

## The end of innocence?

**Biologists must become more aware that their work could be abused to develop weapons of mass destruction. But it should not have taken the disturbing events of recent weeks to bring this debate to the fore.**

In suggesting that biologists must regulate their work to prevent the free flow of information to would-be bioweapons developers, George Poste will win himself few friends at the lab bench. Yet biologists would do well to ponder on the comments of this adviser to the US Department of Defense, and former senior executive in the drugs industry, made at a conference in London (see page 237).

Poste accuses biologists of naivety in failing to consider the possibility that their research findings could be used for malign purposes. *Nature* expressed similar sentiments in an editorial published in May this year (411, 223; 2001).

But the difficulty is how to respond to the fact that data generated in legitimate projects could have applications in bioweapons development. The anguished reactions to some of Poste's suggestions — such as the vetting of manuscripts to determine whether 'sensitive' findings should be withheld from the open literature — show that there are no simple answers. Although such ideas might not shock cryptographers, who are used to dealing with issues of national security, this is uncharted territory for most biologists.

Scientific societies and research agencies should now rise to the challenge by holding meetings to debate the issues. Poste points to the example of the 1975 Asilomar Conference on Recombinant DNA Molecules, which considered the risks of recombinant DNA research at a time when US biologists were observing a voluntary research moratorium. Out of this came guidelines that were adopted, in modified form, by the National Institutes of Health.

The potential applications of advances in biology to the development of 'enhanced' bioweapons poses more complex problems, however, and it is unlikely that a clear consensus will emerge. It is also important to understand the nature of the threats involved. The sorts of projects that Poste is most worried about — such as the creation of 'stealth' viruses that would evade the immune system — are most probably beyond the technological capabilities of whoever is behind the current mailed anthrax attacks in the United States. It would be inappropriate, therefore, to impose stringent restrictions on such work as a reaction to the immediate terrorist threat.

Such technologies are within the reach of a well-funded state bioweapons programme, however. So, in the longer term, Poste is right to be concerned. The most useful result of the debate he wishes to stimulate would be a heightened awareness among biologists of the potential dangers, which hopefully would influence decisions on whether or not to pursue particularly risky projects in the first place.

When experimenting with biotechnologies that try to simulate and accelerate the natural evolution of traits, for instance, is it really wise to test them by heightening the efficiency of genes that confer bacterial resistance to antibiotics, as some researchers have done? The same question can be asked of work that splices genes for cytokines — proteins that manipulate immune responses — into potentially pathogenic viruses.

Some self-restraint is desirable when pursuing the frontiers of biology. Discuss. ■

## Essentials for China's development

**A balance of basic and applied science makes sense, provided resources are deployed wisely.**

At an opening ceremony of the Chinese Science Association in September, Guangzhao Zhou, former president of the Chinese Academy of Sciences, noted some undesirable tendencies in the Chinese scientific community — a rush to get results, imitative work, a fixation on getting large numbers of publications, overstatement of scientific achievements, hesitation in engaging in academic debate and lack of interdisciplinary collaboration. Even worse, he noted, some people engage in unethical conduct such as scientific fraud, self-promotion and plagiarism.

Despite such criticisms, the development of China's research has an air of inevitability. Beijing and Shanghai are buzzing with scientific activity as the government has recruited many promising young scientists from abroad. These are mostly ethnic Chinese, whose families came from mainland China, although Tsinghua University recently appointed its first Western chair of department — in industrial engineering. Like all developing countries, China is looking to new technology for industrial applications. But it has also been far-sighted enough to pour money into fundamental research initiatives that have the makings of world-class science (see page 240).

But low salaries mean that many researchers depend greatly on grants or other rewards, such as those given for publications in major scientific journals. Reliance on frequent publication for evaluation

puts excessive pressure on researchers, even more than in the West. Scientists are too often tempted to submit reports of work that represents only a promising start. To bear fruit requires time, and it is not clear that China is willing to be patient.

The Chinese government needs to give more researchers, both academic and applied, better salaries and a firm footing so that they do not need to scramble for proof of their worthiness. Academic researchers should be encouraged to apply their research, and science should be capitalized on wherever possible. For what China needs is an industrial base that can support research that will complement the work done in universities and academy institutes. Only then can the government's burden of overseeing most scientific research be lightened. But application of science, like good academic results, also takes time.

To evaluate new technology properly will require a strong private industrial base that is in the business of long-term profitability, not state-owned companies out to impress government with flashy products and a quick profit. And to evaluate researchers for grants without depending solely on past publications, China needs to establish a wider network of external reviewers.

China's scientific development seems inexorable. It has assembled considerable human and financial resources. But unless it makes wise policies now, much of this money and talent will be wasted. ■