



Scientists and entrepreneurs share lab and office space at LabCentral in Cambridge, Massachusetts.

MASSACHUSETTS

Mass effect

The Boston region has become a hotbed for life-science jobs, thanks to a constant push to meld research and industry.

BY NEIL SAVAGE

Governments have long thought that if they could lure a multibillion dollar company to their area, smaller firms would grow up around it to provide goods and services, thereby creating jobs. A car manufacturer, for instance, would need parts and materials suppliers.

But the experience of Massachusetts and its booming life-sciences scene turns that old industrial model on its head. “If you can somehow attract small companies, those small fish will attract bigger fish,” says Barry Bluestone, a political economist at Northeastern University in Boston. “What they want to be is proximate to all these small firms,” he explains. “You really don’t have to support the big guys. They’ll come on their own.”

Those small companies do a lot of very early-stage research that large firms won’t spend the money on. A hundred small companies tackling a biological pathway for cancer, for example, have better odds of coming up with a solution than a big pharmaceutical company following just a few avenues of research. And if one of those start-ups comes up with a product, being located close by means the large corporation is perfectly placed to acquire the smaller company.

Massachusetts, and more specifically the Boston–Cambridge region, has created a dense life-science ecosystem. Research at universities and teaching hospitals has spun out into start-ups and fast-growing mid-sized firms, and the combination has lured pharmaceutical giants to the state, creating jobs and bringing in tax revenues. The life-sciences sector has grown out of decades

of federal investment in basic research and more recent state efforts to boost the science-driven economy.

Employment in the life sciences in Massachusetts grew by 27% between 2001 and 2011, compared with 12% for the rest of the country (B. Bluestone and A. Clayton-Matthews *Life Sciences Innovation as a Catalyst for Economic Development: The Role of the Massachusetts Life Sciences Center*; The Boston Foundation, 2013). By the end of 2011, about 14 in every 1,000 residents were employed in the life sciences — a bigger proportion than any other US state.

The Boston area is home to a rich collection of research universities, including Harvard University, Massachusetts Institute of Technology, the University of Massachusetts, Boston University and Worcester Polytechnic Institute, that have long pulled in substantial amounts of federal research funding. It is also home to world-class hospitals; of US independent institutes, Massachusetts General Hospital was the biggest recipient of National Institutes of Health (NIH) funding in 2014, receiving nearly US\$350 million, followed by Brigham and Women’s Hospital, Boston Children’s Hospital and the Dana-Farber Cancer Institute, all of which are teaching hospitals for Harvard. In addition, the Kendall Square area, the epicentre of the boom, is home to independent research institutions, including the Broad Institute of MIT and Harvard and MIT’s Whitehead Institute for Biomedical Research. “I think one could credibly claim that we have the strongest concentration of research-based enterprises in the life-science area of any region in the world,” says Richard Lester, who studies innovation strategy and management at MIT.

While federal funding built up the science, the state government began supporting the industry side of the equation. It created the Massachusetts Life Sciences Center (MLSC) in 2008, a quasi-public agency charged with spending up to \$1 billion over 10 years, in the hope of stimulating the local economy with loans to small businesses, investments in education, and support for buildings and equipment.

KEEPING IT LOCAL

One company drawn by the concentration of life-science organizations is the German-based pharmaceutical company Bayer, which is opening its East Coast Innovation Center in Cambridge later this year. “We want to be part of the community, where there is excellent science,” says Chandra Ramanathan, head of the centre. “You can be there and engage with them in a much more collegial way.”

Indeed, 17 of the world’s 20 largest drug companies have a presence in Massachusetts, and the sector is growing faster there than in any other state. The thriving cluster is benefiting the state economically, leading

to thousands of new jobs and millions in tax revenues.

Massachusetts does well when life-science companies scale up, Lester says. These growing companies have more stability and market clout than smaller outfits, and are a bigger source of new jobs than start-ups and giant firms. When companies are acquired, often it is by other firms in the state, thus keeping the pool of talent local. Research managers can be “recycled”, Lester says — they leave one company to help start a new one, thereby continuing the sector’s growth. Density is essential, he argues. “Serendipitous interactions, the ability to walk from your lab on campus to your start-up’s offices, these things really do seem to matter,” Lester says.

“The jobs created are not just jobs for an elite workforce.”

Location is important to innovation, agrees Travis McCready, president of the MLSC. “You need to be proximate to where the best R&D is happening,” he says. “We’ve learned over the years that proximity contributes to the speed of development.”

Many of the interactions between researchers and businesspeople, big and small companies, and venture capitalists are informal — “a lot of this happens over a cup of coffee at the local Starbucks,” says Bluestone. But the MLSC provides a mechanism for big pharma to find out what start-ups are doing. The MLSC offers loans of up to \$750,000 to help support new companies. To qualify for a loan, a start-up must be approved by a board made up of scientists and venture capitalists. Pharma companies often find that the firms that qualify for loans are attractive research partners or future acquisitions. “We have an extraordinary scientific advisory board,” McCready says. “The ideas that they vet are then viewed as being best in class.”

The MLSC also helped fund LabCentral, a facility that provides laboratory space for up to 25 start-ups so that they can develop their research without having to invest in their own lab; pay for equipment, such as a research-grade MRI machine; and fund buildings for academic researchers, on the condition that these can be rented out to other researchers. These investments, in turn, have helped the researchers to gain NIH funding, because they could show that they had the resources for a proposed project.

Schools, particularly vocational-technical high schools, throughout the state are also benefiting. The MLSC provides funding and equipment to help educate students who will eventually apply for some of the life-science jobs. “The jobs created are not just jobs for an elite workforce,” says previous MLSC president Susan Windham-Bannister, now an independent consultant. Indeed, Bluestone’s

study found that 15% of the jobs in life-science firms required a high-school diploma or less, another 8% required no more than a two-year degree, and 48% were open to people with only a bachelor’s degree.

Windham-Bannister says that the state played a “catalysing role” when it created the centre. “This is government as protagonist, not antagonist,” she argues. But others say that it’s difficult to tell how much of the current boom is attributable to government policy and how much to the state’s already existing strengths. “I’m sure it had a positive impact,” Lester says. Much of that impact may have been at the margins, he says, with hard-to-quantify effects such as influencing the decision about where to locate a business. “Was it the defining element for the success of life sciences in our region? No.”

Bluestone says that before he began his study, he was sceptical about the value of the state’s investment. Now he thinks that MLSC has played an important part in job creation. “I cannot affirmatively say that the life sciences center created X billion dollars of additional state revenues,” he says. But he points out that it was after 2008 when many of the smaller companies sprung up and when the number of life-sciences jobs in Massachusetts surpassed those in other states (see ‘Investment hub’). “There is no proof that this wouldn’t have happened otherwise,” he concedes, but the timing of the employment spike, the fact that Massachusetts out-competed other areas with strong life-sciences research — California, Pennsylvania and New Jersey — and his interviews with company executives convinced him that the state’s efforts had an important role in bolstering the sector. “The correlation is awfully strong,” he says.

LESSONS FROM THE PAST

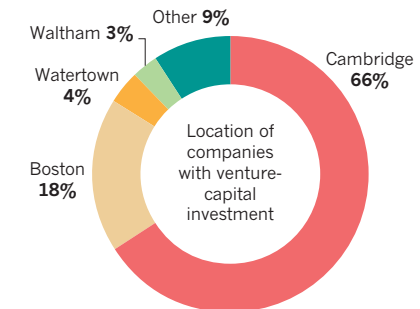
Massachusetts has seen a technology-led sector come and go before. In the 1970s and 80s, Route 128, which arcs around the Boston area, was dubbed America’s Technology Highway owing to the large number of workstation and minicomputer manufacturers — including once-dominant names such as Digital Equipment Corporation, Wang Laboratories, Prime Computer and Data General — that sprung up along the corridor. The minicomputer industry “really drove Massachusetts’s growth in the 70s and 80s”, says AnnaLee Saxenian, an urban-planning researcher at the University of California, Berkeley, and author of *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Harvard Univ. Press, 1994). But the computer companies couldn’t cope with the rise of the personal computer, and eventually the ‘Massachusetts miracle’ collapsed, leaving the cutting-edge information technology innovation to Silicon Valley. “I went to school for engineering, thinking I could

INVESTMENT HUB

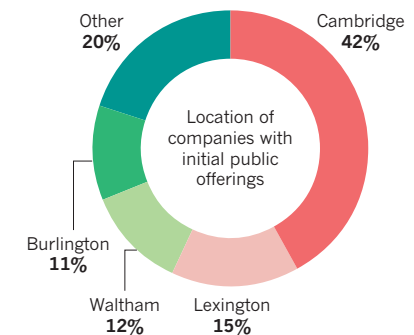
Investment in Massachusetts biotechnology has grown steadily over the past 10 years, reaching a high of US\$2 billion in 2015.



In 2014–15, most of the early-stage biotech companies were located in Cambridge.



During the same period, most biotechs launched on the stock market were located outside Cambridge.



work at any of the computer companies on Route 128,” muses Robert Coughlin, head of the Massachusetts Biotechnology Council. “By the time I graduated they were gone.”

The problem, Saxenian says, was that those companies were large and insular. They were not part of an innovative ecosystem in the same way that the life-science companies are. They did everything — from chip design to software development — in-house, and didn’t interact with people outside their firms. When they failed, there were no growing start-ups to take their place. “I think that the industrial model was not able to adapt as quickly as this more decentralized model,” she says. Saxenian expects life sciences to fare better. “What’s happening in Kendall Square,” she says, “looks a lot more like what I saw early on in Silicon Valley.” ■

Neil Savage is a science and technology writer in Lowell, Massachusetts.