The globalization of universities and science in Southern China

Universities in south China are taking the lead in an array of reforms aimed at making academic centers and scientific collaboration more international and more dynamic. Leaders of universities across southern Guangdong Province are expanding award schemes designed to recruit researchers and scientists who have obtained advanced degrees or taught in the United States or Europe. These measures are increasing openings for scholars trained abroad, and are helping globalize university faculties and joint scientific research. In the process, China is strengthening its position as a world power in science.

By Kevin Holden

As the new millennium unfolds, reform-minded leaders of Chinese universities and academies, and of independent scientific institutes, are all pushing for research discoveries and applications that will bolster China’s rise in diverse spheres of science. These leaders—many of whom have received advanced degrees in the United States or Europe—have bolstered the scientific envelope. This trend is gaining momentum in south China’s Guangdong Province and is creating new openings for scientists trained abroad.

For centuries, coastal Guangdong has been China’s main portal for contact with the West—everyone from Italian astronomers to British tea traders ended their seafaring passage from Europe at one of the province’s harbors—and the region is moving to expand these intercontinental connections.

Capped on one side by the South China Sea and by mountains on the north, Guangdong features the palm-tree–lined megacities of Guangzhou and Shenzhen along the Pearl River Delta, one of the planet’s most densely populated regions.

Zhuhai, a smaller seaside outpost opposite the former Portuguese colony of Macau, hosts China’s biggest space technology exhibition every 2 years. Daya Bay, a boating resort in eastern Guangdong, holds a massive nuclear power complex.

On the island of Hainan, just off Guangdong’s coast, China is constructing its most technologically advanced spacecraft launch center—the first spaceflight complex to be open to international tourists.

Although Guangzhou, the provincial capital, has been the academic center of south China for hundreds of years, Shenzhen—a sleepy checkerboard of coastal villages when the People’s Republic was founded nearly 6 decades ago—is now experiencing a construction boom in terms of new colleges.

Guangdong’s simultaneous moves to expand universities and attract scholars worldwide to conduct research or teach at these academic centers are rapidly boosting progress across a spectrum of scientific areas.

Guangzhou’s universities are magnets for scholars trained abroad

In Guangzhou, which has been an export powerhouse in terms of manufactured goods since the launch of China’s market-oriented reforms more than three decades ago, academic leaders are ramping up campaigns to “import” scholars who can help shape the transition to a knowledge-based economy.

At Guangzhou’s Sun Yat-sen University, President Luo Jun is using an assortment of talent schemes, along with perks like access to one of the world’s fastest supercomputers, to attract scientists worldwide to the university’s School of Advanced Computing, School of Engineering, and School of Life Sciences. The university was founded by Sun Yat-sen, the Hawaiian-educated leader of the 1911 revolution that toppled 2,000 years of imperial rule and gave birth to the Republic of China. Sun, a medical scholar who became the first president of the new republic, envisioned a rejuvenated China guided by “science and democracy,” and he promoted ever-closer ties with the West.

These days, the university he created is transforming itself into an international center for the life sciences and engineering, partly by forging partnerships with American schools: Sun Yat-sen University has teamed up with Johns Hopkins University to create the Medical Research Center for Clinical and Translational Research, and with Carnegie Mellon University to launch the Joint Institute of Engineering.

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The university recently received international attention after a group of 16 scientists based at the Key Laboratory of Gene Engineering published the results of a controversial experiment in which they genetically modified single-cell human embryos to repair the human β-globin (HBB) gene in a procedure aimed at preventing a serious blood disorder (www.sciencemag.org/content/348/6234/486.full).

Some scholars argue that the Chinese scientists have crossed an ethical line by editing the human genome, but others welcome China’s comparatively liberal regulation of this area of experimentation, which allows genetics researchers to push the scientific envelope.

Meanwhile, Sun Yat-sen University and other academic centers across Guangdong are competing against one another to attract talented researchers...
“Over 95% of the current faculty members are Chinese scholars returning from abroad.”
— Chen Shiyi

To attract Chinese scientists who have relocated to Europe or North America after studying there,
For example, Jinan University, which has five campuses spread across the cities of Guangzhou, Zhuhai, and Shenzhen, is stepping up recruitment of researchers who have obtained a degree or taught abroad, says university president Hu Jun.

Jinan University’s academic focus ranges from aquatic ecology and biotechnology to medical bioengineering and traditional Chinese medicine.
The university’s globe-spanning headhunting campaign covers the fields of biology, medicine, information science, and engineering; this effort has been so successful that more than half of the scholars currently joining the faculty have been trained abroad, Hu says.

“Talent from overseas have more expansive academic views and international ways of thinking,” Hu explains. These scholars likewise tend to develop innovative approaches to research and thinking about science.

Shenzhen’s new universities and their global alliances

In the seaside city of Shenzhen, which borders the former British enclave of Hong Kong, the speed of change across the sciences and the university system has been dramatic.
At Shenzhen’s South University of Science and Technology of China, which was launched just 5 years ago, “over 95% of the current faculty members are Chinese scholars returning from abroad,” says university President Chen Shiyi.

Chen, a former Oppenheimer Fellow at the Los Alamos National Laboratory in New Mexico, says: “This high ratio of professors with [training from] foreign universities makes South University a leader in Chinese academic and scientific communities in terms of the level of globalization.”
The university, which holds departments in physics, chemistry, life sciences, electronic engineering, and environmental engineering, “was built with a mission to serve as an experimental ground to reform the Chinese higher education system,” he explains.

Many courses are taught in English, with textbooks from North America or Europe, Chen says. He adds that South University is currently searching for experts in the fields of neural and cognitive sciences, biology and gene engineering, physics, nanotechnology, environmental sciences, large-scale computational research, robotics, and artificial intelligence. The university is also searching for candidates to serve as dean of the School of Engineering or the School of Life and Health Sciences.

“South University of Science and Technology of China is also making a huge effort to increase the level of globalization by recruiting more high-quality non-Chinese professors and international students to its campus,” Chen says.

Many new academic centers launched across China, he adds, are becoming testing grounds for reforms aimed at connecting universities and students through a global network of partnerships.

At South University, which has woven a web of collaboration with 18 world-leading universities, Chen says, “The goal is to provide the opportunity for every student to take part in an international exchange.”

A new Chinese-Danish college in Guangdong

South University is also co-founding a new college in a unique union with the University of Copenhagen in Denmark and with Shenzhen-based BGI, one of the world’s leading genome research institutes.

The new BGI Genomic College will recruit scientists and students globally, says Wang Jun, executive director of BGI.

Wang says the experimental structure of the new college, in contrast with China’s traditional universities, will foster innovation across the life sciences, and will feature cutting-edge research in medicine, biology, genomics, and bioinformatics.

BGI—which is part research institute and part genomics applications developer—has already launched satellite research groups in Europe and the United States and aims to move its talent from city to city, continent to continent, to promote scholarly collaboration.

This worldwide rotation of talent will allow scientists to understand different cultures and approaches to research.

BGI was set up as an independent research institute in 1999 in order to represent Chinese scientists in the Human Genome Project (www.genome.gov/1001772), and recently signed an agreement with the Bill and Melinda Gates Foundation to collaborate on genetics studies tied to global health and agricultural breakthroughs envisioned as part of the United Nations Millennium Development Goals (www.un.org/millenniumgoals).

The leaders of BGI, which was founded in the Chinese capital, say they opted to move the institute’s headquarters to Shenzhen due to the city’s openness to international trends and thinking.

Shenzhen was a sparsely populated region of rice paddies with a tightly guarded, barbed-wire border with British-ruled Hong Kong during the isolationist rule of Chairman Mao Ze-dong. It was transformed into China’s first “special economic zone,” aimed at integrating the country into the global market, after Mao’s successors began jettisoning the chairman’s most radical policies.

Shenzhen, now one of the globe’s fastest-growing cities, is also seeking ever-closer economic, academic, and cultural ties with post-colonial Hong Kong.

And as Shenzhen adopts components of Hong Kong’s capitalist-model economy and open, international education system, it has begun competing with the former British outpost to build China’s biggest stock market, attract biotech startups, and recruit leading scientists.

South China’s global collaboration in visual computing

The Shenzhen Institutes of Advanced Technology, part of the Chinese Academy of Sciences, have tapped...
The Chinese Academy of Sciences has similarly attracted Western scientists who are co-powering progress in such fields as “electric vehicles, integrated circuits, pharmaceutical development, and computer science.”

— Hui Huang

**Featured Participants**

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the national Thousand Talents program to attract a circle of scholars including German computer scientist Oliver Deussen into the new Visual Computing Research Center. Deussen, one of the world’s leading experts on modeling three-dimensional urban scenes, architecture, natural objects, and biological processes, has developed a sophisticated series of software packages to render these subjects in videos, computer graphics, or animations.

Based at Germany’s University of Konstanz and recently nominated for an American Academy Award for scientific achievement, Deussen is now working with his Chinese colleagues at the visual computing outpost on everything from transforming human models into animation characters to creating abstract renderings of architectural works or entire city sectors.

“In my area of visual computing, which includes computer graphics, image analysis, and data visualization, the Chinese Academy of Sciences [has been] able to gather top international scientists,” Deussen says. A new research group that combines these international scientists with their Chinese colleagues is already making significant contributions to the field of visual computing, he adds.

One of the primary challenges facing researchers in southern China, he says, is government pressure to make internationally recognized advances in their field at hyper-speed. “Change is happening so fast,” Deussen notes, “that individuals and systems can hardly follow.”

Hui Huang, the Canadian-educated director of the Visual Computing Center, says the Chinese Academy of Sciences has similarly attracted Western scientists who are co-powering progress in such fields as “electric vehicles, integrated circuits, pharmaceutical development, and computer science.” These scholars, she adds, are helping transform southern China into a globally linked hub for new frontiers of research in science and technology.

**Nuclear reactors and neutrino experiments at Daya Bay**

Due east along Guangdong’s coastline, one of the region’s most sophisticated technological projects, the Daya Bay Nuclear Power Complex, is also the stage for a cutting-edge experiment in high-energy physics: measuring the proportion of electron antineutrinos from the nuclear reactors that morph into other types, or generations, of these leptons as they speed through space.

Ghost-like particles that were first created in the instant following the Big Bang, antineutrinos and their partner neutrinos travel at close to the speed of light and are notoriously difficult to observe as they move through space, passing through planets, star systems, and galaxies with scant interactions with other forms of matter.

But Daya Bay’s nuclear reactors produce billions of trillions of electron antineutrinos every second, emitted by neutrons during a process called “beta decay,” and scientists have finally been able to measure their metamorphosis as they pass through a series of detectors positioned outside the reactors.

Physicists from south China’s Shenzhen University, Dongguan University of Technology, the Chinese University of Hong Kong, and the University of Hong Kong, along with counterparts from the Lawrence Berkeley National Laboratory in California, are all part of the Daya Bay collaboration measuring this antineutrino transformation with increasing precision.

Many of the Chinese researchers leading the Daya Bay experiment have been trained in the United States or Europe, and the Chinese Academy of Sciences is now searching for international experts in particle physics to work on similar experiments in the future.

Kam-Biu Luk, a professor of physics at the University of California, Berkeley and a visiting professor at the University of Hong Kong, heads the United States’ participation in the China-based neutrino experiment. The Daya Bay project, which is being co-led by China and the United States, “is one of the most productive experiments in particle physics [being] carried out by an international collaboration,” he says.

The success of Daya Bay “has captured the attention of the international community of particle physics,” adds Luk.

Chinese breakthroughs in understanding these fundamental particles, like its progress in human spaceflight, Luk says, “demonstrate the capability and potential of China in science and technology, which are on the rise.”

“With the steady decline in supporting basic science in the Western world,” Luk predicts, “China could well be the future Mecca for particle physics.”

Kevin Holden, a writer based on the east coast of China and the west coast of the United States, covers advances in science and technology across the Pacific Rim.

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