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UK scientists champion Singapore's biosciences industry



Singapore's burgeoning biosciences industry is being given a boost by scientific expertise from the UK.

Fifty years ago, one March day in Cambridge, the young scientist Francis Crick burst into his local pub and triumphantly declared that he and his colleague, James Watson, had discovered "the secret of life".

He was talking about their identification of the structure of DNA (Deoxyribonucleic acid). The

pair, working at the Cavendish Laboratory at Cambridge University, identified what DNA looks like and how it works, and recognised that DNA could replicate itself and pass on genetic information. They later received a Nobel Prize for their work.

Crick and Watson's breakthrough revolutionised science and paved the way for the modern biosciences industry. Fifty years on, their discovery touches wide-ranging aspects of our lives, from criminal prosecutions to paternity issues to understanding disease and drugs. It would not be an understatement to say that theirs was the scientific discovery of the last century.

The tradition of excellence in biosciences in the UK, which no doubt helped Crick and Watson in their quest, continues to this day. More than half of the 46 Nobel Prizes awarded to UK scientists over the last 50 years have been for biosciences and medicine.

Besides marking the 50th anniversary of the identification of DNA, 2003 also saw the completion of the Human Genome Project, which identified every letter (almost 3 billion of them) in the genetic code of human DNA. Here, too, the UK played a major role. The Wellcome Trust Sanger Institute, the only British institute taking part in the international project, completed almost a third of the sequence - the biggest contribution by any one single institution.

With such excellence to draw from, no wonder that research institutes, universities and companies in Singapore are eager to recruit British scientists. Indeed, such scientists are vital if Singapore is to realise the aims of its

Biomedical Sciences Initiative, launched in June 2000. For the biosciences industry is leading the way along Singapore's economic roadmap, replacing IT as the engine of growth. The island's best minds and resources are being carefully channelled into this sector, in what may be a matter of survival for the Lion City.

"Singapore is going through a transition," explains Dr Gunaretnam Rajagopal, acting director of the Bioinformatics Institute, a research and postgraduate training institute. "The dragon in China is waking up, and then an elephant in India is also waking up, and we're right in the middle. So we need to take adversity and turn it into an advantage. We're within a seven-hour radius of two-thirds of the population of the world. A lot of the drugs that are developed are developed for the Caucasian population. But we all have certain genetic characteristics that make us susceptible to certain chemical treatments, positively or negatively. If we can work on drugs that are relevant to this region, then we have a market. So that's why the government decided to invest a lot of money in building up the biomedical industry here."

Big-name companies that already have a presence in Singapore include Becton Dickinson, Eli Lilly, GlaxoSmithKline, Johns Hopkins, Novartis, Schering-Plough, Siemens and Wyeth.

As well as major companies, some of the scientific world's best minds are also moving to Singapore. Biosciences is still a relatively new sector in Singapore, so foreign expertise is crucial in helping to forge the nascent industry. Already here is Dr Yoshiaki, former director



of virology at Kyoto University and Dr Edison Liu, former director of clinical sciences at the US National Cancer Institute. From the UK, Dr Alan Coleman, one of the scientists involved in creating Dolly the Sheep, moved to Singapore just over a year ago to take up the position of chief scientific officer at ES Cell International Pte Ltd, a regenerative medicine company and provider of products and technologies derived from human embryonic stem cells.

Not only that, a new 2-million-square-foot R&D complex called the Biopolis ('biology' + 'metropolis') is currently under construction. The Biopolis will be home to five biomedical research institutes as well as R&D laboratories of pharmaceutical and biotechnology companies.

There are early signs that the Biomedical Sciences Initiative, not yet two years old, is already beginning to bear fruit. Under the auspices of the Biomedical Sciences Group of the Singapore Economic Development Board and the Agency for Science, Technology and Research (A*STAR), Singapore's biomedical sciences manufacturing output grew by 48 per cent in 2002 to reach a value of US\$5.4 billion. By 2005, Singapore hopes to achieve a biomedical sciences manufacturing output worth US\$6.7 billion. This target should not be impossible to achieve – sources agreed that the Singapore biosciences sector has much in its favour.

Dr Tony Buss, president & CEO of MerLion Pharmaceuticals Pte Ltd, a privately held company engaged in drug discovery and development, explains that one of the advantages of working in drug discovery in Singapore is the ease of communication, both locally and overseas. "We're very close to neighbouring research institutes. Everybody is our neighbour here – the Institute of Molecular Cell Biology, the Genome Institute, the National Cancer Centre," he says. "Communicating with our business partners, most of whom are on the other side of the world, is not really an issue because of e-mail and the Internet. Of course face-to-face meetings are not so readily achievable, but we don't find it a major problem. It just means some long flights on occasion."

Dr Quaratulain Zaidi, laboratory director of CordLife Pte Ltd, a private cord blood bank, stem cell technology and regenerative medicine company, appreciates the faster pace of life in the Singapore private sector. "Here I'm with a start-up, so I'm learning as I go along," she explains. "You're rapidly growing and you really need to learn very quickly. You get things done. You may never

money are being invested in biosciences education. Rupert Wilmoth, assistant professor with the School of Biological Science at Nanyang Technological University (NTU), was recruited from Oxford University a year ago. He explains that the Singapore government provided S\$100 million to establish a new School of Biological Sciences at NTU. "The money has allowed



Phase 1: 1,845,240 sqft	Biomedical complex	Shared R&D facilities
<ul style="list-style-type: none"> • June 2003 completion • Common areas include retail outlets, housing, and entertainment 	<ul style="list-style-type: none"> • Public R&D centres (BII, BTC, GIS, IBE, IMB) • Corporate R&D centres 	<ul style="list-style-type: none"> • Shared R&D equipment • Shared utilities • Shared animal facility

Companies located at the biopolis will be able to leverage in common facilities such as shared utilities and animal facility.

have done something before, but you get on with it, and you do it."

Associate professor Philip Barlow, director of the Food Science & Technology Programme at the National University of Singapore, explained that access to government agencies is fairly straightforward and on the whole the government is supportive. "If you're involved in life sciences, research doors will open easily for you. If you're working in other areas, it may not be so easy," he says. "That's not a criticism. Singapore is such a small country that it's impossible to do everything."

Dr Gunaretnam agreed that Singapore's ability to focus on a particular sector is a benefit. "There are so many good people in the UK but the resources are divided. The strength of Singapore is that they can focus things, to try to push things in a certain direction," he explains. "However, in Singapore we're still building up our capabilities, we don't have a critical mass of good people yet and we need to build that up."

In order to develop this talent base in Singapore, large sums of

a state-of-the-art building to be constructed and for superb equipment to be purchased. In addition, the salaries for university academics are excellent and significantly higher than in the UK and compete well with those paid by industry," he says.

While top academic staff may be well paid, raising equity in the private sector presents a somewhat greater challenge. Dr Buss of MerLion Pharmaceuticals explained that the venture capital sector in Singapore has limited experience in investing in the relatively new biotech sector. "For a company like MerLion, as we were last year, in a position of needing to raise funds, it presents a problem. Where do we get funding from if locally there's not the experience?" he says. "We believed strongly that we needed an international presence in our first round of funding. That was tough, because in the United States there are so many good opportunities for investment that the US venture capital community really doesn't need to look abroad. Our break came when we found a lead investor



MerLion Pharmaceuticals



from Switzerland, a small venture capital company with a strong scientific advisory group." Despite the harsh economic climate in 2002, MerLion managed to raise US\$13.5 million in funding.

And at the very core of the development of Singapore's biosciences industry is training and development. Here too, UK scientists are spearheading significant work. Philip J Barlow, for example, moved from the UK to Singapore to establish the Food Science &

Technology Programme at the National University of Singapore.

"Within the region, Singapore has a five-star rating in terms of educational reputation. So by setting up the course here, the graduates automatically have a quality mark," he says.

Dr James A. Hill, technical manager of Chemical Genetics at the Temasek Life Sciences Laboratory, sees Singapore's decision to create an industry from the classroom up as a practical move. "All the top students are being funnelled into biotechnology because Singapore is trying to develop its own talent base to take over the reigns of the biotechnology industry," he explains. "It makes sense. What else can Singapore do? They're basically identifying an industry and taking it all the way back into the classroom. Why not

start from the classroom and build the industry from there?"

On a more current note, UK scientists based in Singapore are also helping to battle severe acute respiratory syndrome (SARS). Dr Buss of MerLion Pharmaceuticals, for example, revealed that the company is working with the Genome Institute to devise a test for SARS. The Bioinformatics Institute, headed by Dr Gunaretnam, is working on the analysis of the genome. The Institute hopes to collect and analyse data and make this available in order to help develop a cure or vaccination. "We'll share any information we think might be useful," says Dr Gunaretnam. "After all, this isn't a competition. It's a matter of life and death."

Jo Kent

The food scientist



Philip J Barlow came to Singapore to establish the Food Science & Technology Programme at the National University of Singapore in 1999. Associate professor and director of the Programme, Philip explains that the impetus for setting up the Programme came from the need to produce technical managers for the increasingly sophisticated food industry.

The Programme's four-year honours degree covers three key areas: food safety, new product development and the globalisation of the food industry. Graduates of the course go on to pursue a wide range of careers, as varied as a trainee manager for a well known fast food outlet, to a food technologist, to a trainee with a traditional Chinese herbal medicine company.

In terms of research, Philip's team is working on identifying the active components of Gingko Biloba with a view to alleviating neuro-degenerative diseases; and is also looking at food waste solutions - extracting beneficial components from mango kernels, for example.

In future, Philip is keen to develop a part-time masters programme and to establish closer links with established food research institutes around the world.

Website: www.fst.nus.edu.sg

The skills developer



Dr Gunaretnam Rajagopal, originally from the UK, is acting director of the Bioinformatics Institute. Founded just under two years ago, the government-funded Bioinformatics Institute, which falls under the A*Star umbrella, was conceived as a research and postgraduate training institute. The aim is to help lay a strong foundation for a thriving biomedical R&D hub in Singapore.

The Bioinformatics Institute runs graduate (MSc and PhD) programmes, research programmes and collaborates with industry - partners include Lilly and Novartis - with a view to eventual drug development.

In the near future, the Bioinformatics Institute will become the heart of a soon-to-be constructed Biopolis opposite Buona Vista MRT station, which will be composed of bioengineering, bioprocessing, research, molecular and cell biology and genome facilities.

Website: www.bii.a-star.edu.sg



The drug discoverer



President & CEO of MerLion Pharmaceuticals Pte Ltd, Dr Tony Buss has been in Singapore for just over three years. Previously with Glaxo, Tony has headed up MerLion Pharmaceuticals since it was founded in 2002, the result of the privatisation of the former Centre for Natural Product Research, which in turn was funded by Glaxo and the

Economic Development Board. The privately held company is engaged in drug discovery and development and collaborates with pharmaceutical companies and research organisations around the world.

MerLion Pharmaceuticals has one of the world's most diverse natural product collections, which it uses to look for naturally occurring chemicals that can be applied to unmet medical needs, in the form of prescription drugs.

The company partners with entities that have advanced test systems, which can be used to test thousands of chemicals very quickly. The test systems are transferred to Singapore and are run against MerLion Pharmaceuticals' collection of naturally occurring chemicals. The company can then identify any interesting active compounds and offer these back under license to respective partners. MerLion Pharmaceuticals is not a contract research organisation, but expects to receive milestone and royalty payments further down the line once drugs progress towards market.

Website: www.merlionpharma.com

The chemical geneticist



Dr James A Hill has been in Singapore for four and a half years and is technical manager of Chemical Genetics at Temasek Life Sciences Laboratory. Working at the sub-gene level, Jim's primary goal is to describe development from a chemical perspective.

Specifically, this means taking one chemical and screening 200,000 to 300,000 protein functions in order to see the effect. The aim is to identify chemicals that block the normal process of development. This is useful because the same genes which give cells instructions about what to become during development can become harmful if they are somehow switched on again in adulthood, often with the result of causing tumours or cancers.

It is hoped that a thorough understanding of development and the chemicals that effect it will lead to much greater understanding of the way tumours and cancers develop.

Website: www.teratochem.com
(site under construction)

The biological scientist

Rupert Wilmoth is assistant professor at the School of Biological Science, Nanyang Technological University. Rupert's research is currently focused on the hepatitis C disease, which affects more than 170 million people worldwide.

Chronic hepatitis C patients often suffer from significant liver disease. At present the only treatment is a liver transplant or drug therapy, which is only effective in around 40 per cent of sufferers.

When the hepatitis C virus invades a liver cell it synthesises new proteins which are essential for replication of the virus. Rupert's research group is studying one of these proteins, known as the NS3 protein, in order to gather structural and functional information about it.

Once this information about the NS3 protein has been collected, the aim is to predict which small molecules (i.e. potential drugs) might be able to block its action. By inhibiting the action of NS3, it may be possible to either cure hepatitis C completely, or reduce the risk of severe liver complications arising.

Website: www.ntu.edu.sg/sbs/



The stem cell scientist

Dr Quaratulain Zaidi, originally from the UK, is laboratory director of CordLife Pte Ltd. CordLife stores stem cells collected from the umbilical cord at birth. The procedure is painless and takes around three minutes - a much simpler process than collecting bone marrow, the other ready source of stem cells. The blood is then processed and preserved at CordLife's laboratory. Once frozen, the child owns the sample, and the parents are the guardians.

Stem cells are useful because they can be used in transplant medicine to regenerate a patient's blood and immune system. Over 45 medical conditions can be successfully treated using stem cell transplants, including leukaemia. And because patients use their own stored stem cells, there is no risk of rejection. Storing stem cells is of particular interest to families with a history of inherited disease.

CordLife has expanded significantly over the two years since its establishment and now has a presence in Singapore, Malaysia, Thailand, China, the Philippines and Switzerland and has 450 samples at its Singapore facility. The company is planning to build another lab in Singapore and has recently acquired the US company Cytomatrix LLC, which will focus on stem cell R&D.

Website: www.cordlife.com

