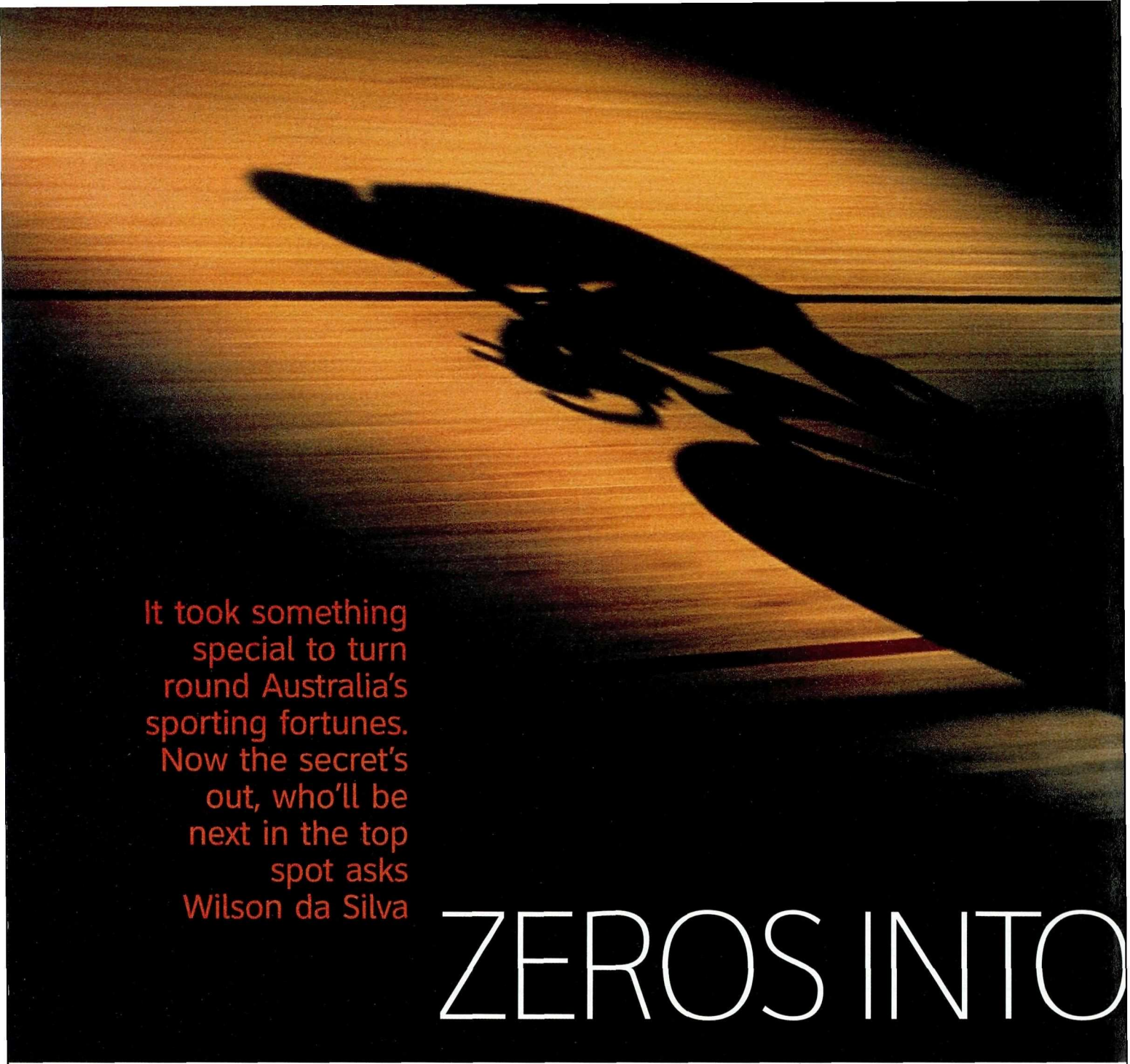


It took something special to turn round Australia's sporting fortunes. Now the secret's out, who'll be next in the top spot asks Wilson da Silva

ZEROS INTO

THEY play hard, they play often, and they play to win. Australian sports teams win more than their fair share of titles, demolishing rivals with seeming ease. And Australians top the rankings in numerous individual sports, from swimming to golf and squash to triathlon. How do they do it?

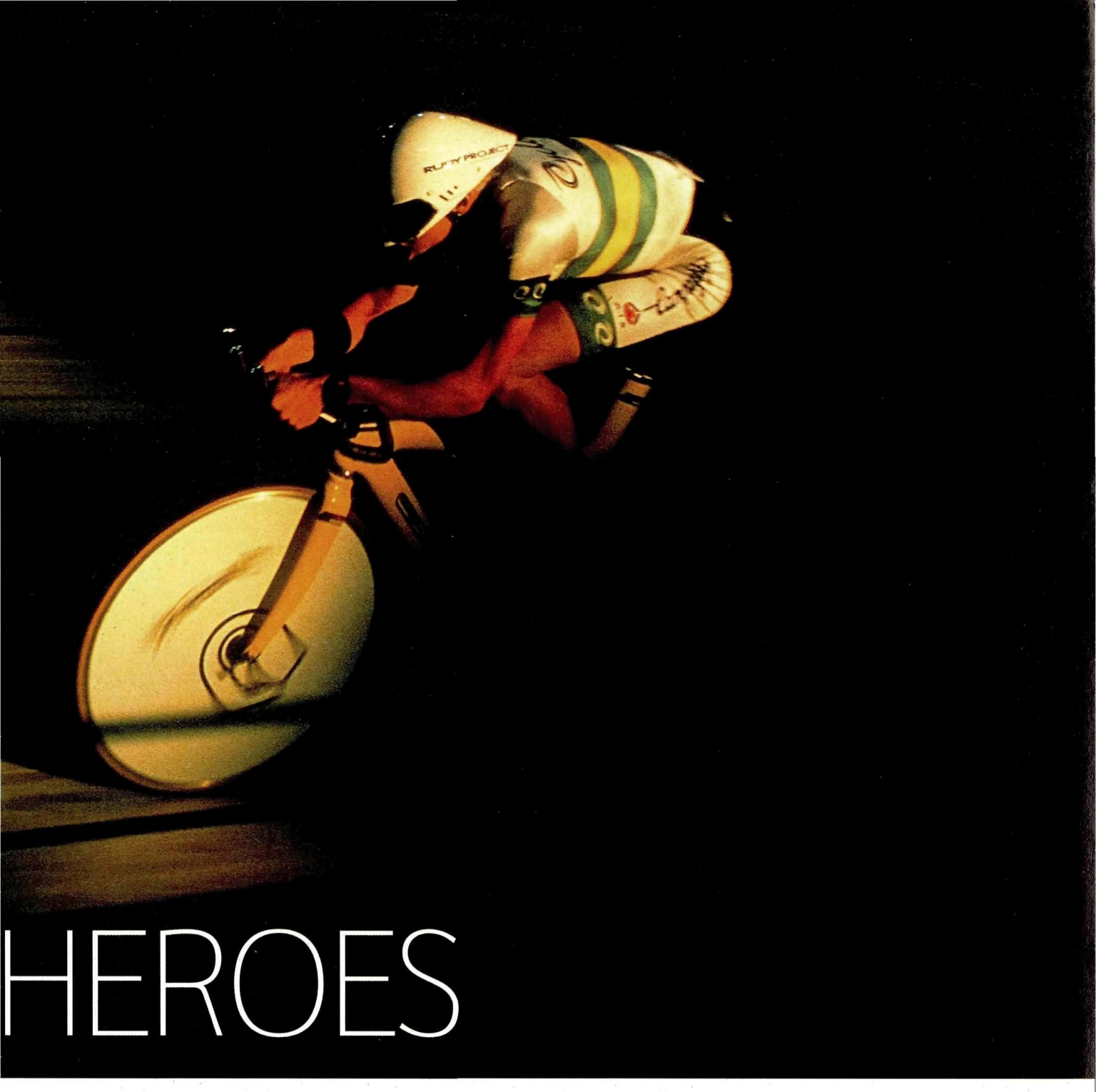
A big part of the secret is an extensive and expensive network of sporting academies underpinned by science and medicine. For two decades Australia has quietly invested in sports research and development, building a national system that scoops up talent and turns it into victories. "It's been a 20-year process of working hands-on with coaches and athletes, developing research questions and applying the answers back to coaching," says Peter Fricker, chief of sports science at the Australian Institute of Sport.

It has certainly paid off. Since the national system was set up in 1981 (see "Rising from the ashes", p 32), the country's medal tally at the summer Olympics has soared from 9 in Moscow in 1980 to 58 in Sydney in 2000. Australia finished fourth in the medals table—a remarkable achievement for a country with a population of just 19.4 million. True, it had home advantage, which always seems to help. But only the US, the Russian Federation and China won more medals. Australia came in ahead of Germany, France, Italy, Spain, Britain and Canada—rich and populous nations that, all things being equal, should have beaten it with ease.

It's not just in Olympic sports that Australians do well. Its teams are reigning world champions at rugby league, rugby union, cricket one-day and test match, netball and squash, and the men's tennis team narrowly failed to win last year's Davis Cup.

Just 10 minutes' drive from the centre of Canberra, sprawling across 65 leafy hectares

A. Pretty/Allsport



HEROES

in a quiet suburban setting, is the nerve centre of this quest to be best: a scattering of buildings, sports fields and parkland that makes up the Australian Institute of Sport (AIS). Here, 350 promising youngsters and established pros live and train under the eyes of a legion of coaches and sports scientists. Day in, day out they are prodded and poked, swabbed and videotaped, watched and measured with an intensity more often associated with the space programme. Another 250 established athletes regularly visit for training and performance analysis. More than half of the Australian team at the 2000 games were AIS athletes, including the iconic 400 metres champion Cathy Freeman.

Another body, the Australian Sports Commission, runs programmes of excellence in 96 sports, from archery to wrestling, at 400 centres. At any time, 4500 sportsmen and women are under the watchful eye of the commission's sports scientists. On top of that, each state and territory has its own sports institute, and the most populous state, New South Wales, has a further eight regional academies. Each provides intensive coaching, training facilities and nutritional advice.

More than 34,000 children, ranging in age from 8 to 16, pass through the system every year. If you're a young Australian and show talent in just about any sport, you'll be spotted and signed up. It's a national dragnet that helps the country extract the most from its small population.

Inside the academies, science takes centre stage. The AIS employs more than 100 sports scientists and doctors, and collaborates with scores of others in universities and research centres. AIS scientists work across a number of sports, applying skills learned in one—such as building muscle

BIG SPLASH: Ian Thorpe won five medals in Sydney

Rising from the ashes

It's no surprise that Australia has built the world's best sports development system. "Australia's national sport is winning," says John Daly, a sports historian at the University of South Australia in Adelaide. "We seem to believe that success can help define our place in the world."

But it took a sporting disaster to make it happen. At the 1976 Olympics in Montreal, Australia picked up just one silver medal and four bronzes—its worst performance in 40 years. There were calls for a public inquiry.

Prime minister Malcolm Fraser commissioned a report on sports development, but shelved it on the ideological grounds that government had no role in funding sport. Then came the Soviet invasion of Afghanistan. Under pressure from Fraser, many Australian athletes pulled out of the 1980 Moscow Olympics in protest. The depleted team won nine medals, including two gold, but the move damaged Fraser. Facing an election, he finally committed to the funding of sport. Fraser was re-elected, and the AIS opened in January 1981.

strength in golfers—to others, such as swimming and squash. They are backed up by technicians who design instruments to collect data from athletes. They all focus on one goal: winning. "We can't waste our time looking at ethereal scientific questions that don't help the coach work with an athlete and improve performance," says Fricker.

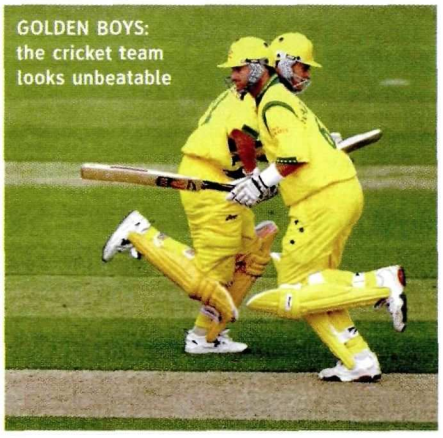
A lot of their work comes down to measurement—everything from the exact angle of a swimmer's dive into the pool to the second-by-second power output of a cyclist. They then use this data to wring improvements out of their athletes. The focus is on individuals: understanding how each athlete moves through the water or swings a bat, then tweaking their technique to squeeze an extra hundredth of a second here, an extra millimetre there. No gain is too small to bother with. It's the tiny, gradual improvements that add up to world-beating results.

To demonstrate how the system works, Bruce Mason, head of the AIS biomechanics department, shows off a 3D analysis tool being developed to study swimmers. A wire-frame model of a champion swimmer slices through the water, her arms moving in slow motion. Looking side-on, Mason measures the distance between strokes. Then, from above, he analyses how her spine swivels. From this, he builds a biomechanical profile that coaches can use to help budding swimmers, or study off-form swimmers to discover where their problems lie.

The data comes from an underwater filming system pioneered at the AIS. A digital video camera mounted on a boom is immersed in the water alongside the swimmer. Mason uses a hand-pushed dolly to shadow the swimmer up and down the pool. Another camera films head-on. The output is linked with other data—turn times, velocity, stroke length—then analysed immediately after each race.

Mason also developed the SWAN (SWimming ANalysis) system now used in Australian national competitions. It collects images from digital cameras running at 50 frames a second and breaks down each part of a swimmer's performance into factors that can be analysed individually—stroke length, stroke frequency, average duration of each stroke, velocity, start, lap and finish times, and so on. At the end of each race, SWAN spits out data on each swimmer that coaches can use to pinpoint aspects of their performance that need to improve.

"Take a look," says Mason, pulling out a sheet of data from a race at last year's short-course nationals in Perth. He points out the data on the swimmers in second and third place, which shows that the one who finished third actually swam faster. So why did he finish 35 hundredths of a second down? "His turn times were 44 hundredths of a second behind the other guy," says Mason. "If he can improve on his turns, he can do much better."



GOLDEN BOYS: the cricket team looks unbeatable

It's the kind of accuracy that AIS scientists are bringing to a range of sports. With the Cooperative Research Centre for Micro Technology in Melbourne, they are developing unobtrusive sensors that can be embedded in an athlete's clothes or running shoes to monitor heart rate, sweating, heat production or any other factor that might have an impact on an athlete's ability to win.

And there's more to it than simply measuring performance. Fricker gives the example of a couple of swimmers who were down with coughs and colds 11 or 12 times a year. "They'd have to be pulled out of the pool, couldn't train for three or four days, and would risk infecting other athletes," he says. These swimmers almost always fell ill as their training regime intensified, and quickly recovered when they stopped training. Could a test be found that would allow coaches to predict an illness so that they could ease back on training before it struck?

After years of experimentation, the AIS and the University of Newcastle in New South Wales developed a test that measures how much of the immune-system protein immunoglobulin A is present in athletes' saliva. If IgA levels suddenly fall below a certain level, training is eased or dropped altogether. Soon, IgA levels start rising again, and the danger passes. Since the tests were

EMPICS

ICON: Cathy Freeman is the system's best-known product

introduced, AIS athletes—not just swimmers but those in all sports—have been remarkably successful at staying healthy. The institute is now developing a portable test, and is studying ways of identifying which athletes are prone to illness, so that their training can be tailored from day one.

It may seem a small advance, but such details can make all the difference. The reigning 1500 metre champion Sebastian Coe failed to qualify for the 1988 Olympics because of a respiratory infection, and more than 50 top athletes, including American sprinter Carl Lewis, missed events in the 1992 games because they fell ill at the wrong time. Had the test been available, they might have been able to stay healthy enough to compete.

Target practice

But it's not just about collecting data: it's how you use the data too. Well before a championship, sports scientists and coaches start to prepare the athlete by developing a "competition model", based on what they expect will be the winning times. "You design a race model to make that time," says Mason. "A start of this much, each free-swimming period has to be this fast, with a certain stroke frequency and stroke length, with turns done within these times." All the training is then geared towards making the athlete hit those targets, both overall and for each segment of the race.

Techniques like this have transformed Australia into arguably the world's most successful sporting nation. According to the latest figures from the Australian Sports Commission, Australians hold number one rankings in 21 of 50 major sports, from golf to surfing, and top five rankings in a further 15.

Of course, there's nothing to stop other countries copying—and many have tried. Six years ago the AIS unveiled coolant-lined jackets for endurance athletes. At the Atlanta games in 1996 these shaved up to 2 per cent off cyclists' and rowers' times. Now everyone uses them. The same has happened to the "altitude tent", developed by the AIS to replicate the effect of altitude training at sea level.

But Australia's success story is about more than easily copied technological fixes, and up to now no nation has replicated its all-encompassing system. But some are getting there. Every researcher and sports official *New Scientist* spoke to nominated Britain as the hottest competitor. A funding system set up in 1995, backed by £350 million of National Lottery money plus £70 million a year from the government, means that Britain is now spending three times as much as Australia. "They are putting big, big bucks into sports science and sports medicine," says Fricker. "And they've quite sensibly recruited a lot of Australians with a 10 to 20-year history of the system here." Dozens of people from the Australian sports system are taking up key positions in Britain: examples include David Moffett, former head of Australia's National Rugby League, who started as chief executive of Sport England this month, and former test wicketkeeper Rodney Marsh, for a decade director of the Australian Cricket Academy and now director of the England and Wales Cricket Board's new National Academy.

"There's going to be a lag time," Fricker says. "They have got to get that expertise on board, create a sports system and have the scientists and the doctors to service it." He says a good programme can deliver results in about seven years, though some sports take 10 or 12.

If he's right, British sports fans could soon be toasting the Australian sports system instead of cursing it. Could a British team win the rugby union world cup, or bring a tub-thumping haul of medals back from Athens in 2004? Maybe even the Ashes could change hands one day.

"Yeah, we're worried about the Brits," says Fricker. "But we are just going to have to find new ways to stay ahead of the pack." Don't bet on them losing the edge. □

Wilson da Silva is a science journalist in Sydney