with organic groups that allowed them to dissolve in an organic solvent. That enabled them to lay down a thin liquid film of the clusters. When the researchers then heated their film up to 350 degrees Celsius, the organic groups essentially burned off and neighboring clusters sintered together in larger aggregates 10 to 15 nanometers across.

Jacobson and his colleagues reported that devices made with the films moved charges at 1 cm^2/Vs, 10 times as fast as Bell Labs' new organic material. Moreover, the MIT researchers have devised a potentially cheap and easy scheme for printing circuits made from this material. "This is nice work and could be a good track to follow," says Francis Garnier, a pioneer in conducting organics at the CNRS Laboratory of Molecular Materials in Thiais, France.

Still, the approach has its drawbacks, concedes Jacobson. To burn off the organics and sinter the nanocrystals requires heating the devices to a point that would melt transparent plastic substrates envisioned for use in displays. And, like many other such materials, they must remain isolated from air.

Improving the speed and stability of these novel electronic materials aren't the only goals being pursued. Another Bell Labs team, led by physical chemist John Rogers, reported at the meeting that they are making heady progress in printing complex circuits of plastic electronics. To do the printing, Rogers and his colleagues wet preformed stamps with a solution containing gold and then pressed the stamps onto a layer of semiconducting polymer, which itself sits atop a plastic substrate. And although the work remains in its early stages, they've already succeeded in printing a circuit with 300 transistors that they plan to use to control light emission from a flat-screen display. "We've yet to make a functioning display, but we've built the electronics and been able to show that [the transistors] have good characteristics," says Rogers.

For now, Rogers and his colleagues have been making their circuitry out of a variety of semiconductors such as polythiophene. That material has a modest charge mobility, but because variations on the stamping technique can make such small features—down to about 100 nanometers—they can create ultrashort "channels," or pathways for the electrons to follow in the transistors. With a shorter distance to travel, the overall speed isn't such a drawback.

That experience drives home a key lesson that is dawning on researchers in the field, say Bao, Rogers, and others. For any next-generation semiconductor to succeed commercially, it must meet so many demanding criteria that the one that wins may not necessarily be the one that pushes current along the fastest. But then again, it may be. Says Rogers: "It makes for a good horse race."

–ROBERT F. SERVICE

HUMAN RESOURCES

New Incentives Lure Chinese Talent Back Home

China is dangling higher salaries, bigger research budgets, and improved management practices to lure top young scientists now working abroad

BEIJING—At the age of 37, Chinese-born She Zhensu had already carved out a place in the upper ranks of the U.S. research community. A tenured professor of mathematics at the University of California, Los Angeles (UCLA), who studies turbulence, he published regularly in leading journals. But last year, after 12 years in the United States, She returned home to lead a multidisciplinary experimental group at Beijing University that has also been designated a state key laboratory. The salary "cannot be compared with what I earned in the States," She admits, but he has no complaints about the move: "It is an opportunity for me to contribute to higher education and research in my motherland. I think I made the right choice."

That attitude is exactly what Chinese officials were looking for when they selected She to be among the first group of Changjiang Scholars. It's one of several new programs that offer premium salaries, generous research budgets, and other perquisites (see table on next page) to try to bring back—or retain—top-level Chinese researchers who can provide the mentoring that young scientists now often seek overseas. So far, the numbers are small. The special grants have gone to some 150 researchers like She who have shown significant promise overseas, plus dozens of scientists who trained and worked abroad before returning home. But the government sees them as a core that will elevate Chinese science for decades to come. "They are role models for both productivity and good research practices," says Bai Chunli, vice president of the Chinese Academy of Sciences (CAS), which runs the nation's premier research labs.

Homeward bound. Mathematician She Zhensu left UCLA for greater opportunities in China.

These incentive programs are just one part of a broader strategy to reverse the tidal wave of scientific talent that has flowed out of China in the past 2 decades. The Ministry of Education estimates that upward of two-thirds of the 300,000-plus scientists and engineers who went abroad to study during that period remain abroad. In addition to the special incentives, the government is improving research conditions and adopting performance rather than seniority as the basis for funding and professional advancement. The strategy appears to be working. Last year 564 researchers returned to CAS from overseas while only 432 left for foreign positions—the first-ever positive flow. "We're finally turning the tide," says Peng Liling, who oversees the incentive programs at CAS.

The prototype for the new programs was CAS's so-called Hundred People Program, which has given out $32 million to 177 scientists since it began in 1994. The central government supplemented it in 1998 by the 300 Talents Program, a $72.5 million program spread over 3 years. Last year the Ministry of Education began its Changjiang Scholars Program with a plan to spend $15 million annually for 3 to 5 years. Roughly half the cost is being picked up by Li Ka-shing, a Hong Kong business tycoon and philanthropist. In addition to these efforts, some of the bigger universities, including Qinghua and Beijing, have their own incentive programs, as do several cities.

Simple calculation. Mathematician Yuan Ya-xiang says coming back to work in Beijing was an easy decision.

Participants in these programs can do quite well. Changjiang scholars, for example, get a yearly salary of 100,000 yuan (about US$12,000), a hefty premium over the typi-

CREDITS: (TOP TO BOTTOM) D. NORMILE; BEIJING UNIVERSITY

cal professor's salary of 9600 to 24,000 yuan. When combined with housing subsidies, She says, "it allows for a fairly comfortable living in China." Research support is even more generous. The CAS programs provide about US$242,000 over 3 years to set up and equip a researcher's lab. "It's a good amount of money," says physicist Xue Qikun, who last year joined CAS's Institute of Physics in Beijing to continue his work on semiconductor epitaxy techniques after 7 years at Japan's Tohoku University.

Money isn't the only incentive, however. "For me, returning to China was just returning home," says Yuan Ya-xiang, 39, a computational mathematician at the CAS Academy of Mathematics and System Sciences in Beijing. Yuan came back from the United Kingdom in 1988, long before the first incentive programs. Others say that working in China allows them to avoid a crowded career ladder that may be biased toward local researchers. "It's difficult for foreigners to become professors in Japan," says Xue. Even in the United States, where foreign-born scientists are common, some researchers say it's still difficult for them to hold top management posts. "At universities, you see a tremendous number of Chinese-Americans holding distinguished chair professorships, but you find relatively few Chinese-Americans in senior administrative posts," says Feng Da Hsuan, a professor of physics at Drexel University in Philadelphia, who is on leave as general manager of SAIC, a scientific consulting firm.

In contrast, career paths in China are wide open, thanks in large part to the 10-year hole in higher education caused by the Cultural Revolution. "We have an urgent need for young blood," says CAS's Bai. That demographic void was a boon to Wang En Ge, who returned to China in 1994 at age 37 under the Hundred People Program after 9 years in Europe and the United States. Last year he became director of CAS's Institute of Physics and also head of the institute's Center for Condensed Matter Physics, both in Beijing. "I am trying to do my best to provide a good environment for younger researchers," he says.

However, moving up quickly also can have a downside. "We've been promoted 10 or 15 years earlier than we should be," admits Yuan, who holds the titles of vice president of the Academy of Mathematics and System Sciences, director of the Institute of Computational Mathematics and Scientific/Engineering Computing, and director of the State Key Laboratory of Scientific and Engineering Computing in Beijing. These administrative duties drain time from his research on nonlinear optimization at a time when his generation should be making a major contribution to new knowledge, he says, but he feels a sense of responsibility to the community. "Chinese scientists in a position [like this] also can do a lot," he says.

Returnees face other challenges, including readjusting to China's notorious red tape and thin infrastructure. "For the first 9 months, I had no time for work as I was filling out various forms," says Changjiang recipient and Beijing University professor Ou Yangqi, a 44-year-old chemical physicist who came back to Beijing University in 1998 after more than a decade in France and the United States. Physicist Wang says the equipment, while adequate, may not match what was available overseas. His institute, for example, will get its first scanning tunneling microscope system this spring. But acquiring the technology isn't the problem, he says: "We felt we first had to find the people [who can use such equipment] and then get the money for it."

The Center for Condensed Matter Physics is a good example of how a critical mass of returned scientists can boost output. The center published 290 papers in peer-reviewed journals in 1998, more than any other Chinese institute. Wang attributes the output in large part to the tone set by returnees, including seven recruited through incentive programs, who together account for more than 100 of the center's 180 researchers and two-thirds of its 44 group leaders. He says his rate of publication is "almost the same as when I was in the States."

But not all fields enjoy such success. Nearly all of the hundreds of graduates of the physics department at Beijing University, the nation's most prestigious school, have headed overseas in the past 2 decades for graduate or postdoctoral training, for example, and only 10 so far have returned to positions at their alma mater. Officials say it's particularly hard to attract scientists in the computer and life sciences because of the opportunities overseas and competition from China's growing private sector. Yuan says the Academy of Mathematics and System Sciences has managed to attract just three returning scientists under the incentive schemes, and less than a quarter of the institute's 200-plus researchers have held regular jobs overseas. Many Chinese mathematicians and computer scientists who do return from abroad head straight for private labs like Microsoft's new research lab in Beijing (*Science*, 13 November 1998, p. 1235), he says, or to Internet start-ups. "The [incentive] programs are not really doing as well as we had hoped," says Yuan. Even She, who is on leave from UCLA and still teaches there part of the year, intends to "keep in touch with U.S. institutions."

Of course, luring back a scientist is no guarantee of success. CAS officials also admit privately that some of the researchers in the Hundred People Program have been disappointments. To improve their chances, they have tightened standards for the 300 Talents Program to the point where meeting its goal in 3 years seems unlikely. Still, even if the incentive programs work spectacularly well, their very existence points to a deeper problem that officials say will take a long time to solve: "We need to be able to have our own students educated in China, doing research in China, at a world level," says Yuan. "We've still got quite a long way to go to achieve that." **–DENNIS NORMILE**

With additional reporting by Li Hui in Beijing.

BRINGING THE BEST BACK HOME

Program	Hundred People	300 Talents	Changjiang Scholars
Funder	Chinese Academy of Sciences	Central government	Education Ministry, Li Ka-shing
Duration	1994–97	1998–2000	1999–
Cost	$32 million	$72.5 million	$15 million/year
Target audience	100+ scientists under age 45 in 15 fields	300 scientists under 45, outside CAS	300–500 university posts, under 45
Award size	$242,000/3 years for research	$242,000/3 years for research	$12,000/year salary for 5 years
Perquisites	Housing, equipment, and staff	Housing, equipment, staff, grad students	Housing, eligible for research prize
How chosen	Institute and CAS review	CAS review/Finance Ministry approval	Expert panel
Outcome	177 recipients (60% directly from abroad)	111 recipients	73 in first class (17 from abroad)

SOURCES: CAS, MINISTRY OF EDUCATION