

Building a biopolis

Having established itself as a financial and manufacturing centre, Singapore now wants to become a leading player in advanced biological research. David Cyranoski assesses the scientific ambitions of a vibrant city-state.

Clean, confident and cosmopolitan — that is the impression Singapore gives most visitors. With English as its first language, many foreigners quickly feel at home. And under the watchful eye of its autocratic but competent government, Singapore has become one of Asia's leading financial and industrial centres.

Now the ambitious leaders of this city-state have turned their attention to biological science. They plan to make Singapore a major player in biomedicine and biotechnology — and as the cash begins to flow, expectations are rising. Some Singaporean biologists talk excitedly about showing developing countries how to compete with the world's best. Others see their city becoming the hub of a pan-Asian research network. Those with an eye for business, meanwhile, are promoting it as a gateway to the lucrative Asian market for Western drug and biotech companies.

This push in biology is making waves internationally. "They have really bright, far-sighted people in high places willing to put in significant investment," says pharmacologist Paul Lietman, research director of the Singapore branch of Baltimore's Johns Hopkins University. "Singapore could and should be a model for other nations that are trying to build biomedical research capacity."

Rising tension

But if Singapore's biological ambitions are to be realized, some nagging problems must be addressed. Foremost are concerns about the recruitment and retention of sufficient top-class researchers. "The rate-limiting step is getting the people," says Sydney Brenner of the Salk Institute for Biological Studies in La Jolla, California, one of a group of prominent biologists advising the Singaporean government. And in the current hothouse atmosphere, rivalries between disciplines and institutes have created some bitter tension.

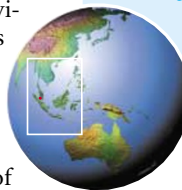
The driver behind Singapore's scientific revolution is Philip Yeo, who took over as chair of the National Science and Technology Board (NSTB) in February. Having headed the Singapore Economic Development Board since 1986, Yeo gained credit for the rise of the city's microelectronics and other lucrative

industries — giving him a celebrity status unusual for a government official. Nowadays, his efforts are concentrated on the expansion of Singaporean biomedicine. Trained as an industrial engineer, Yeo brings in biologists to tutor him on Saturday afternoons. When *Nature* visited his office, the previous week's notes — on cell signalling — were still scrawled on a whiteboard.

"We're building the entire range of medical advance, from drug discovery through early-stage clinical trials to manufacturing and marketing," says Yeo. The government is putting money behind this vision. The NSTB's budget from 2001 to 2005 is some US\$3.8 billion, a 75% increase over the previous five years. Most disciplines are benefiting, but biomedicine has been singled out. The Biomedical Research Council (BMRC), established last September, has a five-year budget of some US\$800 million, and is ploughing these funds into a series of new institutes.

The NSTB is also building a chemical institute as infrastructure for its budding pharmaceutical and biotechnology industries. Major biotech players such as Chiron of Emeryville, California, have announced plans to set up research initiatives in Singapore. Last month, the drugs multinational Eli Lilly and the Singapore Economic Development Board announced the opening of a joint Center for Systems Biology, with a research budget of US\$140 million over five years.

In this favourable climate, Singaporean biology is making rapid progress. The



Mapped out: the city's leaders plan a glittering biological future.

nation's small size means that there is little inertia. "We can turn on a dime,"

boasts Chris Tan, director of the Institute of Molecular and Cell Biology (IMCB), which is a key player in the international effort to sequence the genome of the puffer fish *Fugu rubripes*.

The IMCB is now part of the BMRC's expanding empire, as is the Genomics Institute of Singapore, created with an influx of funds announced a year ago. Its executive director is Hong Kong-born Edison Liu, former head of clinical sciences at the US National Cancer Institute in Bethesda, Maryland. With an operating



Leading lights: Chris Tan, inset, and his Institute of Molecular and Cell Biology.

budget of US\$25 million a year, Liu plans to recruit 250 researchers to study areas such as the transcription of genes into proteins and the influence of genetic variability on drug metabolism within Singapore's population.

To manage the anticipated deluge of genomic data, the BMRC in February added a new Bioinformatics Institute — expanded from the National University of Singapore's existing bioinformatics centre. And the BMRC is now gearing up for the launch of a bioengineering centre to work on tissue engineering and regenerative medicine.

At present, the BMRC's institutes are hosted by the National University. But in 2003, they are scheduled to move into a science park dubbed the 'Biopolis', being built in the district of Buona Vista, still close enough to interact with the university. The Biopolis will include living space for up to 1,000 scientists. "It will be a place where people want to come," says Louis Lim, the BMRC's executive director, who has his sights set on attracting the best international talent.

Thin veneer

For the time being, that will be essential, as there are not enough home-grown scientists to fill all the available positions: more than three-quarters of the researchers at public institutes are foreigners. The English language — a legacy of British colonialism and the glue that holds together Singapore's Chinese, Malay and Indian communities — is an important draw. For researchers from elsewhere in Asia, Singapore provides an opportunity to become comfortable with English while still in a familiar culture. For Westerners, the language makes integration easier.

But some observers say that too many visiting researchers view Singapore as a temporary stopover, which means that the city-state gains less than it should from its investment in science. "Singapore's research infrastructure is a thin veneer," one distributor of reagents and scientific instruments told *Nature*. "There is a lot of top-of-the-line equipment, but few know how to use it."

Yeo and other leaders recognize the problem, and are taking steps to solve it. The Bioinformatics Institute, for instance, plans to churn out 100 graduates each year. The National University of Singapore and the Nanyang Technological University, meanwhile, have established a collaboration that will see 40 leading professors at the Massachusetts Institute of Technology offer masters courses over the Internet for 30 Singaporean students each year.

With these and various other programmes — for attracting foreign researchers, training Singaporeans and bringing back natives who have trained abroad — Lim is optimistic about the future. "Five or ten years down the line, there will be no shortage of talent," he claims. The IMCB's Tan argues that Singapore should not worry too much about

researchers leaving for foreign labs, provided they stay long enough to make a significant contribution. "Ideally, we'd be a 15-year revolving door," he says.

Some foreign scientists find it hard to adjust to a country sometimes dubbed "Singapore Inc.", in which the government exerts control over most aspects of life — in particular those that underpin the nation's economic competitiveness. "It's the most hierarchical place in Asia," claims one visiting biomedical researcher. But other scientists argue that Singapore no longer deserves its reputation for control-freakery. "The government does not direct my research at all," says Liu. "I can exercise my own vision."

For a visiting journalist, perhaps the biggest surprise is the bitter rivalry between some of Singapore's leading institutes. Tan's IMCB stood alone for eight years after its launch in 1987 as the city's world-class biology centre. But in 1995, it gained some competition when plant molecular biologist Nam-Hai Chua of Rockefeller University in New York convinced the NSTB to establish the Institute of Molecular Agrobiology (IMA).

The IMA now has 190 researchers and an enviable scientific reputation. But some powerful critics say a tiny, densely populated island has no place investing in agricultural research. "It's a criminal waste of taxpayers' money," says Yeo. "I would close it down tomorrow if I could." To stress his point, Yeo suggests a trip to a supermarket. "Everything there is imported. We have no agriculture."

Such violent attacks have placed the IMA's soft-spoken director, Venkatesan Sundaresan, in a difficult position. Last autumn, it looked as if the IMA's days might be numbered, as articles in *The Straits Times*, Singapore's leading newspaper, debated the wisdom of investing in agricultural biotechnology. But in November, the outlook brightened when the IMA gained a powerful



Precious resource: Singapore's biggest problem in biology is recruiting and retaining staff.



Only the best will do: Singapore's laboratories are furnished with top-line equipment.

advocate in its newly appointed chair, Ho Ching, chief executive of the engineering conglomerate Singapore Technologies.

Whether the rivalry will harm Singapore's efforts to compete internationally is unclear. But many researchers would prefer the protagonists to collaborate in pushing for Singapore to become the centre of an emerging research network. Established in 1997 by a group of leading Asian biologists, the Asia-Pacific International Molecular Biology Network (IMBN) is envisaged as a counterpart to the successful European Molecular Biology Organization.

So far, the IMBN has organized a handful of meetings and assembled a membership of almost 250 scientists. But its leaders are now pressing their respective governments to provide the funds to run a fellowship programme and establish a laboratory — probably in Singapore, which already hosts the organization's secretariat. "Singapore is the natural home for the IMBN," says Ken-ichi Arai, president of its governing council and director of the University of Tokyo's Institute of Medical Science.

Arai and his colleagues face a tough task winning financial backing for their vision (see Opinion, page 361). But if they do attain their goal of establishing an Asian analogue of the European Molecular Biology Laboratory in Singapore, it would set the seal on the city-state's emergence as a biological power. ■

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National Science and Technology Board

► <http://www.nstb.gov.sg>

Institute of Molecular and Cell Biology

► <http://www.imcb.nus.edu.sg>

Genome Institute of Singapore

► <http://www.genomeinstitute.org>

Institute of Molecular Agrobiology

► <http://www.ima.org.sg>

Asia-Pacific International Molecular Biology Network

► <http://www.a-imb.org>

IMA

NSTB