

BIOTECHNOLOGY

Lab-on-a-Chip Maker Looks to Put Hong Kong on Biotech Map

Better known for business acumen than scientific smarts, Hong Kong is betting on biotech as a new "pillar industry"; a novel biochip suggests it's on the right track

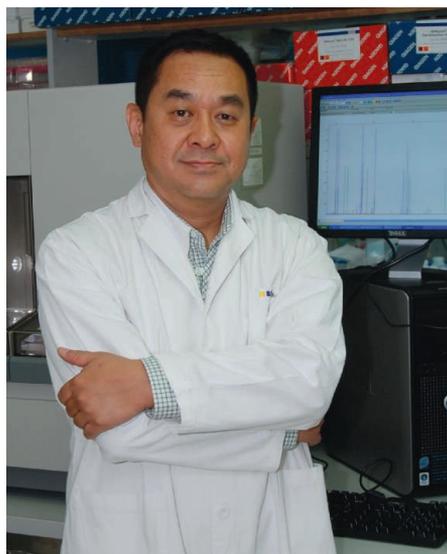
HONG KONG—In 1994, neuroscientist Albert Cheung-Hoi Yu gave up a plum position at Stanford University to join the new Hong Kong University of Science and Technology (HKUST). The career gamble paid off in an unexpected way. In 1997, H5N1 avian influenza hammered Hong Kong. "There was no sensitive tool for diagnosing this virus," Yu says. Polymerase chain reaction (PCR) tests were not standardized and therefore not reliable, he says. He launched a company to develop molecular diagnostics. As his start-up made headway, Yu aimed higher. He hoped to succeed where larger companies had failed: devise a biochip that quickly diagnoses emerging pathogens.

Overcoming obstacles that dogged previous efforts, Yu's company, Hai Kang Life, has rolled out a novel chip that binds target DNA strands and coats them with nanoparticles for identification. The Chinese Center for Disease Control and Prevention of Guangdong Province will soon begin testing the chips and automated readers. "It's a unique system," says Zhengping Zhuang, a clinical pathologist at the U.S. National Institutes of Health, who is not connected to Hai Kang Life. "You get a readout much faster than with other technologies."

If Yu's Electric Field Assisted Diagnostic (EFAD) chip proves its mettle, it will be a milestone in nascent efforts to make Hong Kong a biotechnology hub. For decades, the city reigned as Asia's financial powerhouse. Then in 2008, the Lehman Brothers collapse sparked a crisis in the financial services industry—and jarred leaders here. "They started thinking about how to diversify the economy," says Janet Wong, Hong Kong's Commissioner for Innovation and Technology.

The next year, Hong Kong's government designated innovation and technology as one of six new "pillar industries." To stimulate the biotech and pharmaceutical sectors, the government last February unveiled a clutch of measures, including \$138 million for a new medical research fund and a \$5 million initiative to open centers for international clinical trials and translational research.

Success is by no means assured. Hong Kong embraced biotech later than other



Underdog victory. Albert Cheung-Hoi Yu's young company beat the competition in developing a DNA chip for rapid diagnoses.

regions in China, such as Shanghai, Tianjin, and the new medical city rising in Taizhou. These municipalities have showered companies with tax incentives and spent billions of dollars on infrastructure. Here, meanwhile, land is scarce and expensive. "We never say our cost is low," Wong says. The city's chief selling point may be strict enforcement of intellectual-property rights, she says: "We're attracting IP-sensitive R&D."

That's a sea change. When Yu relocated here, he says, "Hong Kong was not a place to do science." Local universities set out to shift that perception in the 1990s by recruiting overseas talent. During a stint overseeing undergraduate admissions soon after joining HKUST, Yu touted biotech as a potential career option. "But graduates had nowhere to work in Hong Kong. At best they could be a salesperson for a drug company," Yu says. He realized his own company could play a small role in changing that; Hai Kang Life employs several HKUST grads, including its founding chief operating officer, Terence Lau.

At the outset, Yu's company picked low-hanging fruit: It was the first private laboratory accredited in Southeast Asia to test foods for genetically modified organisms and to

do prenatal testing for Down syndrome and other chromosomal abnormalities. Then in 2003, the emergence here of the SARS virus spurred Yu to redouble research on a diagnostic lab on a chip. "We saw the bottleneck was hybridization," he says, in which DNA is dissociated into single strands that bind to a probe. This process typically takes many hours. Yu hit upon a winner: applying an electric field to tweak the capacitance of DNA strands and speed up probe-to-DNA binding. Yu's team could get DNA or RNA to hybridize in minutes. The technique is also sensitive enough to eliminate the need for PCR to amplify targets. "It's easy to say you want to make a biochip like this," Zhuang says. "It's another thing to do it. Albert is focused and stubborn, and he found a way."

Another challenge is to identify strands bound to probes. Other companies use fluorescent tags, which require a pricey microscope and trained eyes. Yu's team floods sample wells with silver nanoparticles that latch onto bound DNA strands. Like a black-and-white picture, the coating's contrast is picked up by an inexpensive charge-coupled device camera and analyzed by a small automated reader.

The approach is so simple, Yu says, that when Hai Kang Life applied for patents, "we were thinking that someone else must have done this." They were wrong and now hold 30 patents. It's no surprise that Hai Kang Life got there first, says Bernard Roizman, a virologist at the University of Chicago in Illinois. Many diagnostics companies prefer to sell large, complicated, and expensive machines, he says. EFAD chip readers are the size of a microwave oven. "Attach it to a power supply, and it's a lab on a chip on wheels," Roizman says. "It could identify a new infectious agent in time to curtail its spread."

When he's not in the lab, Yu, who moved to Peking University in Beijing in 2002 and now shuttles between Beijing and Hong Kong, promotes biotech here as inaugural chair of the Hong Kong Biotechnology Organization. To better compete with the mainland, Hong Kong's science park, home to more than 340 companies, has just launched a \$600 million expansion expected to create 4000 R&D jobs. "We need to identify our niches," for example, nurturing start-ups focused on Chinese medicine or medical devices, says Nicholas Brooke, chair of Hong Kong Science & Technology Parks Corp. "We will be lost if we attempt to be all things to all people."

The first step is to get an innovative biotech product on the market. Yu's biochip is poised to do just that. "Nobody in the world would believe that this could be done in Hong Kong," he says.

—RICHARD STONE