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An irresistible force

Singapore's impressive advances in biomedicine are driven by the energetic personality of Philip Yeo. **David Cyranoski** meets a man who just can't stand still.

Modesty is not one of Philip Yeo's faults. As we tour Biopolis, the futuristic complex that is the centrepiece of Yeo's efforts to turn Singapore into a powerhouse for biomedical research, he announces that he has never failed in an attempt to headhunt a leading scientist to join the campus. "I have patience," he says with a wry smile.

Yeo's friends and admirers will be amused by this comment. Ask them for a description of him and the adjectives flow readily: persistent, passionate, provocative, even playful. But patience is rarely identified as a trait of this government official — a man whose charismatic influence on his nation's science policy has no obvious parallel anywhere in the world.

Since 1999, Yeo has chaired Singapore's main research organization, now known as the Agency for Science, Technology and Research, or A*STAR. Over the past couple of years, the agency has spent some US\$300 million building Biopolis, which houses research institutes

specializing in genomics, bioinformatics, bio-processing and bioengineering. It is part of a multibillion-dollar investment in biomedicine, designed to nurture industries in biotechnology and drugs. Yeo has led from the front, enforcing an aggressive schedule and attracting some of the biggest names in biology to head the complex's lavishly equipped labs. "He has so much energy. If you tapped it, you could light a small city," says cell biologist Axel Ullrich, who was recruited from the Max Planck Institute of Biochemistry in Martinsried, Germany.

Biomedical research is just the latest endeavour to be swept up by the Yeo whirlwind. An engineer by training, his career took off in the 1970s when, as an official in the Ministry of Defence, he helped to turn a struggling manufacturer of munitions for the Singaporean military into an international supplier of armaments. Then, as chairman of the Economic Development Board from 1986, he oversaw the expansion of the semiconductor

and electronics industries that has underpinned Singapore's economic miracle. And in a country where the boundaries between government and business are somewhat blurry, he has also become a wealthy electronics entrepreneur.

Island builder

By the late 1990s, Yeo's attention had shifted to the chemical industry. In his office, he proudly shows me satellite images documenting the year-by-year construction of an artificial island named Jurong. Today, it houses a huge petrochemical complex and has attracted some US\$23 billion in investments from multinational companies. "It takes about five years to build each industry. Then I move on," he says.

Given this track record, Yeo has the trust of Singapore's leaders, who have given him almost total control over the nation's science budget. In a society known for its conservatism, he's a one-off — an impish character who darts out his tongue to punctuate each

provocative statement, and who clearly relishes every minute of his working day.

Three walls in his office are covered by white writing boards. As he explains his plans for Biopolis, Yeo jumps up and scribbles notes. Again, he shows me satellite images, before we drive to the complex for a whistle-stop tour. In addition to the gleaming labs, he makes a point of showing me the basement car park — a colour-coded expanse that wouldn't look out of place at an international airport — and a new French restaurant. "It is a self-contained city," says Yeo. "The only thing I can't control is the weather."

Yet Yeo has found biomedicine a tougher nut to crack than the subjects of his previous grand schemes. "With biology you have to read and read before you can absorb and understand," he says. When Biopolis was on the drawing board, he took Saturday tutorials on immunology from local researchers. "Immunology is related to sexy fields such as stem cells and cancer, but it has been neglected," he says. Next to his office is a room full of primary literature on all of these fields. When he finds something interesting, he sends it to scientists at his institutes. "I do my homework," he says.

Magnetic personality

For some of the big names who have been attracted to Biopolis, Yeo's personal enthusiasm for their work was a powerful draw. "He always sends PDFs of papers he's reading. I'm just trying to keep up with him," says David Lane, who in January was recruited from the University of Dundee in Scotland to head the Institute of Molecular and Cell Biology at Biopolis.

Even more popular is Yeo's policy of giving his principal investigators large five-year grants with no strings attached. "As a bureaucrat, I don't tell the scientists what to do. I let them decide," he says. The lucky recipients say they can get things done in months that elsewhere would take years just to clear the red tape. "It's fun," says Lane. "I've never before been anywhere they say you can do whatever you want."

In addition to headhunting big-hitters such as Lane, renowned for his work on the *p53* tumour-suppressor gene, Yeo has made a concerted effort to bring young people into science. Recruitment posters present biology as a hip activity. One, in a scene reminiscent of *The Simpsons*, pictures a student at a blackboard repeatedly scrawling: "I will not genetically manipulate the class hamster". Another features an attractive young woman — the 'DNA girl' — with a double-helix tattoo encircling her arm. The caption reads: "Got a burning passion for science? We'll take it to the highest level."

Those fast-tracked into A*STAR university scholarships get generous grants, but are given only three years to finish courses that take most students four. And Yeo thinks the brightest could be pushed still harder. "They could do it in two years," he says.



Powerhouse: Singapore's Biopolis is attracting top names in biological research.

The promotion of youth is a recurring theme. In Yeo's office, there are few greying civil servants; instead, he is surrounded by a coterie of bright, sharply dressed young staff. During our interview, they rush around providing background material to reinforce the points their boss is making.

But Yeo's aggressive youth policy has gained critics, as well as admirers. In early May, one Singaporean student working in the United States, writing a weblog under the pseudonym 'AcidFlask', criticized A*STAR's scholarship scheme and the expectations it places on students. A*STAR immediately threatened legal action, and the student — not himself an A*STAR scholar — apologized for a posting that was "defamatory of A*STAR, its Chairman, Mr. Philip Yeo, and its executive officers". With characteristic wit, Yeo issued a press release inviting the blogger to tea.

Yeo seems to relish such confrontations. In a newspaper interview given shortly after the incident, he laid into male students who break their contractual obligations to work for A*STAR for six years after their scholarships, saying he was tired of "whining Singaporean boys". He hands me a copy of the article. "I had to scold them," he says, adding that most

A*STAR scholars are now foreigners and Singaporean women.

And during our interview, he can't help taking another shot at *Nature's* coverage of his controversial 2001 move to close the Institute of Molecular Agrobiolgy. At the time, Yeo suggested that the journal should have paid the institute's running costs. Even now Yeo scoffs at the idea that the institute might have been able to offer agriculture-related intellectual property to Singapore's economy. "You've got to be kidding!" he exclaims.

Breaking the mould

It's not what I've come to expect from high-level government officials, but Yeo's supporters say that his combative and autocratic traits are part of the package that makes him so effective. It's difficult to imagine a similar character rising to the top in the more consensual environment of most national research agencies, says Ullrich. "Elsewhere, there is no space for people like Yeo," he notes. "He would become frustrated."

If Yeo can deliver on his promise to turn Singapore into a biotech and pharmaceutical powerhouse, its leaders will forgive him the occasional spat. Drug manufacturers lured to Singapore by generous tax breaks are already bringing in annual revenues of about US\$9.5 billion a year. Yeo predicts that by 2015 the commercial spin-offs from home-grown research will have boosted this figure to US\$15 billion.

The next phase of Yeo's master plan is the Centre for Molecular Medicine, where 150 researchers will bring advances in regenerative medicine, oncogenomics, immunology and epithelial biology to the clinic. Currently housed in Biopolis, it will move next year to the nearby National University of Singapore, to take advantage of its teaching hospital.

The centre will include a facility for the scaled-up production of stem cells for clinical use. "Nobody's doing that," says Yeo. "Industrialization is Singapore's strength." And by 2010, an expanded Biopolis will be joined by an information-technology hub called Fusionopolis, plus a complex designed to incubate spin-off businesses.

Lane sees the early signs of commercial success in the form of collaborations among institutes at Biopolis and industry. And with drug giants such as Novartis and Eli Lilly establishing research bases at Biopolis, the future looks promising. "It's an amazing experiment here," says Lane. "I was overwhelmed by the opportunity."

Indeed, the biggest worry for many of Singapore's scientific leaders is what will happen should Yeo eventually retire. A youthful-looking 58, Yeo shows no signs of slowing down. And he is typically provocative when asked how Singaporean science would fare if he were no longer around. "I'm not indispensable," he says, "but I am irreplaceable."

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