



## China

# From SARS to the stars

**Y**ang Liwei is a *bona fide* national hero. After clambering from his space capsule after touching down in Inner Mongolia on 16 October, he was hoisted shoulder-high by his ground crew, looking somewhat bemused. Having completed 14 orbits of Earth in a craft based on 1960s-vintage Soviet technology, Yang was lauded by China's state-run media and accorded instant celebrity status. The Beijing Space Medical Institute has even attempted to register his face as a trademark to keep it from appearing on calendars and playing cards.

For the 1.3 billion people of more than 50 ethnicities who inhabit the People's Republic of China, Yang's voyage was proof that their nation is now a major technological power. It is also a leading player in research, according to a report released in October by the Paris-based Organisation for Economic Co-operation and Development (OECD). This placed China third in the global league table of spending on R&D, behind only the United States and Japan, with an annual expenditure of some US\$60 billion. What's more, the OECD's figures dated

from 2001 — since when China's investment in fields from stem-cell research to nanotechnology has continued to blossom.

China's leaders often seem to be obsessed with superlative engineering feats. In July, for instance, the world's biggest hydroelectric project — the Three Gorges Dam in Hubei province — began to generate power. But recent years have also seen a concerted effort to build a solid base in fundamental research. Labs throughout the West have been filled with eager young Chinese students and post-docs, sent abroad for training. And in activities such as field trials of transgenic crops, China is already established as a world leader.

Now China's investment is beginning to bear fruit more widely, with the emergence of research centres and projects that are making waves internationally. This year, for instance, biologists in Shanghai sparked widespread interest with a claim to have generated embryonic stem cells from 'hybrid' cloned embryos derived from human cells and rabbit eggs<sup>1</sup>. And in October, China became the first country to license a form of gene therapy for regular clinical use, treating head and neck cancer using the *p53* tumour-suppressor gene.

But the dominant story to emerge from China in 2003 was not Yang's joyous homecoming, nor any of the country's various other scientific and technological achievements. Instead, an outbreak of a new respiratory disease, which originated in the rural province of Guangdong, made headlines worldwide. Severe Acute Respiratory Syndrome, or SARS, eventually killed more than 800 people across the globe. Had the virus responsible turned out to be more infectious, the toll could have run into hundreds of thousands. Yet public-

health experts believe that the disease might never have become a global threat had Chinese officials not reacted to the outbreak in such a confused and secretive manner.

For months, China refused to acknowledge that a new virus was circulating among its population — its medical establishment tried to convince the World Health Organization (WHO) that the culprit was the bacterium *Chlamydia pneumoniae*. Officials eventually came clean in March, after the WHO released a global alert about a mystery form of pneumonia that was, by then, turning up across the world. In the months that followed, the SARS outbreak became a symbol of change in China. In an unprecedented move, the minister of health and the mayor of Beijing were sacked for failing to protect the public. "Officials in the future will have to think about whether they are doing their job," says Ziheng Rao of Tsinghua University in Beijing, who led a team that determined the structure of an enzyme required for the SARS virus to replicate<sup>2</sup>.

SARS ignited a wave of research activity in China. "The epidemic pushed people," says Nan Shan Zhong of the Guangzhou Institute of Respiratory Diseases, whose team established that the outbreak in Guangdong was indeed caused by the SARS virus<sup>3</sup>. But some of the resulting activity has been as chaotic as the initial response to the disease. Zhong estimates that more than 100 different research groups are trying, with little coordination, to produce a SARS vaccine. In November, government officials announced plans to begin testing a vaccine based on live, weakened SARS virus, produced by the Beijing firm Sinovac Biotech. But with so many labs working with the virus, some scientists are

## HIGHLIGHTS

## History on ice

A core some 3.2 kilometres long was pulled from the Antarctic ice, allowing geologists to see at least 750,000 years into the past. Although not the longest ice core ever recovered, it is the oldest, and should contain a record of eight ice ages. Palaeoclimatologists are especially keen to inspect a period some 450,000 years ago when Earth's orbit was very similar to what it is today, giving a good idea of what the present climate might have been like without human influence.

## Copy rats

Rats have been a favourite lab animal since the early nineteenth century and, for many studies, provide a better physiological match with humans than mice do. But they missed out on the cloning revolution of the 1990s — the method that gave us cloned mice failed to work. This year researchers came up with a subtly different technique, which involves delaying the activation of the egg, to clone the rodents successfully. Using cloning, it should become easier to produce certain types of genetically engineered rat.

## Puzzle solved?

A Russian mathematician claimed to have proved the Poincaré Conjecture, a problem that has gone unsolved since 1904, and which involves properties of objects that do not change when they are stretched or shrunk — such as their number of surfaces. Grigori Perelman of the Steklov Institute of Mathematics in St Petersburg toured American universities describing his solution. Something of an eccentric, he does not plan to submit his work to a peer-reviewed journal.

## Flavour saviour

Particle physicists confirmed the mechanism by which the ghostly particles known as neutrinos flicker between different forms, or 'flavours', with an elegant experiment. Japan's KamLAND detector on the island of Honshu picked up neutrinos belted out by a ring of nuclear reactors that coincidentally surround it. Previous experiments have relied on the Sun as a neutrino source. Although physicists have a good idea of the number and type of neutrinos emitted by the Sun, there remained a tiny uncertainty, which the KamLAND experiment neatly eliminated.

## Quantum leap

The second of the two basic building blocks of a quantum computer — a 'controlled NOT' logic gate, which flips the state of a target bit of information based on the state of a control bit — was demonstrated by several teams this year. One group managed to make the gate in a solid-state system, using electrons in a silicon chip. The same team also made a solid-state version of the first building block — a 'rotation' gate — in 1999. But no one has yet linked the two gates together to form a functioning computer.



**Triumph and tension:** a varied year for China saw Yang Liwei (left) feted as a national treasure after becoming the country's first man in space, while on the ground panic spread over the SARS epidemic.

concerned about safety. "We are really worried about the risk of SARS escaping from a laboratory," says parasitologist Zhao-Rong Lun of Zhongshan University in Guangzhou.

Given these problems, wholesale changes are needed before China can truly claim a place among the world's premier scientific, medical and technological powers. The SARS story is symptomatic of a wider failure to tackle public-health issues. Hepatitis B is rampant and AIDS is a growing problem, particularly in Henan province, where tens of thousands of people are thought to have become infected in the 1990s thanks to poor hygiene in a scheme for collecting blood plasma. 'Western' diseases of affluence are also on the rise — obesity among schoolchildren, for example, has risen tenfold over the past eight years.

Meanwhile, China's burgeoning research purse is not matched by a corresponding development of structures to ensure that funds are distributed by merit, or that ongoing projects are properly evaluated. Cronyism is rife, researchers complain. "I constantly have to fight a system that is not used to a merit-based approach," says Muming Pu, who divides his time between the University of California, Berkeley, and his post as director of the Chinese Academy of Science's Institute of Neuroscience in Shanghai.

There is a growing recognition that reform is needed. In September, at a meeting of the China Association of Science and Technology, a semi-governmental body that oversees China's various academic societies, its chair Guangzhao Zhou criticized health officials' unsupported claims about the cause of the SARS outbreak. Presentations at the

meeting highlighted the problems of data-falsification and plagiarism — bold stuff in a country that, until recently, would never have admitted that such misdemeanours take place. Some scientists remain frustrated, however, at the lack of concrete progress towards solving these problems. "Things are not changing fast enough," laments C. L. Tso, a retired molecular biologist who has been pushing for reform for the past 15 years.

Others wonder whether China has its priorities right. Says one molecular biologist at the Shanghai Institutes for Biological Sciences: "Can we really afford a space programme when we have so many people sick and lacking medical care?"

Nevertheless, scientists who have made their names abroad are flooding back to China. Their reasons are many and varied: some are enthused by the chance to run their own research group at a young age; others say they want to contribute to China's development; some are undoubtedly enticed by lavish salaries and research funding.

Botanist DeZhu Li was an early returnee. In 1997 he joined the Kunming Institute of Botany in southwestern China, after three years of postdoctoral work in Britain. He was quickly made deputy director of the institute, which will soon open a new, US\$18-million germplasm bank to store seeds and frozen tissue samples. "It's a really good sign," says Li. "The government cares about science and it has the resources to back this up." ■

## David Cyranoski

1. Chen, Y. *et al. Cell Res.* **13**, 251–263 (2003).
2. Yang, H. *et al. Proc. Natl Acad. Sci. USA* **100**, 13190–13195 (2003).
3. Zhong, N. S. *et al. Lancet* **362**, 1353–1358 (2003).