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Groundbreakers

From biotech to nanotech, three Chinese pioneers look to lead the nation to a new scientific frontier

BY HANNAH BEECH | SHENYANG

Nowhere is Asia's scientific revolution unfolding more dramatically than in China, where researchers are taking advantage of bounteous funds and pushing hard to fulfill a government mandate to innovate. Here are three Chinese scientists whose discoveries in the emerging biotech and nanotech fields could transform the way we live and help secure China's position as a scientific superpower:

PENG ZHAOHUI

Gene Healing

In 1998, Chinese molecular biologist Peng Zhaohui left the safe confines of San Diego, where he had worked for several years, for a newly built science park in the southern Chinese boomtown of Shenzhen. His immodest goal: to create a gene-therapy medication that would save many lives. Five years and $6.25 million in government seed money later, the firm Peng founded, Shenzhen SiBiono GeneTech Co., became the first corporation in the world to be granted a license for a gene-therapy treatment. Called Gendicine, the drug aims to combat different types of cancer by injecting a virus laced with a tumor-suppressing gene into the human body. By the end of 2005, more than 3,500 Chinese and foreign patients had been treated for 43 types of cancer with the $1,700-per-dose treatment. (A course typically requires at least six doses.) Peng says that combining radiation and chemotherapy with Gendicine is three times more effective than just using the traditional cancer treatments. "Westerners never imagined that the world's first gene-therapy medication would come from China," he says. "But if they had been watching what was happening in China, they might not have been so surprised."

Gendicine's success is due in part to China's relatively relaxed regulatory environment. American biotech firm Introgen, which has developed rival technology to that used by SiBiono, is still awaiting regulatory approval in the U.S. after undergoing exhaustive clinical trials for its gene-therapy drug. Testing can easily take a decade in the U.S., but SiBiono

accomplished it in just six years. Moreover, the trials cost SiBiono just $2,500 per patient, compared to around $100,000 per person in America. The possibly looser rules and comparative lack of transparency surrounding Gendicine's approval by the Chinese Food and Drug Administration have prompted criticism that SiBiono may not have adequately tested the long-term effects of its treatment. Peng's efficacy claims have not been internationally verified but he insists that tests have confirmed the drug is safe and effective. Meanwhile, enthusiasm for gene therapy has chilled somewhat in the U.S., after a patient died during clinical trials of another gene-therapy drug in 1999. Still, Peng is hopeful that Gendicine's licensing will help catapult China into the top ranks of this emerging field. Already, the country's gene-therapy guidelines are being used as a model by other nations publishing their own quality-control regulations. "If SiBiono helps China become a leader in biopharma," says Peng, "I will be quite proud."

LU KE

Metal Man

The unprepossessing clump of buildings that make up the government-run Institute of Metal Research in the grim northeastern city of Shenyang hardly looks like the birthplace of groundbreaking science. But inside its dingy halls, Lu Ke, the institute's 41-year-old director, is doing something truly cutting edge. Lu studies metals on a nano scale?one nanometer equals one millionth of a millimeter. Beginning in 2000, he successfully manipulated the atomic structure of copper to create a pliable material that's as strong as steel yet still maintains its original electrical conductivity. Lu's various types of nanometal can add years to the life of high-tech tools and processors. China's largest steel producer, Baosteel, for instance, has affixed a layer of his nanometal to the surface of the rollers it uses to produce steel sheets, thereby greatly extending the tools' longevity.

Just a decade ago, China wasn't a player in nanotech. But in the 1990s, the country unveiled a national science strategy targeting young fields that could be mined for high-profile innovations. The government's $160 million nanotech drive has freed Chinese researchers like Lu from wasting time scrounging for funds. "It's like China's success with Ping-Pong," says Lu, who this year became the first mainland Chinese to be invited to serve as a review editor for the prestigious Washington, D.C.-based Science journal. "When China decides to focus on something, it can achieve success very quickly."

Born in a mountainous village in China's remote west, Lu was one of only three kids from his high school ever to attend college. He later studied in Germany and the U.S., but his sense of obligation led him back to China. Still, he's not yet satisfied with the state of science in his homeland. "We have to give up the existing system based on seniority and reward people with the most talent," he says. "Science requires shaking things up, but people in China are scared of risk." Of course, this call to shake things up

comes from a man who has made a life of busting up atoms. "I like disorder," Lu admits. "It's what excites me."

SHI JIANLIN

Targeted Therapy

Sometimes what's in a drug is not as important as what's around it. Orally administered pills typically release one high-concentration jolt that stays in the system for only 10 hours. But a 200-nanometer carrier (equivalent to one-thousandth the width of a human hair) developed last year by Shi Jianlin, a senior researcher at the Institute of Ceramics in Shanghai, may radically change the way we medicate ourselves. Shi, 43, has created microscopic ceramic spheres that can be loaded with drugs and injected into the bloodstream to slowly release over a 50-hour period. Not only do Shi's mini-drug vehicles offer patients a nifty time-release mechanism, they can also target specific parts of the body. The carriers are outfitted with a magnetic particle, so by putting, say, your hand in a magnetic field, the nanovehicles will move directly there and then unload their cache of drugs. Such specific targeting may lower side effects by keeping medication away from parts of the body that adversely react to a drug. "The idea was pretty simple," says Shi. "But getting it to actually work took a lot of work and luck."

So far, Shi's nanocarriers are too costly for mass use, but it isn't his job to bring the price down. That's the domain of a commercial company, and Shi frets that even as the quality of basic research increases in China, the country could lose out because there are not enough domestic firms to convert innovative technology into commercially viable products. Indeed, science may be the one field in which China is still struggling to live up to its reputation as an unsurpassed manufacturer of low-cost goods. For a man who, with the exception of a year's study in Stuttgart, has stayed in China to conduct his research, the disconnect between idea and commercial application is worrisome. "I hope a Chinese firm can do something with our idea," he says. "It would be a pity if we invent something and someone else took advantage of it."

With reporting by Bu Hua/Shanghai

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