genome. China was the only developing nation involved in the international project, and it finished its 30 million bases in less than a year.

Like those at other major sequencing centres at the time, Yang acquired a taste for big genome projects. While completing a somewhat underfunded 'scan' of the swine genome for Danish agencies in 2000, Yang says he decided to do something "more significant". The BGI launched a project to sequence the rice genome in 2001, using a grant of 60 million renminbi from the Hanzhou municipal government to buy 36 state-of-the-art sequencers. The BGI published the genome of the indica variety of rice in *Science* in 2002 (ref. 5), months before an international consortium published that of the japonica variety.

The BGI moved on to sequence the chicken[6] and silkworm[7] genomes. In 2003, it sequenced the corona virus[8] that caused severe acute respiratory syndrome (SARS) and released a diagnostic kit that impressed Chinese President Hu Jintao. The BGI's reward was to be made part of the CAS, an honour that came with extra funding, but the academy turned out to have stipulations that didn't fit the BGI. CAS institutes are not supposed to have more than 150 scientists; the BGI had twice that and was looking to expand. Yang had to make some of his workforce official CAS staff and make special arrangements for others, stretching the CAS budget to the extreme. "No one was happy," he says.

> "It is clear there is a new map of the genomics world."

The move to Shenzhen provided a release valve, luring the BGI in 2006 with 10 million renminbi in start-up fees and 20 million renminbi in annual grants. The city is a driving force in southern China's 'factory of the world', with many of its 12 million people producing the cheap clothing and electronics that helped to usher in China's economic miracle.

The BGI is at home in Shenzhen. Yang wants to sequence genomes at twice the speed and half the price of anyone else. And he was eager to slip away from some of the oversight in Beijing. Although he doesn't like talking about those with whom he's clashed, Yang likes to say that in Shenzhen, "the mountains are high and the emperor is far away".

The BGI gets big

With this breathing room, the BGI has grown to employ 1,500 people nationwide, more than two-thirds of them in Shenzhen, and this is expected to jump to 3,500 by the end of the year. With the investment in new sequencers, provided by a 10-billion-renminbi loan from the China Development Bank, the BGI's capacity will grow, but so will costs. Staff at the BGI won't say how much they paid for the new sequencers, but the list price is about 3.4 million renminbi each. The purchase, which was announced on the same day the model launched, raised hackles among competing genomics centres. They accuse Illumina of making a secretive deal with the BGI while only granting others access to older models. Illumina denies such allegations, and says it has a trade-in programme for those who want to upgrade.

Of the machines, 100 will be installed in a new Hong Kong lab to facilitate international collaborations. But staff in Hong Kong cost more than the BGI is used to paying, and will be kept to a minimum (40–50 researchers). Reagents cost about 1 billion renminbi per year, and electricity for computers and cooling systems consumes another 9 million renminbi. Yang emphasizes that the loan will be paid back. But as the commodification of sequencing continues to push prices down, how the BGI will do this is an open question.

A BGI monopoly in providing sequencing services is far from assured. Aside from existing academic competitors, private ones using newer technology are starting up. Complete Genomics, based in Mountain View, California, which specializes in human genomes, expects to sequence 5,000 human genomes in 2010, starting in April. It has already logged more than 500 orders.

The BGI's solvency depends in part on scientists elsewhere paying to have microbe, plant and human genomes sequenced and resequenced faster and better than they could themselves. But like many sequencing centres, the BGI is looking to be more than a service provider. Maynard Olson, a genomics researcher at the University of Washington in Seattle who trained Wang and has close ties to the BGI, says it needs to be. "Outsourcing only works well when there is some scientific relationship between the parties. There are too many trade-offs during both the laboratory procedures and the low-level data analysis to commodify sequence data entirely."

Yang says he hopes that collaborators will pay half of the estimated costs of the genomes they want sequenced and then publish jointly, but for interesting projects he will cover 70% or even all of the cost if the collaborators lack funding.

For Eske Willerslev at the University of Copenhagen, it made sense. He collaborated with the BGI on the genome of a 4,000-year-old frozen Greenlander dubbed Inuk. Although his lab had the capacity to sequence up to about 50 billion bases in a week, he went for the BGI's technical expertise. "I have a lot of respect

MASS PRODUCTION

Over the past decade, the BGI has gone from sequencing millions of base pairs (Mbp) to billions (Gbp) in ever shorter amounts of time. Below are some of the institute's previous achievements.

RICE GENOME

466 Mbp
Coverage: ~6x
Sequenced: April 2000–October 2001

SILKWORM GENOME

480 Mbp
Coverage: ~6x
Sequenced: June 2003–September 2003

FIRST ASIAN GENOME

3 Gbp
Coverage: 36x
Sequenced: January 2007–October 2007

CUCUMBER GENOME

240 Mbp
Coverage: ~72x
Sequenced: January 2007–April 2009

PANDA GENOME

3 Gbp
Coverage: ~73x
Sequenced: March 2008–October 2008

ICEMAN GENOME

3 Gbp
Coverage: ~20x
Sequenced: May 2009–December 2009

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