

SPOTLIGHT ON GUANGZHOU

Trade hub to innovation hotbed

The southern Chinese city of Guangzhou is fast becoming an epicentre for scientists and researchers to join forces with industry to develop new high-tech products and innovations.

BY YU FEI AND FU QING

"We encourage enterprises to cooperate with universities and research institutes."

CHEN YANLING

THE CHINESE government has ambitious plans to reinvigorate the country's economy through innovation. This major shift must be supported by making science and technology a major priority, as the country's most recent five-year-plan emphasized.

The city of Guangzhou is well-placed to succeed in this new landscape. Dubbed the "southern gate of China", with Hong Kong and Macao as its neighbours, Guangzhou, capital of Guangdong Province, has been one of China's most important port cities and commercial centres since it was the departure point on the Maritime Silk Road during the Tang Dynasty (AD 618-907).

Today the city's GDP per capita exceeds US \$20,000, the third highest of the country's large cities after Beijing and Shanghai. In 2015, the value of Guangzhou's high-tech products reached more than 842 billion yuan (US \$130 billion) and the number of new patent licenses surged past 6,000, a rise of almost 50% from 2014.

While car manufacturing, petroleum and chemicals are Guangzhou's traditional pillars, emerging sectors such as electronics,

biological and pharmaceutical research and new materials have developed rapidly. The city is also home to 13 of China's 50 most innovative companies as selected by U.S. business magazine *Fast Company*.

As well as being a commercial hotspot, the municipal government also wants Guangzhou to become an international science and technology innovation hub. Already home to most of the research centres in its province (79 universities, 141 research organizations and 19 national key laboratories), under local government plans the city could see a doubling of the number of incubators that help accelerate the growth of sci-tech start-ups. Land and financial support is also being allocated for development of high-tech enterprises and the construction of companies with in-house R&D capabilities.

Supporting research commercialization

The Guangzhou government spent 7.17 billion yuan (approximately US\$1.1 billion) on science and technology projects last year, almost five times the amount spent in 2010. It has committed to increasing the budget to 10 billion yuan by 2017, a significant portion of which will be used to commercialize the city's research effort.

Since mid-2015 policies to facilitate research commercialization have been rolled out, with particular emphasis on the role businesses must play. The Guangzhou Science, Technology and Innovation Commission, which is in charge of science and technology affairs under the Guangzhou municipal government, says more than 80% of the city's science and technology funding will support projects led by business by 2018. The government will also help more than half the city's industrial enterprises

above a designated size establish R&D bases in Guangzhou.

"The policies are similar to those of other cities, developed against the backdrop of China's development of an innovation-driven economy and implementing the amended Law on Promoting the Transformation of Scientific and Technological Achievements in October, 2015. We will see the effect of the policies this year," says Chen Yanling, vice director of the innovation service department of the Guangzhou Science, Technology and Innovation Commission.

Enterprises buying scientific and technological patents can seek government subsidies of 5% of the value of research result transactions. Newly-established sci-tech companies can also apply for subsidies of 50% of their rent for three consecutive years, according to the commission. "We encourage enterprises to cooperate with universities and research institutes," Chen says.

Another new policy also encourages scientists and technology experts in universities and research institutes to commercialize their research. It directs administrators at these organizations to expand the criteria they use to evaluate researchers beyond their publication record, to include commercial achievements such as the number of patents they hold, or their efforts to translate their research.

Incubating sci-tech companies

At the heart of Guangzhou's development district in the city's east sits Guangzhou Science Town. Spread over 20 square kilometers, the town was built in 1998 to facilitate research commercialization by positioning businesses in the same precinct as researchers and entrepreneurs.

The science town is home to »



Guangzhou's impressive skyline reflects the city's bold ambitions to become a national hub for science and innovation.

Guangzhou by numbers

The southern city of Guangzhou, the capital of Guangdong Province, is one of China's top ten best performing cities in the Nature Index, a database that tracks the world's best natural science research. Since 2012, the number of articles Guangzhou scientists have published in top-tier journals has almost doubled.

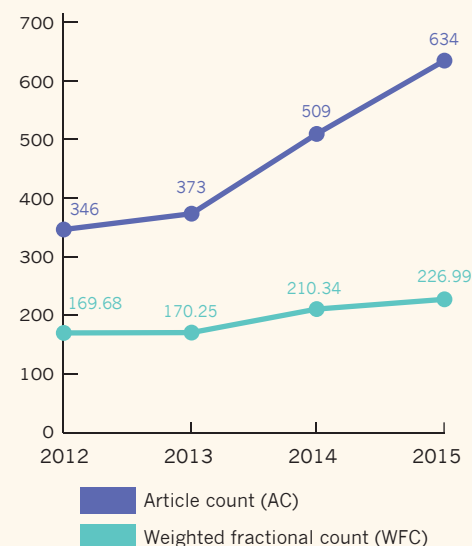
ONE OF CHINA'S TOP RESEARCH CITIES

Guangzhou is among China's best performing cities in the index in 2015 by article count (AC) and weighted fractional count (WFC).

Rank	AC		WFC	
1	Beijing	7188	Beijing	1648.13
2	Shanghai	2982	Shanghai	822.58
3	Nanjing	1599	Nanjing	397.40
4	Hefei	1405	Wuhan	266.27
5	Wuhan	886	Hong Kong	250.60
6	Hong Kong	881	Tianjin	246.54
7	Tianjin	820	Hefei	237.72
8	Hangzhou	719	Guangzhou	226.99
9	Guangzhou	634	Hangzhou	223.00
10	Changsha	427	Changchun	218.66

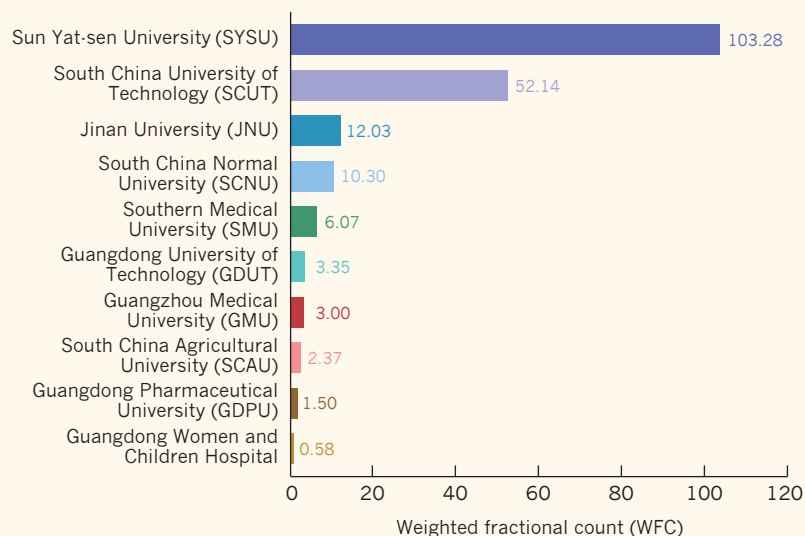
RISING PERFORMANCE

Since 2012 the number of articles (AC) published by Guangzhou researchers in top journals has increased, along with their contribution to those articles.



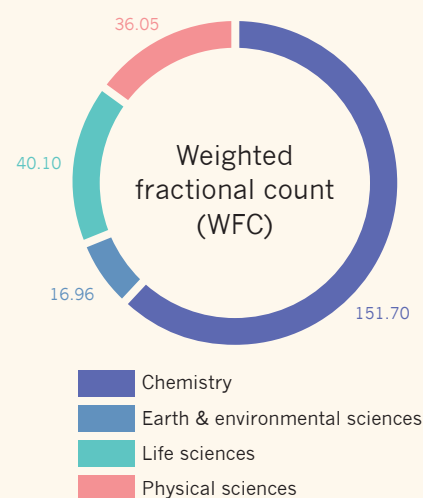
LEADING INSTITUTIONS

Nine of Guangzhou's top 10 institutions in 2015 were universities. Chinese Academy of Sciences institutes are not included in this table.



CHEMISTRY STRENGTH

In 2015, most of Guangzhou's WFC came from high-quality research published in chemistry journals.



About the Nature Index

Since 2012 papers published in 68 top-tier journals have been included in the Nature Index database. The index tallies the article count (AC) of universities and research institutions, and by extension, reveals the output of cities and countries. It also measures the contribution of researchers to articles by a metric called weighted fractional count (WFC), which divides credit for each article by the affiliations of contributing authors. This measure is weighted to account for the disproportionate number of astronomy articles in the index. Data shown on this page was retrieved from the database on March 17, 2016. As the index is continually updated, printed numbers may differ from those on the website. In 'Chemistry Strength', subjects may overlap. The sum of subject area WFCs may therefore exceed the city's overall WFC.

Guangzhou's first modern business incubator, which helps start-ups establish themselves by sharing equipment and support staff, as well as offering management training and cheaper office space. The town now boast 45 incubators – including some set up by the government, universities or research institutes – collectively assisting about 3,000 sci-tech companies.

“The incubators provide the space and services for the transformation of scientific and technological achievements. As researchers and university professors are unfamiliar with commercial registration procedures and legal and financial issues of business, the incubators help solve those problems,” says Xia Jian, deputy secretary of the Technological Innovation and Intellectual Property Bureau of the Guangzhou Development District.

One recently established incubator set up by the Guangzhou Research Institute of Optical-Mechanical-Electrical Technology, which specializes in bio-medical,

financial and laboratory monitoring equipment, has helped launched several science start-ups or businesses based on the institution's research.

One spin-off from the institute, Guangdong Spectrastar Instruments, has successfully commercialized near-infrared spectroscopy technology developed by one of the institute's research teams, led by Chen Xingdan, an academican of the Chinese Academy of Sciences (CAS). Chen was responsible for measuring the light radiation of China's first nuclear test in the 1960s. He has spent more than two decades studying near infrared spectroscopy, and is enthusiastic about his research results being used outside the lab.

Products made by Guangdong Spectrastar Instruments entered the market in 2015. “Its output value is expected to reach 10 million yuan in 2016,” says Ren Hao, deputy director of the institute. He says the corporation aims to list on the stock market in 2017. The incubator is also helping to realize

Rolling out a bright future

The screen on your future mobile phone or computer could be as thin and pliable as paper, so you could roll it up and put it in your pocket. That's the vision being pursued by one Guangzhou-based outfit.

Despite being a major producer of computers, TVs and mobile phones, until recently China had developed few technologies for high-end flat panel display. Given the vast amount the country spends importing display screens, such technology has become a priority.

Many of China's TV and mobile phone manufacturers, such as Skyworth, TCL, Konka, Huawei and ZTE, are based in Guangdong, where flat panel displays have become a significant industry.

Since 2002, the South China University of Technology, with its strong R&D foundation in new display technologies, has received capital support from the government to establish an industry-research cooperation platform. Cao Yong, one of its professors, is at the forefront of work in this field.

In addition, the university and Skyworth jointly set up the Guangzhou New Vision Opto-Electronic Technology Co. Ltd. in 2010 to commercialize the university's basic research on Organic Light-Emitting Diodes. OLEDs are used to create digital displays in devices with screens.

In 2011, the company developed China's first full colour active matrix OLED (AMOLED) display screen, known for thinness and brighter images. Since then it has created a transparent version and the first colour flexible AMOLED display screen.

Cao's university team is responsible for the basic research to find more original technologies. The team at New Vision complements this with work on applied technologies that meet industry needs.

“Turning the basic research into a real product is a painstaking process. Developing the prototype technology in the university goes only from zero to one; transforming the prototype technology into a mature retail product is one to 100,” says Cao. “We now have travelled half the road.”



Researchers at Guangdong Winsun Bio-pharmaceutical in Guangzhou inoculate chicken embryos with bird flu virus in the process of creating vaccines.

the visions of university graduates developing a new satellite and a group of technicians from Taiwan developing a mini supercomputer.

“The research organizations have a responsibility to help transform and upgrade China's small and medium-sized enterprises. Guangzhou is at the frontier of economic and trade activities that provide us with sufficient market and commercial information. We want to find a new development mode together with business,” Ren adds.

Collaborative innovation

Collaborations between businesses and academic centers are another important source of innovation in Guangzhou. Several alliances have formed between industry and universities or research institutions in fields such as new materials, 3D printing, industrial robotics and biological medicine. The local government has handed out 0.1 billion yuan annually for the last five years to support collaborative innovation and research commercialization in the field of health care.

Animal vaccine-producer Guangdong Winsun Bio-pharmaceutical Corporation is one company that has benefited from alliances with research institutions. Originally a state-owned enterprise established in 1958, the organization was restructured into a private holding company in 2002. At the time, it had no in-house R&D capabilities and competition from other companies threatened to drive it out of business.

After restructuring, the company established stronger connections with the China Institute of

Veterinary Drug Control, the South China Agricultural University, the Sun Yat-sen University, the Guangdong Ocean University and the East China University of Science and Technology to develop and test new vaccines.

“We either buy their research results or jointly develop new vaccines. Our major source of profits comes from cooperation with institutes and universities,” says general manager Lin Xuye. The corporation produces 43 different vaccines, with sales revenue exceeding 300 million yuan in 2015. Now it invests about 8% of its sales value in R&D every year.

Another hotbed of profitable cooperation is the Guangzhou Institutes of Biomedicine and Health of the CAS. In 2009, it set up a drug discovery pipeline to research and develop new medicines and bio-medicine technologies, which aims to combine the resources of research organizations, universities and companies in south China to accelerate development of key drugs.

As a result of the platform, AD16, a new anti-neuroinflammatory agent to treat Alzheimer's disease has passed preclinical trials and has been granted a clinical trial approval by the China Food and Drug Administration (CFDA). An oral kinase inhibitor for the treatment of leukemia is now awaiting CFDA clinical trial approval. ■

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