

Is it worth leaving the US science base?

THERE are about 120,000 scholars and students from the Chinese mainland in the United States. Most are young scientists and engineers who have arrived since 1980, following the end of the Cultural Revolution. By the early 1990s, the number of science and engineering PhDs awarded to Chinese in the United States exceeded the number awarded in China itself; they also became the single largest group of foreign students within the United States, receiving 2,751 PhDs in 1995, about 10 per cent of the total. (Taiwan was second with 1,239).

For China, the emigration of so many talented people represents a brain drain of considerable proportions. But a large and successful expatriot community also represents a huge potential resource, as China seeks to expand its own scientific and technological base. Will this potential be realized in the same way it is already being realized in the Asian 'tiger' economies?

Most Chinese arrived in the United States with the expectation of returning home after completing their studies, but the suppression of the Beijing "democracy wall" protests in 1986–87 forced many to rethink their plans. For example, Xiao-Fan Wang of

Duke University was at that time a post-doctoral fellow in Boston, and planned to return to a job at Beijing University, China's leading university. But he was also active in Chinese student circles, and after he signed a petition protesting at the clampdown, his job offer was withdrawn. Wang later learned that his name had been listed in a classified document that was circulated to high-level Chinese government officials.

Chinese politics and identity

The political repression culminated in the Tiananmen Square massacre of June 1989. In response to human rights concerns, the US government decided in 1992 to grant permanent resident status to some 80,000 Chinese citizens who were living in the United States at the time of the massacre.

The Chinese academic community in the United States thus had good reason to feel betrayed by their government. But they maintained a strong sense of Chinese identity, and since the early 1990s there has been a sea-change in their relationship with China. In part this is due to a more open attitude by the Chinese government, but there has also been something like a

"coming of age" within the expatriot community. As Xiang-Dong Fu, an assistant professor at the University of California at San Diego, puts it, "we feel a sense of responsibility, and now that we are becoming more established here, we want to do something to help China".

So far, few have returned permanently. Ray Wu of Cornell University, who left China in 1949, was involved in placing Chinese students in US graduate programmes in biochemistry throughout the 1980s; he estimates that of some 450 students who went through his programme, less than 4 per cent have gone back to take jobs in China. Wu suspects that outcome is typical, and while the exact figures are uncertain, a recent NSF survey reported that of all the Chinese students who obtained US PhDs in 1992, almost 90 per cent planned to stay in the United States. This is a sharp increase from the figure two years earlier (60 per cent), before most were granted permanent resident status.

Attitudes may change if the political situation improves in China, but many difficulties will face those who do decide to return — not least, a much lower ▶

Singapore taps into Chinese talent and resources

It may seem odd to set up an institute for agricultural research in Singapore, which hardly has a square metre of arable land. But the aim of the new Institute of Molecular Agrobiolgy (IMA), affiliated with the National University of Singapore (NAS), is not to work on agriculture in the island city state. Rather, returnee Chinese scientists at the institute will work with colleagues in the Chinese mainland to develop, among other things, genetically altered pest-resistant cotton.

IMA is one of several new institutes set up by the Singapore government to develop a research and development infrastructure. Others include the Institute of Molecular and Cell Biology, which has already established its name in the world of science, and the Institute of Microelectronics, which is headed by Bill Chen, a returnee from Bell Laboratories.

IMA has recruited several young Chinese mainland scientists from Europe, where they had encountered a "glass ceiling" with no job opportunities beyond the postdoctoral level. These include Wei-Cai Yang, who in 1990 went to an agricultural university in the Netherlands from Lanzhou University (west of Xian in central China) under a Europe–China programme for postgraduate students. He turned down a postdoctoral position in Atlanta in the United States in favour of

the job in Singapore because of a desire to return to Asia, and because his wife and son are happier in the bilingual environment of Singapore, where Mandarin Chinese is widely spoken and taught.

Yang is doing basic research on plant genetics using molecular techniques. But he also has several colleagues direct from the Chinese mainland who are working on a more practical US\$25-million project to develop cotton that is resistant to bollworm pest.

China is the world's leading producer of cotton, but production has fallen drastically from 28 million bales in the mid-1980s to 18 million bales. Under a joint venture between Delta and Pine Land Company and Monsanto of the United States with Imagen Holdings, an investment arm of IMA, Monsanto technology will be used to introduce a bacterial gene into cotton that produces a toxin to kill the pest. Some adaptation of the US technique is required because Chinese cotton differs slightly from the US variety. The "Singapore–China" connection between Chinese scientists will help the US company license its technology with the Chinese government, says IMA acting director Hong-Woo Khoo.

There are several other projects on agricultural products in progress under a Singapore–China Biotechnology Pro-

gramme established between IMA and the Chinese Academy of Sciences last December. "We know the right people in China for collaboration. We plan to cultivate such collaboration. China is good at breeding plants, while we here are good at molecular biological approaches," says Yan Hong, another mainland returnee who came to IMA from the United States.

Returnee Chinese scientists at other institutes at the NUS are developing similar collaborations. For example, Bill Chen's Institute of Microelectronics is working with Fudan University in Shanghai on the characteristics of sheets and films for packing technology for microelectronic products. And the university also has a "big project" with Qinghua University in Beijing to develop the next generation of fuzzy logic systems for control of large industrial plants, says deputy vice-chancellor Chang-Chieh Hang.

"The unique thing about China is that Chinese professors are involved in the building of industrial plants. They bring new ideas and facilities to factories. Professors have a lot of access to pilot plants where we can test out things on a large scale," says Hang. Furthermore, China has plenty of talented basic researchers who can fill the lack of such manpower in Singapore.

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