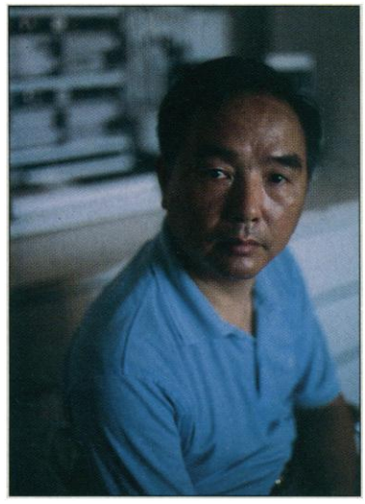
CHINESE SCIENCE POLICY

Shanghai Enlists Scientists To Foster Economic Growth

SHANGHAI—With its spacious, grassy courtyard and stands of tall fir trees, the Shanghai Institute of Cell Biology seems like a tranquil oasis amid the narrow, traffic-clogged streets of China's largest city. But this calm and seemingly timeless setting masks profound changes taking place inside the 44-year-old institute, long a leader within China in basic immunology, molecular biology, and cancer research. Like most academic research centers in the country, the institute is swept up in the government's market-oriented economic reforms, which have led thousands of scientists away from basic research and toward work that leads to the production of consumer goods. Those reforms are changing the scientific landscape in Shanghai, home to 270 research institutes and 50 universities, including such powerhouses as Fudan University and the Number Two Medical Sciences University, the country's leading medical school.



CHEN BAI

Big business. Guo Lihe has moved half the staff of the Institute of Cell Biology into commercial ventures.

The institute's director, molecular biologist Guo Lihe, now spends as much time contemplating the laws of supply and demand as he does studying the laws of nature. Half of the 180 scientists working for the institute have been transferred to five biotech companies recently established by Guo to provide additional sources of revenue. Instead of doing basic research, the scientists now spend their time developing clinical diagnostic kits, chemical reagents, and pharmaceutical products that the companies produce and sell. Last year alone, the thriving companies added 7 million yuan ($800,000) to the institute's coffers—more than triple the core funding of 2 million yuan from the Chinese Academy of Sciences. The added income has restored financial health to an institute where, just 2 years ago, scientists were forced to suspend several research projects. And it's personally very lucrative: Scientists at Guo's companies can earn as much as 6000 yuan per month, more than 10 times the salary of their counterparts who stay behind in the quiet courtyard laboratory.

Guo's freewheeling ways are precisely the sort of behavior China's scientific policymakers hope to encourage. Although the economy is experiencing double-digit annual growth rates, a nationwide construction boom has soaked up massive sums of cash and left the government unable to support science in the same way it did through four decades of socialism and central planning. That strain on funds, combined with the economic reforms, has meant that university science departments and government-run research institutes must generate much of their own revenue. "For a Chinese scientist who cannot do business, there is no way to get by these days," says Guo.

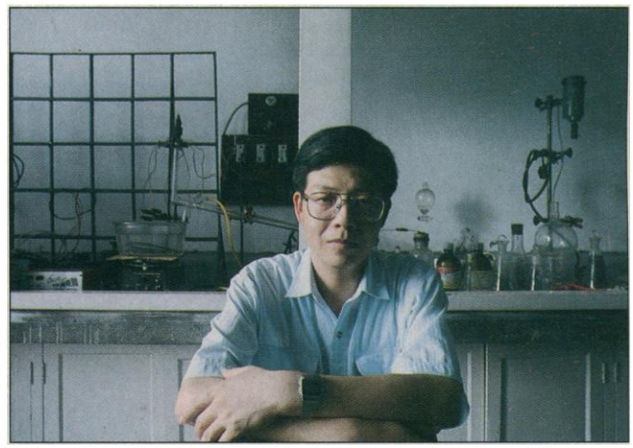
Nowhere is the impact of those policies more evident than in this city of 13 million, a center of capitalism before the Communists assumed power. Shanghai's leaders have enthusiastically endorsed the new policies and are even providing a small pot of money that local scientists can use to attract larger sums from other sources.

The Shanghai Science and Technology Commission (STC) administers a series of high-profile grant programs totaling 10 million yuan this year (up from 3 million yuan in 1992). The peer-reviewed grants favor young scientists and those with well-established research teams. Dozens of Shanghai scientists thus receive annual grants of up to 100,000 yuan to support their work, as well as smaller monthly stipends of 300 to 400 yuan to supplement their salaries, which typically stand at 500 to 600 yuan a month. "We used to divide up the money we had available among everyone who applied for grants, which meant nobody got very meaningful amounts," says a senior STC official who requested anonymity. "Now we give larger grants to fewer people."

The grants program is also intended to help Shanghai scientists compete on a national level. "The idea," says the commission official, "is that scientists who get this kind of support and recognition from Shanghai can then go on to get even more funding from the central government." While the local government does not keep such numbers, it does track the economic payoff from new knowledge generated by Shanghai's scientists. A survey last year by the Shanghai STC, for example, showed that more than 503 research findings led to the development of marketable products that generated revenues last year of almost $1 billion. At the same time, about 3000 enterprises run by research institutes in Shanghai reported a combined 1993 income of $500 million.

In addition to fueling the regional economy, the reforms are also giving Shanghai a chance to reclaim its historic place as China's scientific leader. (Its institute for biochemistry achieved the first synthesis of insulin, for example, and many observers feel it may have already surpassed Beijing in terms of the overall quality of its research.) Although it was China's commercial, cultural, and scientific center for many years, Shanghai was conspicuously excluded from Chinese leader Deng Xiaoping's earliest experiments in free-market reforms in the late 1970s, presumably because Chinese officials couldn't risk failure on such a grand scale. While the rest of southern China boomed, Shanghai felt put-upon, left behind, and even ostracized by Beijing. But in 1990 Beijing removed constraints on trade and investment that had prevented Shanghai from strengthening its economy; indeed, Deng has since admitted that his decision to exclude Shanghai was "one of my biggest mistakes."

Some can't wait. One Shanghainese scientist flourishing in this environment is Yang Yuliang, chair of the department of macromolecular science at Fudan University. In addition to grants of 250,000 yuan from the Shanghai commission, Yang has also been awarded 400,000 yuan from China's National Science Foundation, 300,000 yuan from the State Education Commission, and 200,000



CHEN BAI

Big winner. Polymer researcher Yang Yuliang has won several grants in the country's new competitive funding environment.

yuan from the Beijing-administered "Climbing Up" grant program for his 3-year research project on condensed state polymer physics.

Some scientists take an even more aggressive stance in seeking support. "Our principle is not to just wait for funding," says Zhu Zhang Yu, who chairs the department of biological science and technology at Shanghai's Jiao Tong University. "It's impossible to get a lot of money by just waiting for the government to give it to you."

What Zhu has done is to seek out enterprises, both Chinese and foreign, willing to pay his department to work on such everyday problems as how to process industrial waste water and how to convert the digestive products—both solid and gaseous—of dairy cows into usable energy. Contract fees on such projects run as high as 500,000 yuan, and Zhu says this kind of revenue has allowed him to add both personnel and new equipment to the university.

Zhu relishes his new entrepreneurial freedom. On his business card he is also listed as Chairman of the Board of the Shanghai Zeus Company, a firm established by his department that produces and markets a health tonic. Its sales over the past 2 years have totaled 20 million yuan.

Not everybody is happy with this new, more cutthroat approach to funding science, however. Many older scientists at the cell biology institute, facing enormous pressure to succeed on their own, have found the adjustment especially difficult. Although scientists are welcome to return to the institute if they fail to thrive at a company, according to Guo, they are likely to be given a lower position than they held previously.

Some scientists feel the new policies have altered the essential nature of their work. "You can't devote only half of your mind to pure science," says Chen Liang-yao, vice-chair of Fudan University's physics department, who says he has no desire to enter the marketplace. "A scientist who spends his energy on business deals cannot concentrate on science." At the same time, Chen doesn't expect much help from city officials, whose programs are geared to work that is more applied than his research into optical properties of solid materials. "The city government has no money for basic research," he says. "They have good intentions, but no realistic method to carry them out."

Freedom to fail. Government officials at all levels agree with Chen that the rush to make money is likely to lead to a decline in funding for basic research. But they say it's part of a new policy summed up by the phrase, "Stabilize the core and set loose the rest." The slogan, repeated endlessly, promises adequate levels of funding for a core group of scientists performing vital but unprofitable basic research. And it leaves the rest free to market their talents to the highest bidders.

Zhu acknowledges that his commercial pursuits command most of his department's attention and leave little time—or money—for basic research. But he compares his department to a three-wheeled cart, saying that teaching, basic research, and profitable production are all crucial to its stability. Lacking any one of these "indispensable wheels," he says, his cart would cease to roll.

Guo is also searching for a reasonable balance between the challenges of science and the need to find cash. Although he would like to keep half of his staff at the cell biology institute focused on basic research, he predicts that as many as 70% of his scientists will soon be doing applied research for one of the institute's five companies. "It has to be this way," he explains. "The country can't bear the burden of supporting us in the work we might prefer; it needs us to do this work."

Although high salaries and better working conditions may be enough for now to attract the talent Shanghai needs to retain a vibrant scientific work force, some observers worry that the new market orientation will eventually cripple the country's capacity to do basic research. "They've got a good head start, and they're determined to do it," says a science officer at a Western consulate in Shanghai. "But basic research will inevitably fall away, and that will hurt in the long run." In the meantime, Guo will keep one eye on his micrographs and the other on the market.

–Ted Plafker

Ted Plafker is a journalist based in Beijing.

ELECTRONIC PUBLISHING

AAAS Sells On-Line Clinical Journal

The world's first electronic medical journal has been sold by one of its creators, the American Association for the Advancement of Science (AAAS), to a London-based publisher. *The Online Journal of Current Clinical Trials* was started 2 years ago by AAAS and a major computer library service to give physicians faster access to peer-reviewed findings that might improve the practice of medicine. But AAAS (which also publishes *Science*) knew that the journal's targeted audience might be hesitant to embrace a journal in which all submissions, reviews, editing, and publishing take place electronically.

Those fears proved to be well-founded. *Current Clinical Trials*, which needed 5000 subscriptions to break even, reached barely a tenth of that level. And last fall the AAAS Board of Directors decided to consider seeking a buyer that could afford to mount the type of aggressive marketing campaign needed to make the journal viable.

"We thought about it as an R&D project.... We never did see publishing specialty journals as our line of business."

—Richard Nicholson

"We thought about it as an R&D project," says Richard Nicholson, AAAS executive director. "We wanted to see what you could do with electronic publishing....We never did see publishing specialty journals as our line of business."

Last week AAAS announced that it has sold the journal to Chapman & Hall, the scientific, technical, and medical publisher for the multinational publishing group, The Thomson Corporation. The publisher of 70 journals and such books as Bloom and Fawcett's *A Textbook of Histology*, Chapman & Hall has recently expanded into the U.S. market, acquiring *Microcirculation* and *The American Journal of Therapeutics*.

Chapman & Hall's president, Dana Dreibelbis, says the company will continue to distribute the journal in a partnership with the Dublin, Ohio–based OCLC Online Library Center but that it intends to use direct mail to "promote [the journal] heavily to the medical community." *Current Clinical Trials* "will be the cornerstone of our growing electronic publishing efforts," he says.

An unsolicited marketing tip comes from the founding editor of the journal, Edward Huth, who is stepping down during the transition. Huth, the former longtime editor of *The Annals of Internal Medicine*, thinks the most successful on-line journals will be those published by small scientific societies that have "a natural constituency."

Another promising option, he says, is publishing important journals both on paper and on-line, calming the fears of those worried that their work will be lost to posterity. But to Huth, those fears are misplaced. Of the future of on-line journals, Huth says: "It's going to happen one of these days, one way or the other."

One indicator of their growing popularity is requests for Huth to speak about on-line journals in France, Canada, and Brazil. Another was the landmark decision in January by the National Library of Medicine's *Index Medicus* and its companion *Medline* on-line database to make *Current Clinical Trials* the first electronic journal ever to be listed.

–Jocelyn Kaiser