



A research boom in China's municipalities

In recent years, as China's cities have been transformed with gleaming skyscrapers, an Olympic stadium, and an iconic TV tower, the country has increasingly flexed its new economic might in the scientific arena as well. The government's investment in research grew to 1.98% of gross domestic product (GDP) in 2012, according to the World Bank—surpassing that of the European Union. That injection of resources, together with a strong base of well-educated researchers at home and abroad, has transformed Beijing and Shanghai into scientific powerhouses and jump-started opportunities in second-tier cities like Tianjin and Chongqing. **By Shawna Williams**

China's recent boom in scientific research and development is especially evident in its four municipalities: cities that are effectively their own province, administered directly by the central government. Those cities are Beijing, Tianjin, Shanghai, and Chongqing. Each is a priority target for government-led development efforts and home to top universities and government research institutes, and while Beijing and Shanghai offer an unrivaled array of opportunities in the sciences, Chongqing and Tianjin boast strengths of their own.

Beijing

China's capital is home to dozens of institutes of the Chinese Academy of Sciences (CAS); universities, including Peking University and Tsinghua University, which are widely considered China's best; and a wealth of private and state-owned companies. "As an innovation center, Beijing provides many opportunities in hospitals, universities, big companies, and small businesses," says **Luming Li**, who heads the National Engineering Laboratory for Neuromodulation (NELN) at Tsinghua University. In his work developing brain

stimulation methods to treat neurological diseases such as Parkinson's, Li works closely with colleagues at Beijing's Tiantan Hospital—known for its neurosurgery expertise—and Beijing PINS Medical Co., Ltd., which brings products that NELN develops to the market. Li says NELN is unique in forging ties between clinicians, researchers, and industry that shorten the time needed to develop new devices. For example, researchers in his group all observe neurosurgeries at the hospital and learn to "speak the same language as surgeons," he says.

Synergistic opportunities also abound for researchers in less applied fields than Li's, according to **Junjie Hu**, a principal investigator (PI) at CAS's Institute of Biophysics. Hu, who was previously on the faculty of Nankai University in Tianjin, says, "I have more collaborations here, and I think [there are many such opportunities in the] scientific community in Beijing . . . because of its size." There are several other CAS institutes nearby, he says, and within his own institute, he has access to experts in powerful microscopy techniques with whom he can consult, as well as access to the microscopes themselves. Hu thinks it's these resources that have enabled the Institute of Biophysics to recruit four of the seven China-based researchers who were named International Early Career Scientists by the Howard Hughes Medical Institute in 2012.



Lingli Liu

Lingli Liu, a PI at CAS's Institute of Botany in Beijing, agrees that the city provides fertile ground for collaborations both at home and abroad. "Because Beijing has so many scientists, it's very convenient for us to collaborate with each other, and there are also many international conferences here," she explains. In addition, graduate students tend to be drawn to Beijing, which makes it

easier to recruit them, she says. Another of the institute's selling points is that "students have a chance to work on advanced research and to interact with leading scientists who visit from all over the world," says Liu. And they can apply for one- or two-year scholarships to do research abroad.

Similar strengths are making the Institute of Biophysics increasingly attractive to graduate students, Hu says. Compared to the year 2000, when he graduated from college and left China for graduate school at New York University, "The research in China today is totally different," he says. "Nowadays I think the gap [between China and other countries] is growing smaller and smaller and there are more and more labs doing good research [that students] can choose from." There are also better opportunities for postdoctoral fellows than in the past, he adds, citing the institute's industry-sponsored postdoc packages that promise good pay and emphasize independence. *continued*

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— Tao Yin



Tianjin

Just a short ride from Beijing by high-speed rail, the port city of Tianjin boasts mainland China’s highest per-capita GDP, according to the Xinhua News Agency. That’s partly because of the Tianjin Binhai New Area, a high-tech district lying outside central Tianjin but inside the municipality, and the home of 219 Fortune 500 companies, according to *China Daily*. One campus of the Tianjin University of Science and Technology is also located at Binhai, where the dominant industries include microelectronics, chemical engineering, and energy. **Zhi Yao**, director of the Department of Immunology at Tianjin Medical University (TMU), says the city currently offers many career opportunities in biomedicine, aerospace, information technology, and the petrochemical industry.

Yao projects that more than 300 professors and instructors will be hired at TMU over the next five years. The new hires will have ample opportunity to interact with top colleagues from abroad, as TMU has already awarded 119 honorary and visiting professorships to foreign scholars, says Yao. A new campus is being built to provide more space for teaching and research for new and current faculty.

Hiring is also among the strategic priorities at Tianjin University, which plans to hire about 400 new staff in 2016, including faculty, research staff, and postdoctoral fellows, according to President **Jiajun Li**. He sees many opportunities in Tianjin’s industries as well, particularly in the chemical industry and in manufacturing, construction, energy, environmental protection, new materials, information technologies, instrumentation, biomedicine, and marine engineering.

Although industry provides some of Tianjin’s most promising opportunities for scientists and engineers, the hiring and funding outlook is also good at Tianjin’s Institute of Biomedical Engineering, an outpost of the Chinese Academy of Medical Sciences. **Tao Yin**, a professor of biomedical engineering at the institute, has found China’s funding environment to be favorable for his work there, with most grants coming through the Ministry of Science and Technology and the National Natural Science Foundation. For students who would like to enter his field, Yin suggests acquiring extensive knowledge to “broaden their research horizons,” because biomedical engineering is multidisciplinary. He adds that “since clinical needs are important sources of ideas in biomedical engineering research, it is [beneficial] to have close collaborations and frequent communication [with] clinicians.”

Shanghai

Medical immunology is another area with strong grant funding in China, says **Xuetao Cao**, director of the National Key Laboratory of Medical Immunology in Shanghai. He credits strong government support with enabling the laboratory to develop powerful tools for both basic research and cancer immunotherapy studies. In the coming year, he predicts the laboratory will hire three to four PIs to continue to push the work forward.

Cao’s laboratory is one of many potential destinations for those seeking research positions in Shanghai. China’s largest city and financial capital, Shanghai is also a leader in science and engineering. The municipality is home to multiple CAS institutes and top universities, notably Fudan and Shanghai Jiao Tong, and several high-tech industrial development zones.

Jie Zhang, the president of Shanghai Jiao Tong University, has his sights set on making his institution one of the best in the world. “In China, with a population of 1.3 billion, every student competes to get into one of the top five universities,” he explains. “The goal [at Shanghai Jiao Tong] is to give those students the same quality education in China that they would get at a U.S. institution.” With that goal in mind, the university created different tracks to reward professors for excellence in teaching, not solely for the quantity and quality of their publications, as occurs at many Chinese universities. In the current academic year, Zhang projects that Shanghai Jiao Tong will hire 80 tenure-track faculty through global recruitment and through promoting current faculty. Eight years ago, Zhang also founded the university’s Zhiyuan College, which emphasizes interdisciplinary education and hands-on research for the most talented students. All faculty are adjunct, which Zhang says enables the college to employ exceptionally innovative scientists who are jointly appointed to other departments within the university. He sees Zhiyuan College as a pilot program and hopes to eventually expand its educational model, which earned him a National Award for Higher Education in 2014, to the entire university.

Shanghai’s educational environment has seen a lot of positive change since his days as a student, says **Weijun Pan**, who completed his Bachelor’s in 1999 at East China University of Science and Technology and a Ph.D. at the Shanghai Institutes for Biological Sciences (SIBS). Following his studies in Shanghai, Pan went abroad for postdoctoral training at Yale University and the National Institutes of Health. Now a PI at SIBS’ Institute of Health Sciences, he says that today’s students have many more opportunities than he did to research abroad while completing a Ph.D. in Shanghai, and to interact with foreign researchers who visit the city. For example, of the eight institutes that comprise SIBS, one is a co-venture of CAS and the Institut Pasteur in France, and another is a collaboration between CAS and the Max Planck Society in Germany—both have recruited faculty from abroad as well as within China. And SIBS students can apply for scholarships to work in an overseas collaborator’s lab for a year or two, Pan says.

Pan says that having the combination of a Thousand Young Talents award from the central **continued>**

Featured Participants

Chongqing Cancer Hospital
www.cqch.cn/list.php?tid=365

Institute of Biomedical Engineering, Chinese Academy of Medical Sciences & Peking Union Medical College
www.bme.org.cn (in Chinese)

Institute of Biophysics, Chinese Academy of Sciences
english.ibp.cas.cn

Institute of Botany, Chinese Academy of Sciences
english.ib.cas.cn

The Institute of Health Sciences, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences
www.ihs.ac.cn/eng/eindex.asp

National Key Laboratory of Medical Immunology
www.immunol.org (in Chinese)

NELN, Tsinghua University
www.neuromodulation.cn

Ruijin Hospital
www.rjh.com.cn/chpage/c1352

School of Electrical Engineering, Chongqing University
cee.cqu.edu.cn/enindex.asp

Shanghai Jiao Tong University
en.sjtu.edu.cn

Southwest University
www.swu.edu.cn/english

Tianjin Medical University
www.tjmu.edu.cn/s/2/t/250/p/3/c/1080/list.htm

Tianjin University
www.tju.edu.cn/english

Chongqing

Chongqing, the only inland municipality, may be best known to Westerners as the starting point for many Yangtze River cruises, or to history buffs as the capital of the Republic of China through much of the Second Sino-Japanese War (1937–1945). Formerly a part of Sichuan Province, it retains that province's laid-back reputation to some extent. But with its designation as a municipality in 1997 and a corresponding increase in resources from the central government, the city is regaining eminence. And Chongqing's strong growth has staying power: It was the only city near the top of The Economist Intelligence Unit's (EIU's) report on rapidly growing Chinese cities in both 2010 and 2015. The 2015 EIU report projects that Chongqing's real GDP will grow by nearly 9% between 2014 and 2019—the third-largest projected rate for any Chinese city. Its fast growth means that “Chongqing offers more working opportunities compared to other Chinese cities,” says **Chenguo Yao**, deputy director of the Department of High Voltage and Insulation in the School of Electrical Engineering at Chongqing University.

Much of that opportunity lies in Chongqing's many universities and teaching hospitals. Among these, Chongqing Cancer Hospital's 70-acre campus is unique in its combination of medical treatment, scientific research, cancer screening and education programs for the public, teaching, and postsurgical physical therapy, says neurosurgeon **Xing Cheng**. He cites a dynamic environment and passionate colleagues as advantages of his job, but acknowledges that finding positions at his and other teaching hospitals is “highly competitive.”

In contrast, **Lingfei Luo**, who studies organ development in zebrafish at Southwest University, says the employment picture is bright in his field. Luo earned his Master's and Ph.D. in a cooperative program of the University of Göttingen and the Max Planck Institute for Biophysical Chemistry in Germany, followed by a postdoc at the Max Planck Institute. He later spent a year at the University of California, San Francisco as a visiting scientist. Luo was drawn back to Chongqing because it is his hometown, but the decision has also paid off for his career, he says, observing that it is easier for early-career scientists to win grant funding in China than in the United States or Europe. “The biomedical community is growing very fast. Every large university has a number of positions available.”

With their wealth of opportunities in the sciences, China's municipalities offer something for almost everyone: Those who prefer a large and active community of fellow researchers might opt for Beijing or Shanghai, while those looking for careers in specific fields, such as biomedicine or energy, would do better to seek a position in Chongqing or Tianjin. Any of the municipalities are sure to provide a front-row seat as China's research and development capabilities continue to expand.

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Jie Zhang



Lingfei Luo

government and funds from the Institute of Health Sciences provided a startup package almost equivalent to what he would have expected from a U.S. institution. And because SIBS' eight institutes share resources, it's “easy for me to find advanced instruments,” he says.

Shanghai will soon have another institute specializing in translation, thanks to a \$157 million investment from the National Development and Reform Commission of the People's Republic of China. **Guang Ning**, the deputy director at Ruijin Hospital, is involved in launching a new National Centre for Translational Medicine that will open in 2017 with 300 beds devoted to translational and clinical research. “The translational medicine center also includes a biobank for hundreds of thousands of patient samples and an ‘omics analyses center for genomic and metabolic data,” he says, as well as space for pharmaceutical industry collaborators. The center will have two sites, Ning says, one at Ruijin, a teaching hospital affiliated with the Shanghai Jiao Tong University School of Medicine, and one on campus. He adds that the hiring process has already begun for 50 PIs and 12 scientists, who he expects will be a mixture of clinicians and basic scientists.