the newest equipment and spacious offices, when your daily lunch budget is $1.25. But the very Spartan-like character of their operation impressed would be investors who saw that these young men knew how to work and wouldn't waste their money.

Being in Boston and connected to Massachusetts Institute of Technology was a huge early advantage for their fledgling company. Close to sources of student interns, investment money and with serious academic credentials in their own right, Sonny and Sridhar developed a smart team, worked cheaply and had a product with a large potential market both in the United States and internationally. By the time they were ready to test out their ideas in a more formal setting, they couldn't afford the lab space. Potential institutional backers wanted too much equity in their company to suit them. They were forced to find lab space in Australia for six months where they made a couple of big scientific advances in what would become their product line. They also found another collaborator.

Two years worth of "getting by" convinced them that they should manufacture and distribute their product rather than sell it off to a larger and more established company. With their final investment capital lined up, their last stop before taking their company over the border to New Hampshire was a small lab in Cambridge, Massachusetts.

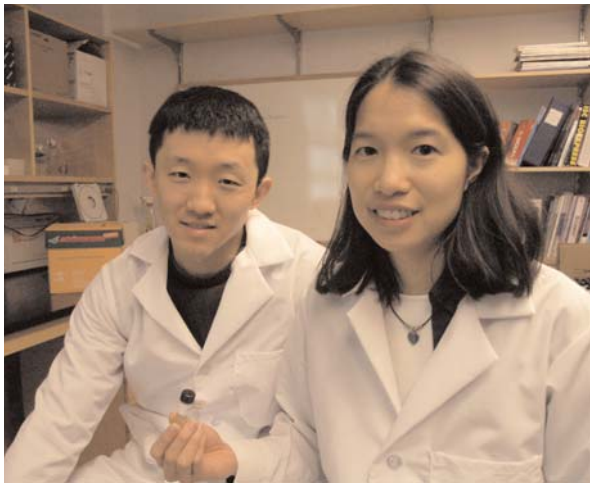
Sonny and Sridhar are convinced that their immigrant backgrounds made the five years it took them to move from having a good idea to creating a product line bearable, if not easy. The backing of their families (although more emotional than financial); the immigrant's desire to "make it" and start his or her own business; and the ability to find other like-minded young men and women to work with (a great many of them immigrants or the children of immigrants) greatly aided them in the struggle to start their business. It's a different kind of immigrant success story but not a new one.

2. Krishna Menon, Founder of Kard Scientific

Dr. Krishna Menon started Kard Scientific in 2002 in order to produce drugs to "alleviate pain and suffering." His past experience working in global pharmaceutical corporations gave him information about how to develop and sell drugs. In starting his own company, he was less driven by a profit motive than to have greater scientific freedom to pursue health applications where greater need exists in the world. However, lacking the deep pockets of a pharmaceutical giant and facing the difficulties of securing outside investors have meant that the company has also had to take on contract research in order to "turn on the lights."

Dr. Menon's mix of idealism and practicality was fostered at his mother's knee. She was a physician in India; as a boy he spent a great deal of time in her clinic learning medical procedures. He later withdrew from medical school and went into the scientific research side on the advice of his mother who felt that there were not enough drugs in the world to treat people. Dr. Menon's career took him all over the world. He began in India selling veterinary products where he also organized the company sports teams. Playing cricket, he met the manager of the West Indies team who also directed a veterinary services company in Jamaica and hired Menon to work there. His next move was to the Cayman Islands working in the ministry of agriculture on public health policy. In 1979, he went to Harvard University where he began his "real research." The move to Massachusetts was facilitated by his wife's parents living in Boston. After his training, he moved out of state to work at two different large pharmaceutical companies making his way up the corporate ladder.

When Dr. Menon began Kard Scientific, he chose Massachusetts because of his connections in the scientific community here and the large talent pool. The state did not provide any incentives to start the business here. He does see hurdles to entrepreneurship as an immigrant. Hearing an accent may put some people off, and there are those who tend to see stereotypes. These tendencies do not make obtaining funding for a new venture, which he said is "very, very hard," any easier. Still, although he has begun working on a small spin-out company in India, Dr. Menon prefers leading a science-based company in the U.S. Particularly here in Massachusetts, he can contact a variety of people for technical information and other "know-how" which would not be an option in many other places.



3. Melina Fan and Benjie Chen, Co-founders of Addgene

Melina Fan and Benjie Chen are 30 year-old graduates of Massachusetts Institute of Technology (MIT). Melina, whose Chinese roots run four generations deep in Boston, and Benjie, who came over with his family after Tiananmen Square, met at MIT and were married several years later. These days they divide their attention between painting rooms in their new house and promoting Addgene, the non-profit corporation they founded.

Addgene was founded to help scientists share plasmids which are valuable DNA-based materials used for biomedical research. When a scientist makes a new discovery about a gene, other scientists will want to build on those findings. They will write to the original scientist and ask the scientist to send them a plasmid containing the gene. Scientists share these tools with their colleagues in order to find life-saving cures. Every laboratory has its own area of expertise, and progress is made through working together.

However, the old system of plasmid sharing placed a tremendous burden on the laboratories that make groundbreaking discoveries. The time spent fulfilling the many requests took time away from their research. Oftentimes, they were simply too busy to respond to requests and, therefore, the plasmids were sent several months later or were never sent. This slowed the progress of research.

The idea for Addgene grew from Melina's thesis work on a protein involved in diabetes. In her initial experiment, she found 20 proteins that interacted with her protein of interest and were potentially important for diabetes. When she wrote to other scientists to request the plasmids encoding these proteins, only half of the scientists sent the materials. Spurred by this negative experience, Melina decided to start an organization to help scientists share their materials more efficiently.

Benjie appreciated the problem that Melina had run up against. As a budding computer scientist, he also saw it as an opportunity to put his computer work to good use in the service of biology. Melina's brother came on board to handle the business side of the operation.

They started Addgene in 2004, though Benjie quickly added that the need for this kind of service had been "out there" for two decades. Cutbacks in federal support for this kind of work really stalled their progress. They used money from a fund established by Melina's grandmother for everyday expenses and lived in her mother's house for a year. Some timely donations to get their operation up and running came in handy. Harvard University gave them good rates on lab space and manages all the facilities. The Massachusetts Biotechnology Council helped them a great deal. Friends from their undergraduate days are working with them as well.

With thousands of labs in the United States and many more overseas, there's certainly a need for the service that Addgene provides. The idea of sharing and collaboration is at the heart of the scientific enterprise. Getting started wasn't going to be easy, however. Fortunately for them, the number of labs at Harvard University and the Boston area provided them with a good foundation upon which to build.

After two and a half years, they are finally breaking even. So far, 250 labs have deposited a total of 4,500 plasmids to Addgene's repository, but that's a very small number compared to the potential market. They expect to see substantial growth over the next few years as

more laboratories send materials to them. There are thousands of labs overseas with Europe and China leading the way and Japan and Korea moving up quickly. Still, the United States remains the biggest market. In addition, the law on intellectual property is better developed here than in other parts of the world.

While their ties to the local Chinese community are indirect through Melina's mother, who is very active in Boston's Chinatown, there is an unmistakable connection between them and the larger community of foreign students and researchers that have come to the Boston area. Indeed, they doubt very much that Addgene could have been launched in any place other than the Boston area, in large part because of the concentration of biology research labs and foreign talent.

Having been brought up in socialist China and having spent most of his adult life in undergraduate and graduate schools, Benjie has embraced the opportunity of starting a non-profit venture as a chance to learn how to make money and be an entrepreneur. A big shock to him was "the amount of legal stuff you had to know."

With hard work, persistence and luck, Melina and Benjie believe Addgene will overcome any challenge to its growth. If it does, the international marketplace in science will never be the same.

Implications for Massachusetts and Beyond

The purpose of this study was to investigate the contribution of foreign-born entrepreneurs to the Massachusetts biotechnology industry.

Our data shows that at least one immigrant was involved in founding 25.7 percent of all biotechnology firms in New England with most firms located in Massachusetts. Our percentage may be slightly lower than the national study by Wadhwa et al. They looked only at Massachusetts companies founded since 1995, finding that 29 percent had an immigrant founder. However, we studied all firms in the Massachusetts biotechnology industry regardless of founding date. The majority of immigrant-founded companies are more recent. A dramatic perspective arises when looking only at the firms for which we were able to obtain data on immigrant status of founders. There we found about 40 percent of the biotechnology firms in Massachusetts and New England had at least one immigrant founder.[6]

The pool of immigrant-founded companies is responsible for contributing an estimated $7.6 billion in revenue and 4,352 jobs to the New England economy in 2006. Immigrant entrepreneurs are more likely to found biotechnology firms that specialize in human therapeutics, the most science-intensive area of biotechnology which seeks to develop cures for human diseases.

In Massachusetts and New England, biotechnology is an important industry for current and future economic growth. It is a small field with a large footprint. While there are fewer workers employed in biotechnology, the jobs are highly skilled and contribute to the knowledge economy. Manufacturing provides about 297,000 jobs; transportation and utilities about 572,000 jobs; and financial services about 225,000 jobs. However, these sectors are either stable or declining in employment and market share.[7] Biotechnology, together with high technology generally, is an area that promises to spur economic growth into the future. This is not to say that there are no risks involved in the pursuit of such knowledge-based industries. The outcomes of scientific research are uncertain. Nevertheless, having a region that provides the best available resources, including drawing in many of the world's brightest minds, gives Massachusetts an edge in this high-risk, high-reward field.

This research finds that U.S. immigrants are an important component of one of the "crown jewels" of the nation's innovative contributions to the global economy. Biotechnology was not only born in the U.S. but has flourished here, particularly in Massachusetts and California. The solutions to some of the worst health crises that humanity faces may well be found right here in Massachusetts in a company started by an immigrant.

Notes

Appendix: Data and Methodology

The purpose of this study is to examine the impact of immigrants in the Massachusetts biotechnology sector. In order to do so, we compiled a list of biotechnology firms in Massachusetts and the surrounding New England states. We were interested in companies based in New England that are not large, multinational pharmaceutical companies. We further limited our examination to include only independent companies; subsidiaries and local branches of larger firms were excluded. We then attempted to identify the founders, the countries of origin of each firm and other information about the firm itself.

Company Data

Companies included in the study were drawn primarily from the member list of the Massachusetts Biotechnology Council (MBC). The MBC member list includes a total of 341 firms classified as biotechnology firms. In addition, seven firms were included in this study whom the Boston Business Journal listed as Massachusetts biotechnology firms but were not listed as members of the MBC. Of these 348 firms, eighty-seven were eliminated from the study for one or more of the following reasons: firm is a subsidiary of a larger company; firm was founded outside of New England; or firm is a large, multinational pharmaceutical company such as Merck or Wyeth.

We then gathered financial information for the remaining 261 firms. The collection of financial information was problematic as there is no one, authoritative source that provides financial data on all firms. This problem was further compounded by the fact that private firms are not required to provide financial information to the public. The public firms were less problematic as they are required to provide the Security and Exchange Commission with their financial information. We collected information on public firms using Mergent Online, a database that gathers a variety of information from public filings. For the private firms, we referenced a variety of sources: Reference USA, an online database; Ward's Business Directory of U.S. of private and public companies, a printed volume listing information on many U.S. firms; and LexisNexis Business Search, a search engine linked to a variety of public reports on businesses. In the majority of instances, we were unable to find specific financial information on the private firms. Instead, many sources listed estimates.

Due to the variety of sources, there were often inconsistencies across sources in what data was available for each firm. We were primarily interested in firm revenues, but this was often unavailable. In such cases, we relied on sales, estimated sales or, in a few cases, net income.

Finally, in order to get a sense of the size of the firm, we examined each firm's number of employees. Both the Massachusetts Biotechnology Council and the Boston Business Journal provided this information.

Founder Information

We used three methods to gather founder information. First, we emailed each company asking for names and countries of origin for each founder. This method was largely unsuccessful; only a few firms responded to our inquiries. Second, we examined each company's website. Many company websites provide a history of the firm that lists the names and biographies of the company's founders. Other companies provide extensive biographies of their key personnel including company founders. We also found many instances where an individual's biography on one site would list that person as a founder of another firm. Unless such information was directly contradicted by the second firm's website, we included the information. Unfortunately, gathering information this way was problematic. In cases where we drew information from biographies of key personnel, we had no way of knowing whether or not all founders were listed. If a founder had left the firm by the time we looked at the web site then his or her biography would likely have been removed. Therefore, we had no way of knowing whether or not our information was complete.

Determining a founder's country of origin was also problematic. In some cases, the founder's country of origin was listed in the company's history or in his or her biography. In most instances, though, this information was not provided. In such cases, we assigned country of origin based on the founder's educational background. If the founder was educated overseas, we counted that person as an immigrant; otherwise, the founder was listed as a non-immigrant. In cases where the founder received degrees from both American and non-American institutions, we used the lowest degree to assign country of origin. For example, if a founder got a master's degree in India and a doctorate in the United States, then we listed that person as an immigrant.

After emailing and searching company websites, there remained 166 companies for which we had incomplete or no data. We called these remaining companies directly and asked company representatives for the information. We followed the following script during each telephone call:

Hello, my name is Jim McQuaid, and I'm calling from the Boston University Department of Sociology. We're conducting a research study looking at the founders of New England biotechnology firms. Would you have a few moments to answer some questions about the founders of [company name]?

1. What were the names of the founders of [company name]?

2. Their genders?

3. Were any of your company's founders immigrants to the United States?

In many instances, we had to leave messages with administrative staff or on voicemail. We made a total of three attempts to contact each company.

Interview Data

We interviewed five founders of three different New England biotechnology companies for this research. Four founders were male and one was female. The founders immigrated from China, Vietnam, and India. The interview questions included the following information:

- Educational background
- How respondent came to live in the United States
- Founding role in biotechnology company
- Company business and history
- Reasons for locating in Massachusetts
- Advantages and disadvantages of immigrant status for being an entrepreneur
- Role of funding in start-up
- Role of gender in entrepreneurship
- Participation in support groups for immigrants and/or entrepreneurs
- National styles of science

References and Notes

[1] Malone, N. et al. U.S. Census, 2003, "The Foreign Born Population," http://www.census.gov/prod/2003pubs/c2kbr-34.pdf.

[2] Levin, S.G. and P.E. Stephan. 1999. "Are the Foreign Born a Source of Strength for U.S. Science?" Science 285: 1213-14.

[3] Wadhwa, V., et al. 2007, "America's New Immigrant Entrepreneurs." Duke University and University of California-Berkeley, http://memp.pratt.duke.edu/downloads/americas_new_immigrant_entrepreneurs.pdf.

[4] Anderson, S. and M. Platzer, 2007, "American Made: The Impact of Immigrant Entrepreneurs and Professionals on U.S. Competitiveness," http://www.nvca.org/pdf/AmericanMade_study.pdf.

[5] U.S. Census, 2005 American Community Survey.

[6] We hesitate to report these data because there may be some response bias. The approximately 60 percent response rate we obtained is comparable to other surveys. However, those firms with immigrant founders may have been more likely to respond than firms without non-native founders. If we assume that all of the non-responders lack immigrant founders, then 25.7 percent of biotechnology firms in Massachusetts and New England were started by immigrant entrepreneurs. If the non-responders look like the firms that did respond, then about 40 percent of firms had immigrant founders. The problem is that we do not know about the firms that chose not to respond. Hence, we report the most conservative estimate of immigrant entrepreneurship in the Massachusetts biotechnology industry region.

[7] U.S. Bureau of Labor Statistics, 2006 December figures for Massachusetts, http://www.bls.gov/eag/eag.ma.htm.

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