



Stockholm is home to several entrepreneurial companies that are reshaping Sweden's scientific industry.

Science diversified

After suffering heavy blows, Swedish science shows signs of sustainable recovery.

BY NIC FLEMING

Mergers, acquisitions and restructuring are par for the course in the pharmaceutical industry. Markets grow and shrink, new treatments are developed and corporate priorities change. Jobs are created, moved and lost. This came as no comfort to the 600 people left out of work when AstraZeneca shut down its research facility in Lund, Sweden, in 2011. As the ripples spread, some saw it as the latest in a series of blows signalling the death of a local industry.

Seven years on, and although Sweden's pharmaceutical sector has yet to recover, those taking a wider view see a more positive picture emerging. Major new materials-science

facilities in Lund are expected to open up prospects in a wide range of fields.

"AstraZeneca left a big black hole in a small country," says Tina Persson, a career coach in Stockholm. "My feeling is that things are growing again, but it's a new environment with lots of start-ups and innovative small companies. Those looking for work in the sector need to understand how the culture has changed so they can best find where their skills are in demand."

Sweden has a tradition of investing in research and development (R&D): it spends 3.4% of its gross domestic product on science, placing it fifth in the world. This helps to

explain why the country came second (behind South Korea) in the 2017 Bloomberg Innovation Index. Policymakers used to worry that this investment was not always matched by business and employment creation, says Åsa Lindholm Dahlstrand, who studies innovation at Lund University. However, this seems to be changing as Swedes take on board trends such as the decline of big pharma, and as the country undergoes wider cultural shifts.

"It used to be that most people in Sweden expected to find a job for life with a large multinational company, and we were relatively weak in entrepreneurship," says Lindholm Dahlstrand. "It has taken a long time but the ▶

▶ culture is becoming more individualistic, and we've seen a growing number of innovative start-ups." Sweden's unusual legislation for intellectual-property rights is also encouraging (see 'Research rewards').

DOCTOR, DOCTOR

One area seeing rapid growth is electronic health, or e-health — a broad sector that encompasses electronic medical records, virtual health-care consultations, health IT systems and telemedicine. Sweden is a highly connected society: in 2016, 93% of inhabitants had Internet access, 79% made online purchases and 77% had smartphones or portable computers — all well above the average for the European Union.

The market for virtual doctors is expanding, with two companies — Min Doktor in Malmö and KRY in Stockholm — using voice, video and text services to cut health-care providers' costs. In March 2017, 13,000 digital medical consultations took place in Sweden, which runs a public health-care system largely funded by taxpayers. "We're seeing rapid growth in the number of digital health companies and initiatives," says Nima Jokilaakso, project manager for e-health at Swecare in Stockholm, a public-private group seeking to boost Swedish health-care and life-sciences exports.

In 2016, Sweden's government and the Swedish Association of Local Authorities and Regions adopted a target of making the country a global leader in e-health by 2025. Jokilaakso, however, says politicians have failed to match ambition with action to address e-health business concerns. "They want to demonstrate they care about the sector, but there is no funding or plan connected to the issues that are relevant to e-health companies seeking to grow." These issues include regulatory hurdles and political hostility to making profits from health care.

Competition for conventional academic and industrial research roles can be stiff, but e-health is one of the areas in which doors are opening for those willing to be flexible. Companies offering virtual-doctor and telemedicine services, for example, need specialists for their telephone advice lines — and are therefore hiring medically trained PhD graduates. "Ten years ago, PhDs weren't needed in those positions, but the world is becoming more technical," says Persson.

SCIENCE CENTRES

The job market looks different in each of Sweden's three largest cities (Stockholm, Gothenburg and Malmö). In Stockholm, Persson says, R&D roles are mostly found in small- and medium-sized companies, as well as universities. There is also a high demand for those with mathematics and physics PhDs to work as data scientists and analysts in the finance industry. Persson says that a growing number of researchers are finding work consulting for

companies, and others are transferring their skills into related roles in sales, marketing and regulation.

AstraZeneca still has an R&D centre in Mölndal, near Gothenburg, where researchers focus on cardiovascular, metabolic and respiratory disease, as well as inflammation and autoimmunity. Jobs in the Malmö-Lund area are mostly at Lund University and in small businesses and start-ups, such as those in e-health and medical technology. The small pool of jobs on offer there makes networking all the more important.

"To those who come from abroad who say it is hard to get a job, I often explain that Sweden is a small country with small, narrow networks," Persson says. "The trick is to make sure you are in them." She suggests taking part in Swedish activities, going to meet-ups and making full use of alumni, expat and Facebook groups. Persson also suggests that prospective candidates try to pick up some of the language, "even though most Swedes speak English". Although not essential for science, it does help with integrating into the local culture. "It doesn't have to be perfect, but it is an important factor when job hunting, and one often forgotten by academics."

THINKING BIG

Sweden is expecting more visiting foreign researchers in the near future, thanks to the development of two world-leading research facilities in Lund. MAX IV, which opened in 2016, is a synchrotron radiation source that, when fully operational, will be about 100 times brighter than existing facilities. Synchrotrons are particle accelerators that use magnets to steer electrons around a circular vacuum tube at close to the speed of light, causing them to radiate high-energy X-rays.

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Thanks to some clever engineering from Mikael Eriksson, a Swedish-born academic and pioneer of the previous three MAX synchrotrons, MAX IV's 528-metre-circumference storage ring can push electrons closer together and create brighter X-ray pulses than its predecessors. MAX IV also includes another, smaller storage ring and a linear accelerator for different types of experiment. It is being used to study materials in greater detail than ever

PROFESSOR'S PRIVILEGE

Research rewards

One unusual aspect of academic research in Sweden is the long-standing law known as professor's privilege: unusually, university employees keep the intellectual-property rights to discoveries they make.

This encourages the creation of spin-off companies, increases patenting activity and can help universities to recruit high-quality researchers. "It has attracted some good international researchers who want to work with companies and commercialize their work," says Åsa Lindholm Dahlstrand, who studies innovation at Lund University. **N.F.**

before, shining a light on chemical reactions in batteries, the precise structure of nanoparticles and the mechanisms of new drugs.

Around 2,500 researchers per year are expected to use the facility when it becomes operational in 2019. "I think MAX IV will do for Sweden and the surrounding region what CERN has done for Switzerland," says Søren Bregenholt, vice-president at Danish pharmaceutical company Novo Nordisk, referring to Europe's particle-physics laboratory near Geneva. "It will attract a lot of researchers and develop into a point of gravity for materials and biological-materials sciences."

Also under construction in Lund is the European Spallation Source, which will open to users in 2023. The facility will include a 600-metre-long proton accelerator capable of producing neutron beams two orders of magnitude brighter than those currently available. Lund University, Chalmers University of Technology in Gothenburg and Uppsala University have been recruiting researchers who can use these world-leading tools for materials science. "We are seeing new positions being opened in areas such as magnetic materials and catalysis, because universities want to position themselves to exploit these facilities," says Tomas Lundqvist, science director at MAX IV.

Few Swedes would have chosen this rocky road, with such a major decline for their country's pharmaceutical industry over the past 20 years. Despite this, there may be long-term gains from the short-term pain: as Sweden discovered, reliance on a small number of multinationals in changing times can be dangerous. The diversified and entrepreneurial landscape currently emerging offers greater resilience to the country as a whole — and new opportunities to those ready to exploit them. ■

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