GENETIC ENGINEERING

First Biotech Safety Rules Don't Deter Chinese Efforts

BEIJING—When a group of European scientists attended a workshop on agricultural biotechnology last year in Hainan in southern China, they were "flabbergasted" to hear Chinese researchers describe field releases of transgenic plants and micro-organisms, recalls Luc Vandebon, co-director of the China–European Union Biotechnology Center (CEBC) in Beijing. "These European scientists, who are happy if they get to cultivate a couple of hundred square meters, were just amazed to hear their Chinese colleagues reporting on field releases of hundreds, or even thousands, of hectares," he says.

Testing, testing. Chen Zhangliang leads a Beijing University team working on transgenic tobacco and tomatoes.

The Chinese scientists at the meeting are at the forefront of an aggressive government effort in plant biotechnology, begun in 1986, to feed the country's 1.2 billion people and to increase exports of grain and other crops. But questions about the health and safety effects of releasing transgenic organisms into the wild, a hot political issue in the West, are not high on the list of concerns. "To them it's just another application of technology, like using a tractor," says Alvin Young, scientific director in the U.S. Department of Agriculture's (USDA's) office of agricultural biotechnology, who led a U.S. delegation that visited 13 research sites only a few weeks after the Hainan workshop. "They don't have the luxury of saying this technology may pose a danger and should be tightly regulated."

Despite that attitude, Chinese authorities are laying the foundation for regulating agricultural biotechnology experiments, in part to retain control over the burgeoning biotechnology enterprise and also in response to suggestions from Chinese scientists to bring their country's practices in line with those used elsewhere. The clearest indication of this new philosophy came last December when China's highest scientific policy-making body, the State Science and Technology Commission (SSTC), issued the country's first rules for research on genetically modified organisms and formed a commission to oversee their implementation.

Levels of risk. The rules are, however, relatively benign compared with those in the West. They establish four levels of risk for work involving genetic engineering: nondangerous, slightly dangerous, moderately dangerous, and highly dangerous. Labs are permitted to proceed on their own authority with work in the first two categories, while work deemed moderately or highly dangerous must receive permission from higher authorities.

"Of course we wanted to control potential dangers, but we are still a developing country," says Lin Jinhu of the China National Center for Biotechnology and Development, who led the five-member drafting team. "We were careful not to make the regulations so strict that they would stifle exchanges and hinder work in this important field."

Working scientists feel that goal has been achieved. "I have heard something about [the new rules], but I don't really know the details," says Tan Jiazhen of the Laboratory of Genetic Engineering at Shanghai's Fudan University, who, as chair of the lab's academic committee, oversees the research of 40 faculty members on yeast and bacteria plasmid vector systems, recombinant virus vaccines, and gene therapy. "Anyway, it has not influenced our work here."

The regulations mandate the establishment of a National Genetic Engineering Safety Commission to "be in charge of the coordination and supervision of genetic engineering safety." But it is not clear how the commission will exercise its authority. That vagueness is due to high-level bureaucratic wrangling during the 4 years it took to produce the regulations, says Lin. "The Ministries of Public Health, Agriculture, Education, Light Industry (which controls food production), and Foreign Trade, as well as the State Pharmaceutical Administration and the Chinese Academy of Sciences, all wanted to have their say," he says. "It was not easy [reaching consensus]."

Indeed, the new rules allow each government department to retain control of genetic engineering safety "within its own scope of responsibility." The practical result will be to leave scientists, or their superiors in the relevant ministry or university, to determine the degree of danger of any proposed research and whether it should be reported to the new commission. "We have the regulations, and we have a committee now, but it is still not clear what forms we have to fill out or where we are supposed to apply for permission," says Chen Zhangliang, director of the National Laboratory of Protein Engineering and Plant Genetic Engineering at Beijing University and dean of that university's College of Life Sciences. Chen leads a 50-member group with several thousand hectares of tobacco and tomatoes under cultivation in a search for hardier plants.

In addition to giving scientists a relatively free hand to carry out their work, the SSTC regulations are also somewhat lax with regard to commercial use of genetically engineered products. They require only that scientists and producers undergo a self-administered safety evaluation and "determine the potential effects" before they proceed. The Science and Technology Department of the Chinese Ministry of Agriculture, according to a ministry spokesperson, is in the process of implementing more thorough rules, involving biosafety, to supplement the SSTC regulations. Existing rules only require data from 3 years of field tests showing the agronomic advantages of the new variety.

Although the ministry spokesperson said that no such products are currently on the market, Chen says his transgenic tobacco is being used in a domestic brand of cigarette. The U.S. team noted that soybeans from experimental plots containing a recombinant nitrogen-fixing rhizobium are not separated from the rest of the harvest and, thus, are likely to have been consumed by the public.

TED PLAFKER

A loose hand. Lin Jinhu says regulations should not hinder research.

Unique work. The lack of any efficient central monitoring body also makes it difficult to know just how much work is being done in China and how many field releases have been conducted. Lin estimates there are 20,000 Chinese scientists engaged in "high-level genetic research." USDA's Young notes that Chinese officials were unable to supply data for overall spending on agricultural biotechnology, explaining that "the budgets of individual agencies are misleading." But he was impressed with what he saw during his visit. "China is doing some unique agricultural biotechnology research," his trip report concludes, and its use of biotechnology "could augment its production of tobacco, cotton, maize, rice, oilseed, and veg-

etables in the medium-term future."

Among research of interest to Western scientists is Chen's work on the coat protein genes of several plant viruses. Chen's team has 35,000 hectares of transgenic plants, mainly tobacco but also tomato, under cultivation at 11 locations throughout China. His lab has also screened more than 1100 strains of bacteria from throughout China and found several that secrete proteins inhibiting the growth of some plant pathogens such as rice blast, wheat blast, and rice bacteria blight. He plans large-scale field tests of both wheat and rice implanted with genes encoding those proteins.

Extensive field testing of transgenic plants is also being conducted by the Beijing Institute of Microbiology under the Chinese Academy of Sciences. Several tens of thousands of hectares of tobacco, potato, and oilseed rape, all genetically modified for resistance to viral parasites, are now under cultivation in test fields, according to plant geneticist Tian Bo.

Chinese officials say there have been no adverse effects from the widespread field testing of genetically modified organisms, and knowledgeable Western scientists say they have not heard of any problems. Still, there is concern. "Biosafety is a very delicate thing, and there are sometimes dangers that are more long-term, so one must be careful," says Rudolf Casper, head of the Institute of Biochemistry and Plant Virology of the Federal Institution for Biological Research in Braunschweig, Germany, who attended last year's conference in Hainan. Adds Vandebon of the joint biotech center, "It is very easy for us in the West to say China should not meddle recklessly with nature because we have either enough food or enough money to buy it. Still, it is time China begins subscribing to the sort of regulations governing this kind of work elsewhere in the world."

–Ted Plafker

Ted Plafker is a free-lance writer in Beijing.

PHYSICS PUBLISHING

Peer Review in Cyberspace

Where do you find the fastest growing physics journal in the world? The answer: http://xxx.lanl.gov/. Three years ago, theoretical physicist Paul Ginsparg created an electronic archive at Los Alamos, accessible at that internet address, to which physicists e-mail preprints and from which they receive the latest work of colleagues and competitors. Since then, the archives have grown almost exponentially. They now include a dozen physics disciplines, plus mathematics, economics, computation, and linguistics, among others; they have more than 20,000 subscribers; and they receive roughly 1000 new preprints a month. Indeed, they have become so indispensable to physicists that they've left many asking whether traditional journals are necesary anymore.

The American Physical Society, which publishes *Physical Review Letters*, among other major journals in the field, has been confronting the same question. Last month the APS, which is planning to publish *Physical Review Letters* electronically starting on 1 July, hosted a meeting at Los Alamos to discuss how its electronic publishing endeavors will fit in with the electronic archives. It was "like the mountain going to Mohammed," says Bob Kelly, director of journal information systems at APS. "The society has become conscious of the fact that if its purpose is to disseminate physics information, we don't have to wait for it to be ink on paper, and it's actually being done a lot earlier, in any case, by the Los Alamos archives, and in some cases, a lot better."

One area in which the traditional journals have had an edge over operations such as the archives is that their papers are peer-reviewed. But even that is likely to change soon: One immediate outcome of the Los Alamos meeting, attended by some 80 physicists, was the development of a plan by Ginsparg and his colleagues to begin peer reviewing submissions to the archives. As Ginsparg describes it, the goal of a system he and nine of his computer-literate colleagues began to flesh out after the Los Alamos meeting is to add more value to peer review than the journals can achieve.

The system, he says, will also have "every imaginable caveat." For starters, reviews will not be anonymous; anyone who wants to criticize a colleague's work will have to attach their name. The system will then likely entail a public scoring system; readers of a paper will give numerical values to the work, assigning separate scores for quality of research, quality of presentation, degree of specialization, etc.

MARK STUCKY

Value added. Ginsparg thinks electronic peer review could outperform traditional journal peer review.

"It will all be completely voluntary," says Ginsparg, "and every author that submits a preprint can say, 'when I submit I don't want to allow any scoring.' " This option, Ginsparg believes, should placate physicists worried that graduate students and postdocs will be afraid to submit to the archives for fear of being devastated by the public response.

Those reading the preprint will also be able to submit comments. To protect the authors from "flame wars"—as devastating personal critiques are called in Internet lingo—the comments will go to authors first, and they can decide whether or not to make the comment public or delete it. The point, says Ginsparg, is to "encourage only positive commentary." But if no comments at all are attached to the paper, says Ginsparg, "there can be only two reasons. Either nobody cared to read it, or nobody cared to comment positively. In either case, it's either wrong or not even wrong, which for our purposes is equivalent."

As for the APS, Michael Turner, a University of Chicago cosmologist who chairs the APS publications oversight committee, says the society is encouraging the experiment with peer review on the electronic archives. These "guerrilla experiments," as Turner calls them, will serve an important purpose for the APS by indicating directions the society itself might eventually take.

These "guerrilla wars" may help instruct the APS in the vagaries of electronic peer review. What the guerrilla publications will not help the APS with is deciding how to charge for their journal electronically. "These young guys," says Turner, "their big motto is 'we're free.' " Right now the APS is considering charging a licensing fee for receiving the journal that will be some percentage of the cost of the print version. "You have to try something," says Turner. "And I'm sure the first thing you try is going to be the wrong thing."

As for the question of why the physics community needs journals anyway, Michael Peskin, a physicist at the Stanford Linear Accelerator Center, put the issue this way: The traditional journals might survive, he says, "because senior people like me think that paper is permanent. However, our younger colleagues do not feel that there is a difference between a page and a disk." And now that peer review may be added to the electronic version of scientific publication, the difference is likely to grow just that much smaller.

–Gary Taubes