

China's challenges

By almost every measure, China's growth is extraordinary. But behind the astonishing statistics is a more complex reality.

CHINA Discussions of China's emergence as a superpower often focus on matters of scale. This is understandable. China's borders encompass more than 1.3 billion people — one in every five humans on the planet — and stunningly diverse terrain, from the Yellow River plain in the east to the Himalayan plateau in the west. In science and technology, China now generates more publications than any other country bar the United States, and ranks third in the number of doctoral degrees it awards. One can take almost any measure and find an extreme in China. Where else would authorities even consider a plan to redistribute water resources by diverting major rivers for more than a thousand kilometres?

But these gargantuan figures may not mean quite what they seem to. China accounts for a smaller proportion of the world's population than it did in the seventeenth century. Many analysts concur that the nation's current economic growth is in a boom phase that cannot last. Most importantly, as the articles in this special issue illustrate, the image of China as a monolithic juggernaut hides a more complex and interesting reality. On page 412, Rogers Hollingsworth and his colleagues argue that the burgeoning of Chinese science does not necessarily mean it will replace the United States as the new hegemon, but rather that it will find a prominent role among a more diverse global research community in which no nation dominates.

Moreover, it is not clear whether China's growing strength in science — which increasingly belies the lazy notion that research in Asian countries lacks originality — will automatically make Chinese institutions major players at all the established frontiers, from drug development to nanotechnology or space science. Nations have different priorities, and this is especially true for those whose economic and technological development is relatively recent. On page 398, Lan Xue outlines the hazards of simply competing on the basis of an agenda determined by previous scientific superpowers, with its unspoken rules about which are the most important areas of research and where results should be published. If China were to decide that its interests lie in, say, massive investment in clean energy production — a matter of national urgency, for which it might be unwise to rely on the leadership of under-funded work in the West — it could both address its own needs and command immense respect on a global stage.

Indeed, the global problems that would be tackled by a Chinese focus on domestic priorities make for an almost perfect wish-list. These priorities include water conservation and water pollution treatment, earthquake forecasting and earthquake-resistant building technologies, flood management and drought-resistant crops — all of which would find widespread application elsewhere. Likewise with health: China's domestic challenges are also the world's challenges. Already, for example, the antimalarial drug artemisinin is one of the most celebrated bounties of Chinese herbal medicine. Avian flu threatens to be China's home-grown epidemic. And the spread of AIDS is now acknowledged as a national issue, especially after the scandal of HIV infections of peasant blood donors in Henan province in the 1990s undermined official denial. When Premier Wen Jiabao was photographed in 2003 shaking hands with an AIDS patient, it seemed clear that the government was at last facing up to the problem.

One of the biggest questions for outside observers is to what extent the social, cultural and political milieu is shaping, and will continue to shape, the very practice of doing science in China. That legislation was proposed last year to make it acceptable for researchers to admit their failures (see *Nature* 449, 12; 2007) suggests that there are deeply ingrained

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misconceptions at an institutional level about how science works — misconceptions that stifle risk-taking and promote narrow conformity. But some suspect that such cosmetic efforts do little to address the problems created by a strongly hierarchical research culture, where an immense pressure to succeed might be seen as a precondition for the sorts of abuses evident in the case of disgraced cloning researcher Woo Suk Hwang in South Korea.

An even deeper question is whether a truly vibrant scientific culture is possible without a more widespread societal commitment to free expression. The right to challenge authority, and to doubt everything, is central to scientific enquiry. And no country can be a major scientific player in the modern world unless its scientists can collaborate with researchers from elsewhere. A poor record on human rights will not make this impossible — but it will make it more difficult. Scientists do, largely, have a commitment to human rights, and will be happier working with colleagues who share that commitment.

Perhaps it is good news that China's current success story continues to be characterized by a canny pragmatism. Granted, this attitude

can sometimes make it seem as though everything is motivated by the economic bottom line. For example, although it would be too cynical to suggest that global warming and environmental degradation are now being taken seriously only because they eat into China's gross domestic product, that is surely one big reason for the concern. Yet, motivated by that same pragmatism, the Chinese authorities are increasingly recognizing that getting the best value from its scientists means providing them with adequate funds and minimal interference, even if this sees them straying 'off-message'. Many outside scientists have been surprised to find that Chinese graduate students and postdocs are now quite willing to challenge their professors. Exaggerated deference to authority is clearly on the wane in China's younger generation of scientists — and who knows how far that pragmatic liberalization will go?

In the meantime, the rest of the world can surely benefit from the self-confidence that will make China a source not just of skilled, hard-working postdocs, but of a new agenda, informed by a tradition of innovation of almost unparalleled antiquity and sophistication. ■

Mind the gaps

The incoming US administration can and should reverse the neglect of Earth observations.

At many places around the world, it is possible to feel the climate changing: the ice cracking, the soil waking earlier in the spring. Perhaps such feelings are merely rooted in a heightened awareness of global warming. Whatever the case, the true significance of such localized experiences can be assessed only through extensive data on key Earth processes over time.

Given the effects of those processes, it would be smart and responsible for policy-makers and scientists to focus on strengthening the international strategy for collecting key Earth observations for the foreseeable future. After all, data on such variables as soil moisture, wind speed and direction at various altitudes, and atmospheric temperature and pressure are essential for improving climate models in the future, and for informing mitigation efforts. Moreover, many of the programmatic elements for global data-gathering are already in place — one notable example being the consortium pursuing the Global Earth Observation System of Systems (GEOSS), which comprises 74 nations plus the European Commission.

And yet the United States, potentially one of the central participants in any such international system, has allowed short-term budgetary considerations to direct too many of its decisions. In June 2006, for example, cost over-runs caught up with the National Polar-orbiting Operational Environmental Satellite System, a proposed joint military and civil satellite programme intended to replace all US weather satellites. Several long-term climate data sensors were axed or pared down, including those measuring the variables mentioned above. A few months later, the Geostationary Operational Environmental Satellites programme got the same treatment.

Earlier this month, the National Academies' National Research Council (NRC) released a report that suggests ways to save from

oblivion the data those sensors would have collected. The council identifies important sensors to be restored to the missions from which they were cut, and recommends that others should be put on new satellites or should hitch rides on other scheduled missions.

After presenting this patchwork solution, the report stresses the importance of a long-term strategy for climate observation. This section should be required reading for anyone hoping for a political appointment at NASA, the National Oceanic and Atmospheric Administration (NOAA) or the US Geological Survey in 2009. In fact, the hopefuls should add the NRC's decadal survey *Earth Science and Applications from Space* to their reading list. What is clear from both documents is that the United States does not have a unified strategy for collecting these observations, and that the three agencies involved have not been able to avoid gaps in data or unnecessary duplication of data gathered by other nations.

The White House will need to exert pressure to make such a strategy a high priority. Neither of the two presidential candidates, John McCain and Barack Obama, has said much, if anything, about Earth observations. Providing for continuous high-quality climate data would be a substantial legacy, serving the interests of both US citizens and the rest of the world for decades to come.

The NRC's suggestions should be taken up immediately, and the next US president should move quickly to appoint directors to NOAA and NASA who see Earth monitoring as a priority. Commendably, the current head of NOAA, Conrad Lautenbacher, has been a driving force behind GEOSS. The occasionally sceptical remarks about climate change from NASA administrator Michael Griffin make him less of an example to follow.

At the very least, the new agency heads should commit to the monitoring of the essential climate variables outlined by the Global Climate Observing System. They should work with other countries through GEOSS to make sure that data are not needlessly duplicated. Satellites can provoke secrecy and competition between nations that, instead, must pull together to monitor the well-being of the planet on which they all depend. ■