

Singapore : Asia's Stem Cell City

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Ariff Bongso remembers the day he looked through his microscope and saw the future. The Sri Lankan-born embryologist has worked at the National University of Singapore since 1985, helping to produce Asia's first test-tube baby. He refined the in-vitro fertilization process, eventually developing a technique that would allow a fertilized human egg to grow into a five-day-old embryo—a blastocyst—outside the womb. Bongso realized that he could extract the inner cell mass within the microscopic blastocyst and use it to produce embryonic stem-cell lines, which have the capacity to grow into any kind of tissue in the human body. "The idea came like a flash," he says now. "But it was a very, very difficult task." In 1994 he became the first person in the world to isolate human embryonic stem cells (hESC), although by the time he'd managed to grow sustained cell lines in 2000, American James Thomson had beaten him to publication and into the history books. But Bongso's achievement helped kick-start the global race to harness the power of stem cells.

It's a race that Singapore is ready to run. When Bongso had his flash of inspiration in the laboratory, he was working nearly alone, and Singapore was a scientific backwater. But today, thanks largely to abundant government funding, the city-state has become a regional hub for bioscience research, with a speciality in stem cells. Leading foreign scientists have flocked to Singapore, attracted by the government's financial largesse and relatively permissive regulations on controversial hESC research. "We need high-value, high-skill work," says Philip Yeo, chairman of Singapore's Agency for Science, Technology and Research (A*STAR). "The future for Singapore is science."

Yeo is the power behind the three-year-old, \$300 million Biopolis, a seven-building science park that houses Singapore's top research institutes, along with R&D facilities for multinational drug companies like Novartis and GlaxoSmithKline. Biopolis positively gleams—its freshly stocked labs are the scientific equivalent of a Prada showroom—but with a population of just 4.4 million, Singapore has a shallow talent pool. That's why Yeo spends half his time on the road, recruiting top foreign scientists to fill his model labs. "Some people snatch babies," he says with a laugh. "I snatch scientists." His targets rarely refuse: 50 nationalities are represented among A*STAR scientists, including Americans like Edison Liu, the former director of the U.S. National Cancer Institute's Division of Clinical Sciences, who now heads up Singapore's Genome Institute. Not content with depending solely on free-agent foreigners, however, the government is also trying to build up local talent by offering hundreds of bioscience scholarships a year to top-flight Singaporeans.

The money being dangled before both foreign and local researchers is generous—late last year the government established the Singapore Stem Cell Consortium, which is chaired by prominent Cambridge scientist Roger



MUNSHI AHMED FOR
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DREAM TEAM: Yeo
pursues star scientists for
Singapore's Biopolis tech hub

Pederson and will set aside up to \$45 million for stem-cell research over the next three years. But there's no price tag on Singapore's science-friendly atmosphere. "You get in a taxicab and you tell the driver where you work, and they get excited," says Lawrence Stanton, who left the U.S. in 2002 to become deputy director of the Genome Institute. "It feels like a bull market in science over here."

When it comes to attracting stem-cell scientists, however, Singapore's biggest advantage may be what it's not doing: restricting research. While the U.S. Federal Government won't fund most research into hESC, Singapore laid out clear, permissive rules in 2002 for work involving hESC and eagerly bankrolls studies in the field. (Not that everything goes—Singapore's regulations, which permit therapeutic cloning but ban reproductive cloning, are no more liberal than those in Britain, another stem-cell hub.) Those policies have helped make possible the work of Alan Colman, the city's most prominent stem-cell scientist, who helped clone Dolly the sheep in 1996. The British researcher was enticed to Singapore in 2002 to head the biotech company ES Cell International (ESI) after the government offered a \$6 million grant. ESI manufactures its own hESC lines, producing several new lines in July, and is working on shaping those cells into insulin-producing pancreatic tissue and cardiac muscle, which could then be administered to patients suffering from diabetes or heart failure. It's not as revolutionary as South Korea's cloning techniques promised to be, but it's practical, beneficial and potentially profitable—exactly the kind of stem-cell work the Lion City can trademark. "I think Singapore punches well above its weight," says Colman. "That's why I'm here."

Yeo acknowledges that Singapore's size means there are inevitable limits to its scientific potential: "Singapore will never be a competitor to countries like America. America is too big." But its successes in concentrated areas like stem cells are an object lesson in what Asian science can achieve with bountiful funding and government support. For Ariff Bongso, who has watched Singaporean science grow from a tiny embryo over the past 20 years, the transformation has been astonishing—and invigorating. "I'm very optimistic, knowing what goes on in these labs," he says. "I think Singapore will be one of the best in the field."