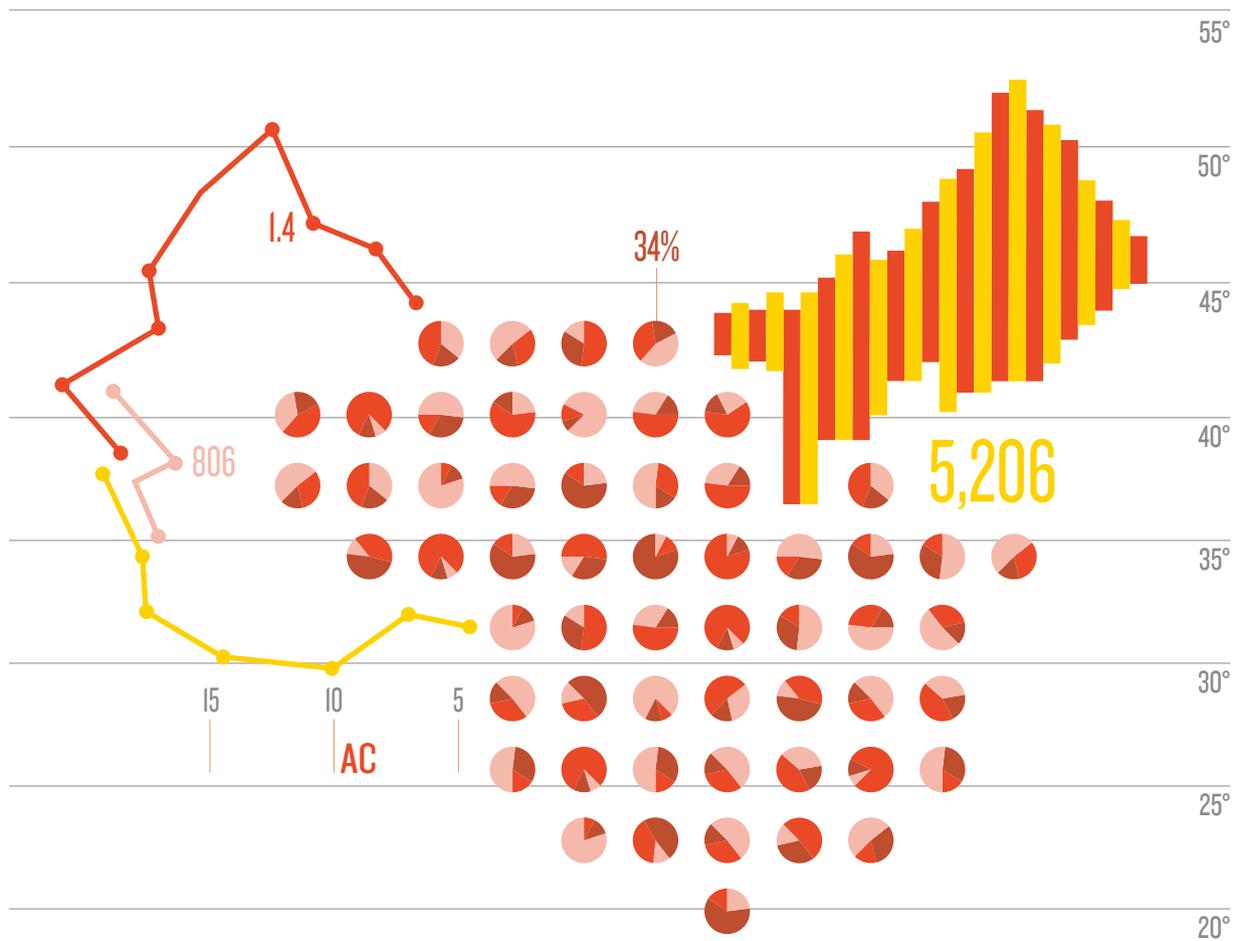


nature INDEX 2014

CHINA



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CHINA

NATURE, VOL. 516, NO. 7531 (18 DECEMBER 2014)

COVER ART: DENIS MALLET/NATURE

Hot on the heels of the November 2014 launch of the Nature Index, we are pleased to present a supplement dedicated to results from China, currently the country with the second largest output in the index. Here we analyse a snapshot of results for papers published between 1 January and 31 December 2013, shining a spotlight on the cities, institutions and individual researchers who have contributed to some of the highest quality research during that time.

The Nature Index is already attracting comments about the window it provides into the scientific literature, and we hope to further the conversation here. The concept is that, by looking at articles from only a small group of journals — those most favoured by researchers — we can offer a new level of analysis that is more targeted and hence more malleable.

We want users to be able to tease out patterns of research, look at trends, analyse individual strengths, and investigate how institutions and countries collaborate.

In this supplement, we start by looking at China as a whole — at its scientific collaborations with other countries, at the spread of its output across four main subject areas, and at its top ten contributing cities.

China is dominated by the Chinese Academy of Sciences (CAS), a 60,000-strong research conglomerate,

with headquarters in Beijing. In this supplement, we identify the contributions of the 100-or-so specialized institutes that comprise this research behemoth, looking at the outstanding institutes and researchers within the different disciplines (S56).

We are also able to examine the index data at the city level. Within each city we try to identify hotspots for high-quality research, based not just on output quantity but also on a range of indicators — for example, the number of researchers and the ratio of collaborators — that help put the data in context and allow a more nuanced view of these patterns. However, it is the insights into research at the institutional level that are most revealing. Using the data we are able to drill down to the level of the individual researcher to see who has been most prolific and in what areas (S60).

Our aim with this China-specific supplement is to show the Nature Index's capacity to generate discussion. Every reader of this supplement and user of natureindex.com will have their own specific interests and questions to address. We encourage use of the freely-available data to do just that, and welcome any feedback that arises.

Nick Campbell
Executive Editor, Nature

Michelle Grayson
Senior Editor, Nature Supplements

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SICHUAN UNIVERSITY

AN INNOVATION POWERHOUSE IN WESTERN CHINA

Sichuan University is located in the heart of China's Sichuan Province in the capital of Chengdu. The city has developed over the centuries into an important centre for commerce, education, transport and communication in western China.

Sichuan University is one of the oldest universities in the country, with its founding institution established as far back as 1896. The university was designated a national key university by the Chinese Ministry of Education for its excellence in education, research, and social impact, and it continues to host several key laboratories that receive financial and administrative support from the government. These include 13 national-level key laboratories and centres sponsored by the Ministry of Science and Technology, 17 national-level key laboratories and centres sponsored by the Ministry of Education and 3 national-level key laboratories sponsored by the Ministry of Health as well as numerous provincial-level key laboratories. The laboratories, research centres and bases at Sichuan University have conducted projects of regional, national and international significance.

According to Thomson Reuters' *Essential Science Indicators*, which identify the most influential researchers, publications and institutions in a range of scientific fields based on their research output and impact, Sichuan University ranks among the top one per cent globally in five subject areas, while an additional five of its disciplines are ranked among the top five per cent worldwide. Having devoted considerable resources to the areas

of teaching, learning and research, the university has gained global recognition and serves as a driver of innovation, propelling China into a new stage of economic development.

STATE KEY LABORATORY OF BIOTHERAPY

The State Key Laboratory of Biotherapy (SKLB) was founded in 2005 and selected as one of the New Drug Creation and Development Integrated Platforms in 2008 under the New Drug Creation and Development Program managed by the Ministry of Health and the Ministry of Science and Technology. In April 2013, the SKLB became the National Collaborative Innovation Center for Biotherapy, which is supported by the 2011 plan implemented by the Ministry of Education and the Ministry of Finance.

The centre's premises are divided between the medical campus of Sichuan University and the Chengdu Hi-Tech Zone. They occupy an overall area of nearly 70,000 square metres and are even now undergoing intensive growth and construction. The SKLB also takes advantage of the rich clinical resources available at the West China Hospital, Sichuan University — the largest hospital in China with 4,300 inpatient beds.

The centre excels in seamlessly integrating basic research with preclinical development and translational and clinical medicine for the discovery and development of innovative drug candidates. The establishment of an efficient and fully integrated technology chain in a single institute has proved advantageous in achieving the SKLB's ultimate goal of improving the treatment of major human diseases, including cancer, cardiovascular diseases, obesity, diabetes, inflammatory diseases, neurological diseases and chronic autoimmune diseases, as well as infectious diseases such as hepatitis, AIDS and tuberculosis.

The SKLB has almost 100 professors, associate professors and assistant professors who



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are conducting well-funded, highly regarded, comprehensive and multidisciplinary research. These researchers are engaged in hundreds of projects focusing on, among other things, gene and cell therapy, vaccination, monoclonal antibodies, recombinant proteins, and the development of synthetic and natural small molecules for drug discovery. As a result of their dedicated study, the laboratory publishes over 300 research papers every year in peer-reviewed journals, including leading international journals such as the *New England Journal of Medicine*, *Developmental Cell*, *Nature Medicine*, *Proceedings of the National Academy of Sciences of the USA*, *Cancer Research* and *The Lancet Neurology*. To date, the laboratory has licensed over 50 patents in the commercial sector across China and transferred 45 potent candidate drugs to over 30 pharmaceutical companies for commercial development.

STATE KEY LABORATORY OF POLYMER MATERIALS ENGINEERING

The State Key Laboratory of Polymer Materials Engineering (SKLPME) was selected to become one of seven national pilot laboratories under the Key Discipline Development Project, which is supported by a loan from the World Bank.

The SKLPME prioritizes research at the frontier of polymer materials science and engineering that has the potential to contribute

to China's national economic development. This includes basic and applied research on the structure and properties of polymers, processing theories and related technologies, and production and engineering, in addition to the development of high-performance polymer materials.

Researchers at the SKLPME have established principles of polymer blending and compositing, developed technologies for preparing polymer-based nanomaterials and created highly efficient polymer materials for application in oil and gas fields. Researchers at the laboratory have won numerous science and technology awards, published many scientific papers and books and patented several of their innovations.

STATE KEY LABORATORY OF ORAL DISEASES

The State Key Laboratory of Oral Diseases (SKLOD) was founded in 1936 as the first research department in China specializing in oral medicine, or stomatology. It was designated a national key laboratory by the Chinese Ministry of Science and Technology.

The laboratory is primarily engaged in basic research on the mechanisms and treatment of oral diseases with the goal of becoming a leading international laboratory in the field. Research activities at the laboratory focus on developing novel techniques for the prevention and treatment of tooth decay, advancing

new dental materials and biomaterials, and understanding the mechanisms of malformation in the oral and maxillofacial area as well as the metastatic behaviour of cancerous epithelial cells that line the inside of the mouth. Researchers and postgraduate students at the SKLOD have access to the latest facilities and technologies, which cost RMB 80 million and occupy an area of 7,000 square metres.

STATE KEY LABORATORY OF HYDRAULICS AND MOUNTAIN RIVER ENGINEERING

The State Key Laboratory of Hydraulics and Mountain River Engineering (SKHL) became the country's first national key laboratory in the field of hydraulic engineering, following authorization in May 1988 by the National Development and Reform Commission, formerly known as the State Planning Commission.

The laboratory was set up as an academic platform for hydraulic engineering and the study of mountain river environments to support projects in water conservation, hydropower construction and disaster prevention. The SKHL divides its research between five key objectives: the hydraulics of high-speed flow and dam engineering; mountain river dynamics and engineering; environmental hydraulics and mountain river protection; dam and reservoir safety; and hydroinformatics and new technologies in hydraulic engineering.

Between 2008 and 2012, the SKHL received one second-prize State Technological Invention Award, four second-prize State Science and Technology Progress Awards, and nine first-prize provincial- and ministerial-level allocations of the same awards. During the same period, the SKHL published 182 papers that have been included in Thomson Reuters' *Science Citation Index*, 225 papers indexed by Elsevier's *Engineering Index* and 13 monographs. The laboratory has also acquired 83 Chinese invention patents, 5 American invention patents and 8 software copyrights. Moreover, the SKHL has participated in the drafting of five volumes of technical specifications and standards.



East Gate of Jiang'an Campus

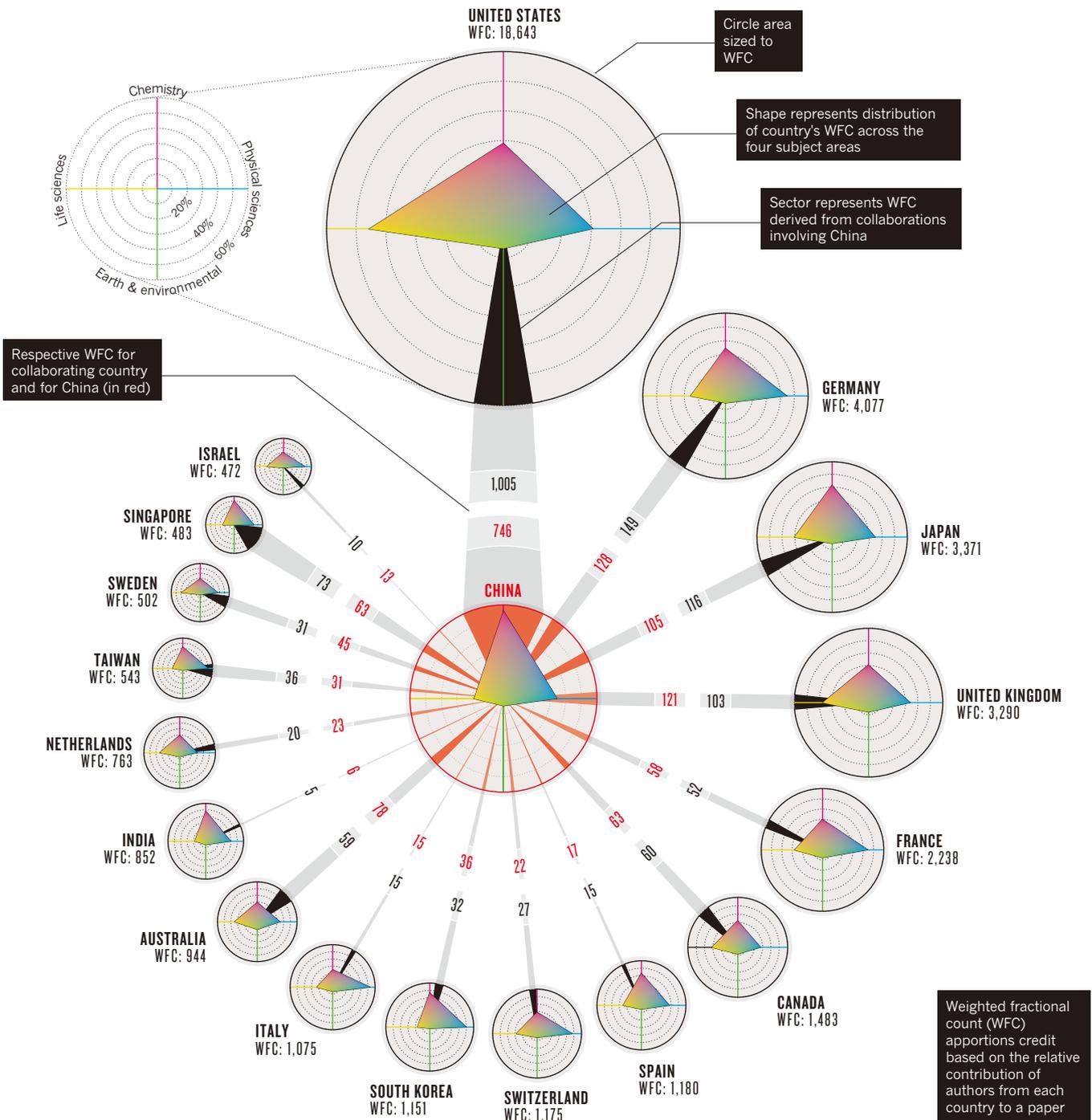
CHINA IN NUMBERS

By 2013 weighted fractional count, China is the second leading country for high-quality science output. Where that research takes place, and who China collaborates with, are shown below.

COUNTRY COLLABORATIONS

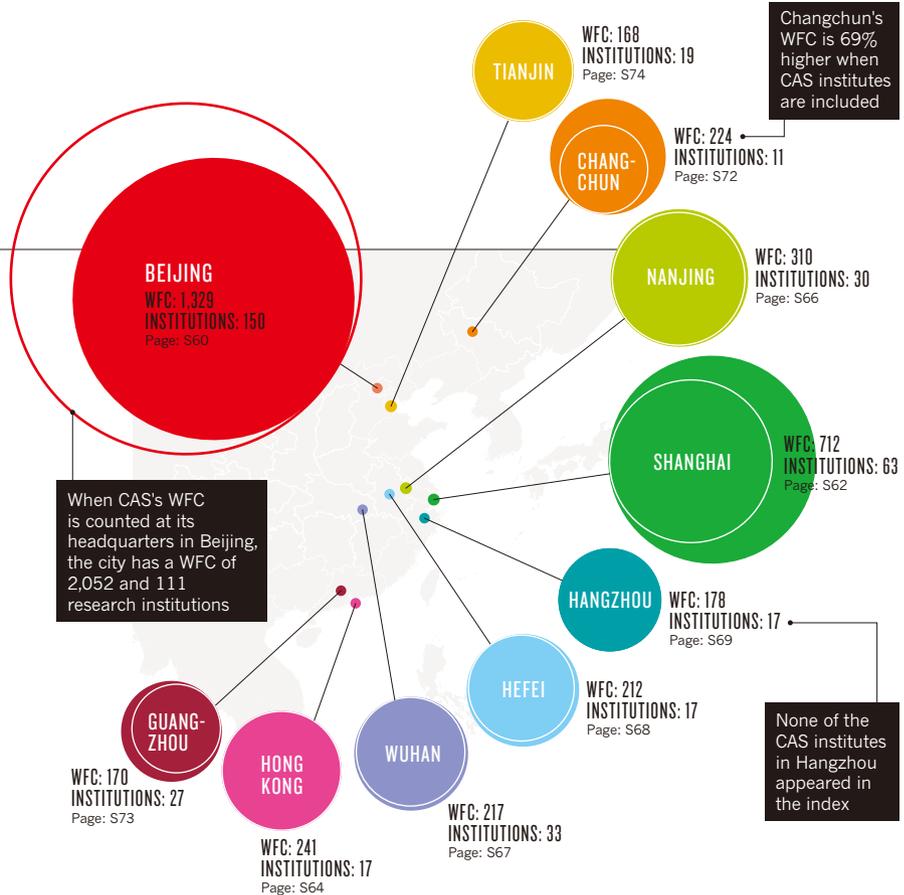
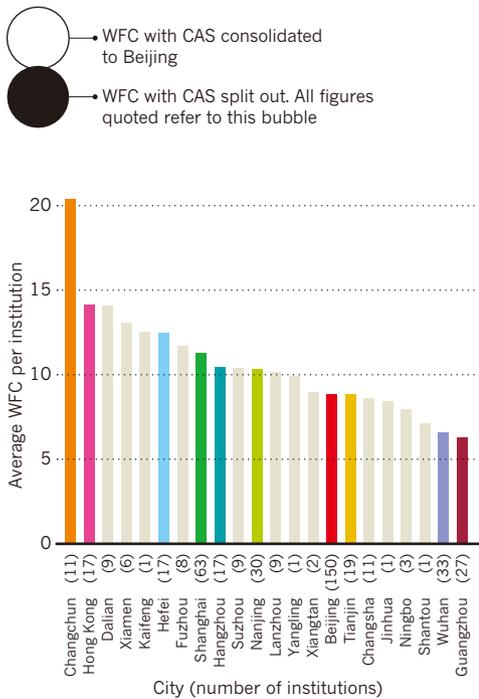
The diagram shows the leading countries by WFC, along with the distribution of their subject strengths and the proportion of their WFC derived from collaborations with mainland China. In the centre, the size and proportion of China's WFC and subject strengths are also shown. Note, this diagram shows all instances of bilateral connections, therefore papers that involve collaborators from more than one country will be double-counted for China.

CHINA'S WFC
 TOTAL: 5,206
 CHINA-ONLY PAPERS: 4,051
 INTERNATIONAL COLLABORATIONS: 1,155



CITY STORY

The ten leading cities by WFC are shown for mainland China. The solid bubbles are scaled to the combined WFC for all the city's research institutions, including the institutes of the Chinese Academy of Sciences (CAS). Shown for comparison are the WFCs without the CAS institutes (circle outlines). For an analysis of CAS, see page S56.



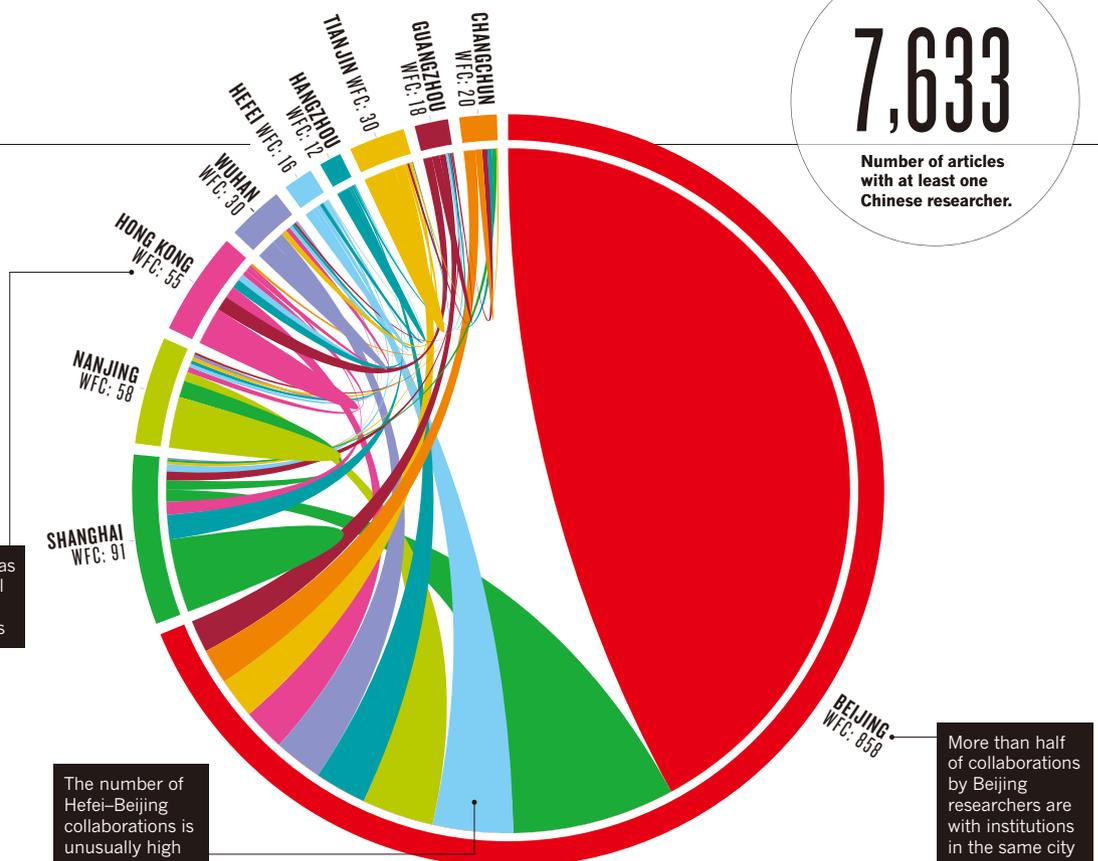
When CAS's WFC is counted at its headquarters in Beijing, the city has a WFC of 2,052 and 111 research institutions

Changchun's WFC is 69% higher when CAS institutes are included

None of the CAS institutes in Hangzhou appeared in the index

INTERCITY COLLABORATIONS

Shown are WFC scores from all the papers that involve collaborations between institutions in the top ten cities. Papers that are written entirely by researchers from one institution are excluded.



7,633
Number of articles with at least one Chinese researcher.

Hong Kong has more external than internal collaborations

The number of Hefei-Beijing collaborations is unusually high

More than half of collaborations by Beijing researchers are with institutions in the same city



:insideview

profile feature



Please visit our website at www.microstructures.org
or contact us at wudi@nju.edu.cn

The Collaborative Innovation Center of Advanced Microstructures (CICAM) was formally authenticated by the Ministry of Education of China in 2014. Here, we discuss CICAM's mission and development with three CICAM directors: Dingyu Xing of Nanjing University, Fuchun Zhang of Zhejiang University and Xingao Gong of Fudan University.

Q: Who founded the centre?

Nanjing University took the lead in founding CICAM in 2012, in partnership with Fudan University and Shanghai Jiao Tong University (both in Shanghai), Zhejiang University (in Hangzhou), the University of Science and Technology of China and the Hefei Institutes of Physical Science of the Chinese Academy of Sciences (both in Hefei) and the company Huawei Technologies. The cities of Shanghai, Hefei and Hangzhou are all connected to Nanjing by high-speed railway and lie in the economically dynamic region of the Yangtze River Delta. The five universities are ranked in the top ten institutions for physics research in China and are especially strong in the areas of condensed-matter physics and materials sciences. CICAM brings together many important leaders in the field of artificial microstructures, including a Nobel laureate, a member of the American Academy of Engineering, 16 academicians of the Chinese Academy of Sciences, 34 Changjiang endowed professors and 45 Distinguished Young Scholars of the Natural Science Foundation of China.

Q: Why was CICAM established?

Research and development into artificial microstructures lies at the forefront of modern physical science. As one of the most important and promising research areas in the 21st century, microstructures research is at the crossover of condensed-matter physics, materials science and information science. Designing and manufacturing artificial microstructures at various scales can reveal novel quantum effects, help advance science and technology for quantum manipulation and lead to new generations of materials, information and energy technologies.



Ding Yu Xing, Co-director,
Prof. of Nanjing University.



Fu Chun Zhang, Co-director,
Prof. of Zhejiang University.



Xin Gao Gong, Co-director,
Prof. of Fudan University.

Q: What advantages do collaborative innovation centres offer?

Collaborative innovation centres attract some of the most talented researchers. They also promote interdisciplinary research through bringing together researchers with expertise in different areas and sharing resources. CICAM will combine the research capabilities of the National Laboratory of Solid State Microstructures and the State Key Laboratory of Coordination Chemistry of Nanjing University, the High Magnetic Field Laboratory at the Hefei Institutes of Physical Science of the Chinese Academy of Sciences, the State Key Laboratory of Surface Physics of Fudan University, the Key Laboratory of Artificial Structures and Quantum Control of Shanghai Jiaotong University, the Center of Correlated Matter at Zhejiang University and Huawei Technologies' Noah's Ark Lab. In addition, CICAM receives support from five provincial key laboratories and 17 national researcher training centres.

Q: What are the main research focuses of CICAM?

Focusing on cutting-edge science, CICAM chose artificial bandgap materials, correlated electron systems and small quantum systems as its three main innovation areas. It established eight cross-institutional innovation platforms: essential facilities for microstructure research, artificial bandgap- and meta-materials, micro/nano-photonics, quantum phase transitions and quantum manipulation for correlated electron

materials, novel superconducting materials and unconventional mechanisms, mesoscopic physics and devices, magnetic nanostructures and spintronics, and functional microstructured devices and system integration. Huawei participates in the construction of the last platform, which is dedicated to converting the scientific achievements of CICAM into practical applications.

“CICAM brings together many important leaders in the field of artificial microstructures”

Q: How does CICAM plan to attract talented researchers?

CICAM will follow international standards for hiring, in line with the Association of American Universities. The centre will coordinate across its different institutions, but will establish an independent management authority for establishing positions based on its research progress. The principal investigators will report directly to the centre's directors. Employment at the centre will be contract based for the duration of the research projects and key researchers will receive international evaluation. CICAM will also provide many incentives to attract talented researchers, especially active young researchers. Once hired, researchers will receive generous non-competitive research funding from the centre.



NANJING UNIVERSITY COLLABORATIVE INNOVATION CENTER OF ADVANCED MICROSTRUCTURES

WHERE MICROSTRUCTURES HAVE MACRO IMPACT

The Collaborative Innovation Center of Advanced Microstructures (CICAM), led by Nanjing University, was established under the 2011 Plan, an initiative of the Chinese Ministry of Education and Ministry of Finance to develop the innovation capacity of universities across the country. The plan was introduced as an important strategic measure in China's higher education system and through the establishment of Collaborative Innovation Centers has focused on four key categories: frontier science, industrial development, regional development and cultural heritage. In an evaluation by the Ministry of Education in early 2014, CICAM was rated top of all the Collaborative Innovation Centers considered.

CICAM concentrates on conducting interdisciplinary research on advanced and artificial microstructure materials where micro- to nano-scale features give rise to interesting properties, which can be exploited for a range of technological applications. Researchers at CICAM conduct fundamental research on advanced and artificial microstructures and also work to translate their findings into relevant applications. Through these efforts CICAM aims to establish itself as a leading centre in the field, producing research that catalyses Chinese industry and meets their technology needs. The centre

is also committed to training researchers and drawing prominent scientists from across the country to become a world-class scientific institution.

CICAM is the result of a partnership between several universities, research institutes and companies located in the Yangtze River Delta region, a thriving area for science and education in China with a very active high-tech industry. The partner institutions have a long history of cooperation in large research projects and are committed to sharing the responsibilities and benefits of CICAM.

THE STRENGTH OF COLLABORATIVE INNOVATION

CICAM's collaborative approach takes full advantage of the expertise cultivated in five established research platforms, including the National Laboratory of Solid State Microstructures at Nanjing University, to create an environment conducive to innovation on a par with that achieved by the international community.

CICAM is responsible for 60 major national research projects with a total research budget of RMB 380 million (approximately USD 62 million). Its research on dielectric superlattices and iron-based superconductors is among the strongest in the world. It has also yielded numerous important advances in the areas of optics, acoustic diodes, quantum integrated chips, high-temperature

superconducting materials and their mechanisms, quantum spin Hall systems, entangled edge states, nanophotovoltaics, all-solid-state laser microstructures and micro-nanofabrication technologies. For example, CICAM researchers have designed a semiconductor laser array chip based on artificial microstructures, which entered into Huawei Technologies' industrial exploration programme on photonic integrated devices in 2013.

CICAM has attracted the attention of the scientific community for the high quality of its research as well as its implementation of novel and innovative training solutions for talented young scientists, such as personalized training for top students. An eight-year programme at the centre covering undergraduate-, masters- and PhD-level study has proved very successful.

Overall, CICAM delivers some of the best science conducted in China today. It is a dynamic centre for both research and researcher development, exploring novel approaches to artificial microstructures and producing original research to meet the country's core technology needs.



南京大學
NANJING UNIVERSITY

Chinese Academy of Sciences

For 65 years, the Chinese Academy of Sciences has been a rich source of technological innovation, scientific discovery and aspiring minds. Making the leap from a regional to a global leader, researchers are taking the intellectual powerhouse to soaring new heights.

ARTICLE COUNT (AC): **2,661**
 FRACTIONAL COUNT (FC): **1,351**
 WEIGHTED FRACTIONAL COUNT (WFC): **1,209**

The Chinese Academy of Sciences (CAS) is the world's largest scientific organization, with about 48,500 researchers in 114 directly controlled institutes spread across the country. Its annual budget for 2013 was US\$5.4 billion. Over the last 65 years, CAS has made many important discoveries and technological advances across diverse fields, including making the first synthetic insulin from bovine sources (1965); building China's first particle accelerator, the Beijing Electron-Positron Collider (1984); and the discovery of iron-based high-temperature superconductors (2008).

There are 49 CAS institutes based in Beijing, including the Institute of Chemistry (ICCAS), the Institute of Physics (IOP), the Institute of Atmospheric Physics (IAP) and the Institute of Vertebrate Paleontology and Paleoanthropology (IVPP). Key institutes outside Beijing include the Changchun Institute of Applied Chemistry (CIAC), Dalian Institute of Chemical Physics (DICP), Shanghai Institute of Organic Chemistry (SIOC), Shanghai Institutes for Biological Sciences (SIBS) and the Purple Mountain Observatory (PMO) — the latter being based in Nanjing (page S66).

In 2013, CAS published 2,661 articles (WFC = 1,209) in the 68 high-quality journals that comprise the Nature Index. It has a larger output in the index than all the other research institutions

worldwide — and in fact has a higher WFC than many scientifically advanced countries — including Spain, Switzerland and South Korea.

CAS is also a regular contributor to *Nature* and *Science*, having published 54 articles (WFC = 18.6) in these two top journals in 2013 (see 'Nature and Science breakdown'). By WFC this represents one-third of China's total contribution to *Nature* and *Science*, reflecting the organization's strength in basic research.

“WE CAN NOW DETERMINE THE ORIGIN OF DINOSAURS AND PROVIDE ANSWERS TO THEIR EVOLUTIONARY HISTORY.”

Here we look at the leading institutes in the four broad subject areas (see 'CAS subject split'), as well as in the *Nature* and *Science* category.

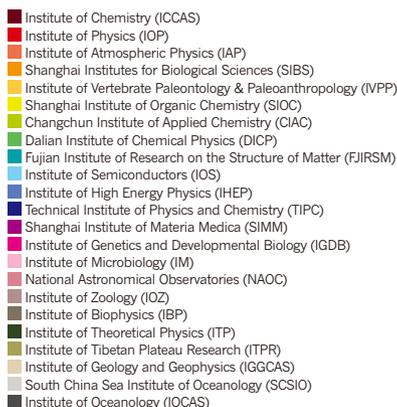
ICCAS, founded in 1956, is the leading CAS institute overall by WFC, and dominates the competitive field of chemistry. In 2013, it published 244 articles (WFC = 124.7) across a wide range of subfields including analytical chemistry,

materials chemistry, organic chemistry and physical chemistry. Top contributor is Lanqun Mao from the laboratory of analytical chemistry for life sciences, who co-authored seven articles (WFC = 4.9) on electrochemical biosensors. He is closely followed by Huimin Ma, from the same laboratory, who wrote four articles with ICCAS colleagues (WFC = 4) on fluorescent probes.

Another major contributor at ICCAS is Song Ye from the molecular recognition and selective synthesis laboratory. In 2013, Ye led four articles (WFC = 3.9) on the development of novel catalysts for use in asymmetric synthesis, all in the journal *Angewandte Chemie International Edition*. Ye explains that in normal asymmetric synthesis of pharmaceuticals using metal catalysts, the catalyst must be removed from solution in a post-treatment process to prevent toxic metals from getting into the final product. “We have discovered an organocatalyst that eliminates the need for this step,” he says.

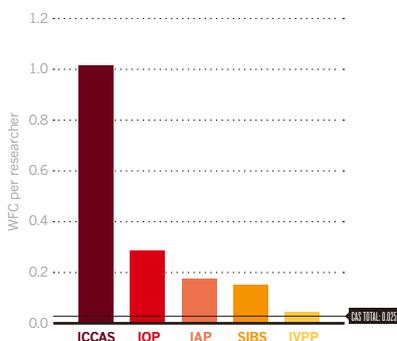
Yuguo Guo from the Key Laboratory of Molecular Nanostructures and Nanotechnology is another prolific author. Guo co-authored three articles (WFC = 3) on lithium-ion batteries in 2013. In particular, his article titled “Binding SnO₂ nanocrystals in nitrogen-doped graphene sheets as anode materials for lithium-ion batteries”, published in *Advanced Materials*, was listed as one of China's most influential

CAS ANALYSIS



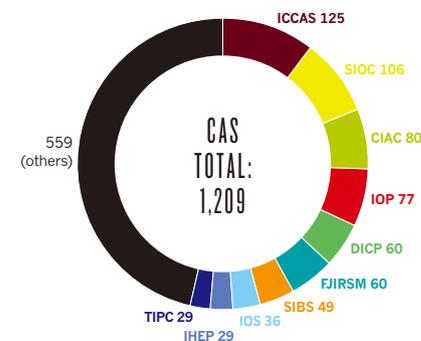
Researcher efficiency

Each ICCAS researcher contributed just over 1 point of WFC to their institute.



Contributing institutions

Chemistry leads overall, but there is no dominant institute of those in the Nature Index.



papers in 2013 by the Institute of Scientific and Technical Information of China.

Scientists from ICCAS are also among the most efficient, index data show. There are 123 researchers who have contributed to a WFC of 125: one of the highest ratios we have calculated for any institution (see ‘Researcher efficiency’).

IOP, one of the oldest CAS institutes and among the top five by WFC in the index, represents the largest contributing institute in the physical sciences. In 2013, the 64-year-old establishment published 172 articles (WFC = 77.2) in the index, with a focus on condensed matter physics. Xucun Ma from the State Key Laboratory for Surface Physics is the most active contributor. She worked on ten articles (WFC = 4.7) — including one in *Science* — on high-temperature superconductors.

Other major contributors at the IOP include Baogen Shen from the Beijing National Laboratory for Condensed Matter Physics. Shen led six articles (WFC = 4.1) on magnetocaloric effect — the heating or cooling of materials by the application of magnetic fields. In his immediate wake is Yongsheng Hu, who produced four articles, all co-authored by IOP scientists (WFC = 4), on the development of electrode materials for use in lithium-ion batteries — two of which, in *Nature Communications*, were listed among China’s most influential papers. Hu’s discovery concerned a new class of electrolytes that improve the performance of conventional lithium-ion batteries. “The material also improves the battery life and stability by preventing the formation of crystals,” he explains.

SIBS is the dominant institute by WFC in the life sciences — and the second largest contributing institute overall of those based in Shanghai (topped only by SIOC). Founded in 1999, SIBS published 111 articles (WFC = 49.3) in 2013, covering a wide range of subfields including cell biology, molecular biology, neurobiology and structural biology. When it comes to publications in *Nature* and *Science*, SIBS also has the highest WFC of any CAS institute — and



The Institute of Atmospheric Physics in Beijing

is third overall for China — for its eight articles (WFC = 3.8) in these two prestigious journals. In particular, plant biologist Peng Zhang from the Chenshan Plant Science Research Center led one article comprised entirely of SIBS researchers (WFC = 1) in *Nature*; in this paper, they solved the structure of a folate energy-coupling factor transporter protein, which is involved in vitamin and micronutrient uptake in prokaryotes.

Other major contributors at SIBS include Xinyuan Liu (WFC = 1.5) and Guoliang Xu (WFC = 0.9) from the Institute of Biochemistry and Cell Biology. Liu co-wrote two articles (WFC = 1.5) on the Hippo signalling pathway, which plays an important role in the regulation of cell proliferation and controlled cell death. Xu co-authored three articles (WFC = 0.9) — including one in the journal *Cell* — on cell reprogramming and neurogenesis.

IAP is by far the biggest contributing institute in earth and environmental sciences. The 48-year-old establishment has 44 articles

(WFC = 18) in the index, most of which were published in the *Journal of Geophysical Research: Atmospheres*. This is not an area of strength for CAS in the index in general, nor indeed for Chinese science overall. In fact, IAP accounts for one-quarter of CAS’s WFC in earth and environmental sciences. There are three major contributors at IAP researching vastly different areas: Tao Wang, who published two articles (WFC = 1.5) on the palaeoclimate; Zhenghui Xie, who published two articles (WFC = 1.2) on satellite measurements of surface solar radiation; and Tianjun Zhou, who published two articles (WFC = 1.1) on long-term changes in the troposphere.

IVPP is not only the largest contributing institute by WFC in palaeontology, but also the largest contributor by percentage of WFC to *Nature* and *Science*. In 2013, half IVPP’s articles were in these two journals, giving it the highest ratio for CAS institutes. However, its total output is fairly modest: IVPP has only 14 articles (WFC = 4.2) in the index. Xing Xu from the department of paleoichthyology and paleoherpetology is the most active writer at IVPP, having produced three articles (WFC = 1.1) — including one in *Science* — on fleas from the cretaceous period, and on early dinosaurs.

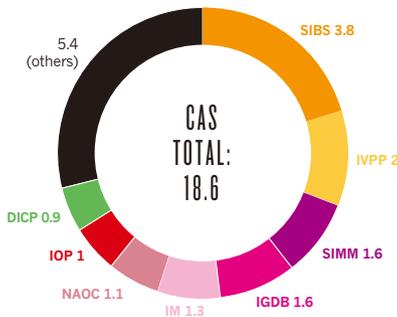
“The traditional method for dinosaur classification is through rigorous analysis of unique characteristics and taxonomy,” says Xu. “With advances in genetics, developmental biology and bone histology, we can accurately determine the origin of dinosaurs and provide confirmative answers to their evolutionary history.”

From the same department, Zhonghe Zhou is the second most active contributor at IVPP, having co-authored two articles (WFC = 0.9) — including one in *Nature* — on the evolution of early birds. “We discovered the fossils of three early birds, all carrying one functional ovary on the left side of their body,” says Zhou. “This suggests that the right ovary was lost in the dinosaur-avian transition and sheds new light on the early evolution of modern avian reproduction.” ■

CAS ANALYSIS

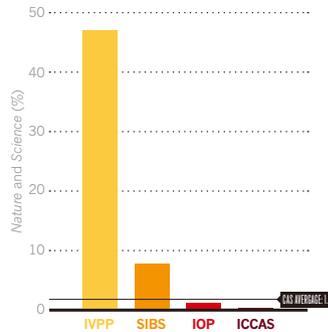
Nature and Science breakdown

Life sciences institutes contribute most to papers in these two journals.



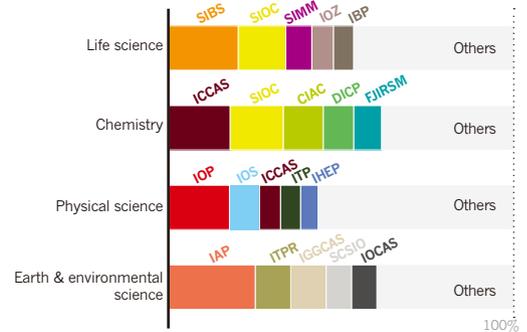
Nature and Science ratio

As a proportion of total WFC, life sciences command a dominant share in these two journals.



CAS subject split

The leading institutions by proportion of WFC for each of the four subject areas.





THE GUANGZHOU INSTITUTES OF BIOMEDICINE AND HEALTH

A CENTRE FOR TRANSLATIONAL MEDICINE IN THE PEARL RIVER DELTA

The Guangzhou Institutes of Biomedicine and Health (GIBH) was established in 2003 by the Chinese Academy of Sciences through collaborative agreements with the Guangdong and Guangzhou governments. It was envisioned to be a modern institute with a forward-looking philosophy that would transform the research landscape in southern China. We are very proud to report that we are realizing this vision of our founders.

We have built a strong organization with approximately 500 dedicated staff members and more than 280 graduate students. Our scientists and students are engaged in three major areas of inquiry — stem cell biology, chemical and synthetic biology, and infection and immunity. We believe that basic research in these three areas will not only enhance our understanding of life and disease,

but also catalyse breakthroughs in disease diagnosis and treatment. Based on this belief, we are devoting our resources to developing cutting-edge technologies and solving important scientific problems in a collaborative environment. Accordingly, we have established a centralized platform for drug discovery and technology development. We are also forming a new unit on public health, which will help us learn more about the impact of social-economic developments on human health in southern China.

Our research has led to high-impact publications in leading academic journals. Our innovative drug-discovery platform, in particular, has advanced several innovative concepts for treating cancer and neural degenerative diseases and has developed drug candidates that are poised for clinical testing and registration. Our dual focus on original

discovery and innovative applications will drive our organization towards even greater achievements in the coming years.

Our mission at GIBH is to serve the citizens of China and the world through scientific discovery. We are looking forward to forming external collaborations and partnerships with scientists and institutes to work towards achieving common goals. We are proud that GIBH represents commitment, creativity and opportunity.

We seek individuals who share our vision and enthusiasm for the future. Positions are available at all levels in our five research programmes:

- Stem cell and regenerative medicine
- Chemistry and synthetic biology
- Infection and immunity
- Public health
- Drug discovery pipeline

For more information, please visit us at <http://www.gibh.cas.cn> or <http://english.gibh.cas.cn>



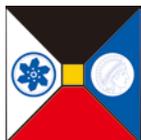
First graduates from GIBH celebrating the successful completion of their studies.



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 Fax: +86-20-32015267



CAS-MPG Partner Institute for Computational Biology

Establishment

The CAS-MPG Partner Institute for Computational Biology (PICB) is a research institute located in the heart of Shanghai. PICB was jointly established in 2005 by the Max Planck Society (MPG) of Germany and the Chinese Academy of Sciences (CAS), and is operated under their joint guidance. PICB is dedicated to broad topics in the quantitative biosciences with a particular focus on computational biology. The institute's purpose is to explore scientific frontiers, contribute to the education and training of excellent junior scientists, and complement scientific research conducted at the research institutes of CAS and the MPG.

Like the Max Planck Institutes, PICB is headed by a board of directors comprising directors and department heads and, as of recently, other institute representatives. The difference in this organizational model to a typical CAS institute is that there are several directors rather than one institute director. Directors are selected by the CAS-MPG Joint Core Commission and are appointed by CAS. PICB enjoys complete autonomy with regard to scientific focus; however, its research work is subject to continuous supervision and evaluation by a scientific advisory board.

Structure of PICB

PICB has a relatively flat structure consisting of the following units:

- departments headed by directors
- research groups headed by principal investigators (PIs)
- Max Planck Independent Research Groups (IRGs)

A department is typically larger than an IRG or a PI group (which stand by themselves). Directors and IRG heads are selected by the CAS-MPG Joint Core Commission and have their budgets directly allocated by CAS and the MPG. PIs are recruited according to strict scientific standards following a CAS procedure, which relies on the vote of a committee of CAS PIs, consisting of both PICB directors and PIs, and at least a third of PIs external to PICB. PICB is managed by the board of directors, which consists of PICB directors, a representative of the IRG heads and the PIs, plus a representative of the Shanghai Institutes for Biological Sciences (SIBS), which is a collection of eight local CAS institutes focusing on biological research.

Research Concept

PICB merges theoretical and experimental biology in three focal areas:

1. Integrative analysis of gene regulation
2. Computational modeling of complex traits
3. Computational analysis of human variation and evolution

In more theoretical terms, the research can be summarized as **translating large-scale multi-omics data into novel knowledge of human biology**. The 'multi-omics data' includes diverse data-types such as transcriptome data, gene regulation data, epigenetic data, proteomics, and metabolomics data. Computational biology today largely deals with these data-types, their analysis, integration and interpretation. Therefore, **PICB strives to seamlessly integrate computational and experimental biology to understand biological processes through quantitative approaches.**

THE CAS-MPG PARTNER INSTITUTE FOR COMPUTATIONAL BIOLOGY IS HIRING 'GROUP LEADERS' IN SHANGHAI, CHINA

The CAS-MPG Partner Institute for Computational Biology is an internationally recognized research institute based in Shanghai, China — jointly operated by the Chinese Academy of Sciences (CAS) and the German Max Planck Society (MPG). Work at this institute is driven by the growing importance of statistical and computational methods in modern biology. We undertake innovative research in the interdisciplinary fields of biology, mathematics, physics and computer science.

PICB is eager to receive applications for several group leader positions from talented scientists working in the broad field of quantitative biology, including but not limited to the following areas:

- genome biology
- epigenomics and RNA processing
- computational biology
- biostatistics
- biomathematics

PICB will offer a competitive salary package to successful applicants, including a basic salary, position allowance, housing allowance and other benefits. There is no deadline and applicant evaluations will remain open until all positions are filled.

Interested applicants should send a covering letter, curriculum vitae and brief summary of past research achievements and future plans, accompanied by three letters of recommendation to:

Professor Jing-Dong Jackie Han
CAS-MPG Partner Institute for Computational Biology
320 Yueyang Road
Shanghai 200031
Phone: 86-21-54920458
Fax: 86-21-54920451
E-mail: jdhan@picb.ac.cn



Beijing

Beijing, the political centre of China for nearly a millennia, has seen unprecedented growth in its research output, scientific impact and technological innovation in the last 15 years. And the momentum shows no signs of abating.

ARTICLE COUNT (AC): **3,985**
 FRACTIONAL COUNT (FC): **1,453**
 WEIGHTED FRACTIONAL COUNT (WFC): **1,329**

Beijing is among the most dynamic capital cities when it comes to advancing scientific research and supporting technological innovation. Last year, the metropolis spent US\$19.3 billion (6.1% of its gross domestic product, GDP) on research and development — US\$7 million more than nearest rival Shanghai. There has been controversy over the way this money is used, however, and in October 2013 the Ministry of Education released new guidelines on the management of research funds. The unprecedented move was seen as a response by the government to reports of embezzlement and fraud.

Beijing is home to the Chinese Academy of Sciences (CAS), the world's largest research body, and to the universities of Peking (PKU) and Tsinghua — the country's two leading universities, making the city by far the most productive in the index. Beijing is the national leader across all subject categories except astrophysics — an accolade taken by Nanjing (page S66). Beijing generates 2.4 times as many research articles as Shanghai, and five times as many as Nanjing. The city has a higher weighted fractional count (WFC) — a measure of the relative contribution of a city to the papers it has published — than the entire country of Canada.

Despite its glittering scientific achievements,

Beijing has been plagued by a problem usually associated with more primitive economic activity: chronic air pollution. This year, in the National People's Congress and Chinese People's Political Consultative Conference, the Chinese president Xi Jinping vowed to improve the city's air quality through a "hefty investment" of US\$124 billion to reduce coal burning, car emissions and fine particulates. Some of this money will also go towards developing technologies for monitoring air quality and preventing smog formation.

BEIJING HAS A HIGHER WFC THAN THE ENTIRE COUNTRY OF CANADA

Founded in 1898, PKU was the first comprehensive national university in China. In 2013 it published 743 articles (WFC = 275.5) in the index, accounting for 21% of the city's WFC (see 'City WFC breakdown').

PKU's output is fairly evenly distributed across three of the four subject areas, the exception being earth and environmental

sciences (see 'Institutional subject spread').

The university is also the largest contributor to *Nature* and *Science* by article count, having published 14 articles (WFC = 4.1) in these two journals. It does not, however, have the highest ratio of output in these two journals (see 'Nature and Science ratio').

Ning Jiao from the State Key Laboratory of Natural and Biomimetic Drugs is PKU's leading chemistry contributor, having published ten articles (WFC = 8.8) on organic synthesis. "The traditional method for forming carbon-oxygen and carbon-nitrogen bonds uses cyanide, a toxic reagent that is bad for human health and the environment," says Jiao. "We developed a 'green' method that first activates oxygen and nitrogen molecules, and then inserts them into carbon-hydrogen bonds in the molecule of interest."

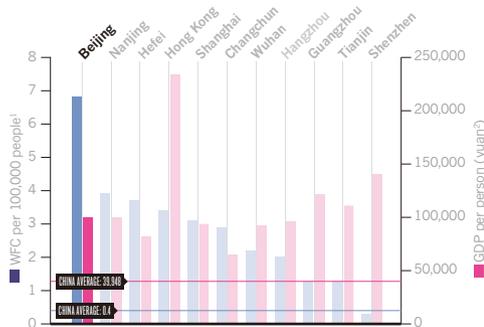
Other major chemistry contributors include Yong Huang from the Peking University Shenzhen Graduate School and Jian Pei from the college of chemistry and molecular engineering, with eight (WFC = 7.6) and ten articles (WFC = 7.5), respectively.

Huang studies asymmetric synthesis, essential for the development of novel drug molecules. Pei, meanwhile, develops conjugated polymers for use in organic field-effect transistors, solar cells and light-emitting diodes.

BEIJING ANALYSIS

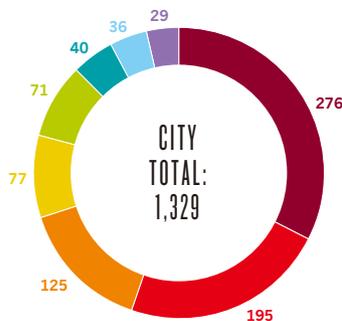
Beijing data

Beijing has the second highest GDP of any Chinese city, but far and away the highest WFC per person.



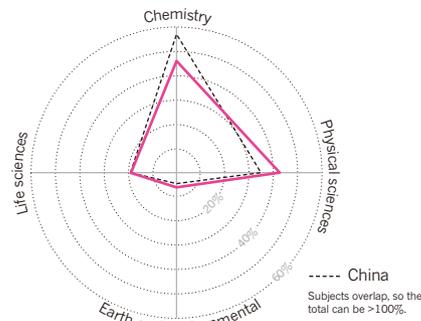
City WFC breakdown

Peking University is top of Beijing's 150 research institutions in the index.



City subject spread

Compared to China as a whole, Beijing has a stronger slant towards physical sciences.





Beauty meets brains in the grounds of China's leading university, Peking

In physical sciences, Qihuang Gong from the State Key Laboratory for Mesoscopic Physics is the most prolific contributor, with 15 articles (WFC = 13.8) on optics and meta-materials. Other major contributors to this field include Bin Chen from the State Key Laboratory of Nuclear Physics and Technology and Bo Shen from the State Key Laboratory of Artificial Microstructure and Mesoscopic Physics. Chen published eight articles (WFC = 8) on the expansion, phase structure and thermodynamics of black holes, while Shen published seven (WFC = 4.3) on electric double-layer transistors, which can be used in next-generation computer chips.

For astrophysics, Yuefang Wu from the department of astronomy, and Xiaowei Liu from the Kavli Institute for Astronomy and Astrophysics are PKU's most active researchers in the index. Wu (who is officially retired, yet still active) published seven articles (WFC = 0.9) on molecular clouds and stellar formation, while Liu published five (WFC = 0.8) on planetary nebulae. Because of the down-weighting of astrophysics journals in the index, the WFC contribution of these researchers is relatively small (see 'A guide to the Nature Index', page S76).

For 2013, Tsinghua has 474 articles (WFC = 194.9) in the index, representing 15% of

Beijing's WFC. Compared to PKU, Tsinghua has a greater percentage of its output in the physical sciences.

Although Tsinghua's 12 articles in *Nature* and *Science* fall short of the number of PKU's publications in these most-selective of journals, its WFC of 5.4 is higher. Indeed, Tsinghua has the highest ratio of all the Beijing universities.

TSINGHUA IS NOTABLE FOR ITS STRENGTH IN STRUCTURAL BIOLOGY — 7 OF ITS 12 NATURE AND SCIENCE PAPERS ARE IN THIS FIELD

Yadong Li from the department of chemistry is Tsinghua's leading contributor, having co-authored seven articles (WFC = 6.4) on bimetallic nanocatalysts. Next is Xi Zhang, from the Key Laboratory of Organic Optoelectronics and Molecular Engineering, who has published six articles (WFC = 5.2) on supra-molecules, followed by Jinghong Li, from the department of chemistry, with seven (WFC =

4.9) — including one in *Nature Communications* — on graphene synthesis and biosensors. Li's technique to synthesize high-conductivity graphene uses a sodium-ammonia solution. "The method is simple, inexpensive and can be used in large-scale production," he says.

In the physical sciences, Shoushan Fan and Qunqing Li from the department of physics are the most prolific researchers. Together they co-authored five articles (WFC = 4.9) on strings of carbon nanotubes. "We made ultra-thin membranes using these special yarns," says Li. "They may serve as lacy support films in transmission electron microscopes."

Also notable at Tsinghua are Fei Zeng and Feng Pan from the school of materials science and engineering. Together they published four articles (WFC = 4) on organic resistive memory devices that operate on electrical pulses. "The technology can dramatically reduce the power consumption for large-scale applications," explains Pan.

Tsinghua is also notable for its strength in structural biology, where life sciences research meets biophysics and biochemistry. Indeed, 7 of its 12 *Nature* and *Science* papers are in this field.

The leading researcher is Yigong Shi from the school of life sciences. In 2013, Shi produced eight articles (WFC = 2.1) — including three in *Nature* and one in *Science* — on the structures of various enzymes, signalling proteins and transporters including aspartate proteases and histidine kinases.

Other major contributors to the index from the same school include Yeguang Chen and Jiawei Wang, who between them produced six articles (WFC = 4.2) on the structures of several proteins that have important roles in cell signalling.

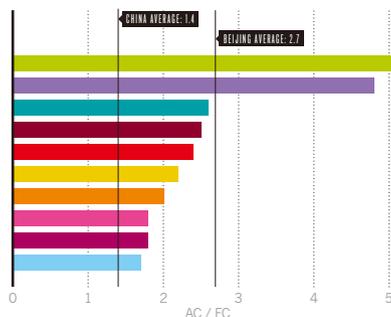
In particular, says Chen, their work shows that the tumour growth factor TGF- β plays a major role in malignancy. "This protein may serve as a drug target for inhibiting leukaemia," he adds. ■

IMAGINECHINA/CORBIS

BEIJING ANALYSIS

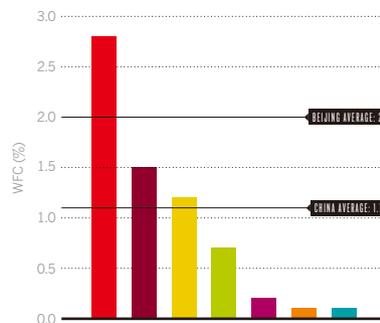
Collaboration rate

Institutes in Beijing are highly collaborative, led by UCAS.



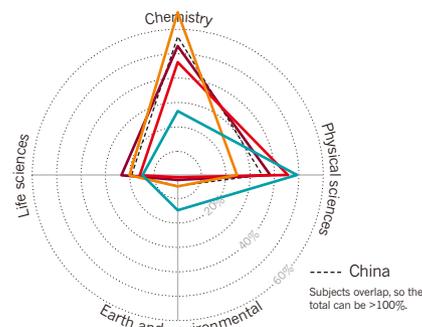
Nature and Science ratio

Tsinghua University has the highest proportion of papers in these two journals.



Institutional subject spread

Beijing Normal University has the most balanced spread of subject areas.



Shanghai

Shanghai has long been the commercial and financial centre of China. Because of its leading life–science research institutions, the city has become the hub for multinational pharmaceutical companies establishing a presence in China.

ARTICLE COUNT (AC): **1,646**
 FRACTIONAL COUNT (FC): **734**
 WEIGHTED FRACTIONAL COUNT (WFC): **712**

Shanghai, the most populous city in China, has undergone rapid expansion and economic transformation over the past few decades. Electronics, car manufacturing and steelmaking have long been integral industries, and now fine chemicals and biopharmaceuticals are becoming significant. In 2013, the metropolis spent US\$12 billion (3.4% of its gross domestic product, GDP) on research, and signed 9,274 technology transfer agreements — 86% of which were for electronic data services, biopharmaceuticals and advanced materials. Innovation-based industries are now responsible for 40% of the city’s GDP. Only one Chinese city — Beijing — has a higher output in the Nature Index.

Shanghai is home to 68 universities, 58 research institutes, 328 hospitals, and 400 joint venture or foreign-owned research centres. Of these, 63 institutions (including 13 institutes of the Chinese Academy of Sciences, CAS) are represented in the Nature Index. The Zhangjiang Hi-Tech Park, located in the central district of Pudong, is home to dozens of multinational pharmaceutical companies, including GSK, Roche, Novartis and Pfizer. This concentration of expertise cements Shanghai’s position as the world’s fastest-growing city in terms of economic contribution to the life-sciences industry, according to a 2012 survey conducted by the

Swiss consultancy BAK Basel Economics.

Nearly one-third of Shanghai’s research output is in the life sciences — a greater proportion than the national average (see ‘City subject spread’). Overall, the major contributing institutions are Fudan University, Shanghai Jiao Tong University (SJTU), East China Normal University (ECNU), East China University of Science and Technology (ECUST), Tongji University, and the Shanghai Institutes for Biological Sciences (part of CAS, see page S56), each of which contributes between 6% and 18% of the city’s weighted fractional count (WFC) — a measure of the relative contribution of an institution to the papers it has published (see ‘City WFC breakdown’).

Fudan is strongest in chemistry (see ‘Institutional subject spread’), particularly in materials chemistry. Huisheng Peng from the department of chemistry is the largest contributor, with nine articles (WFC = 8.6) representing more than 10% of Fudan’s output in this field. Peng has developed composite nanofibres that can be woven into paper-thin capacitors or used in flexible lithium batteries. “These materials perform like conventional planar batteries but are flexible and wearable,” says Peng. Such batteries might one day be used to power electronics in jackets and clothes, he adds.

Other major contributors from the same department include Dongyuan Zhao, Zhongsheng Wang and Yuping Wu. Each of these researchers published between three and five articles in a range of chemistry journals. Notably, one of Wu’s papers in the journal *Nano Letters*, titled ‘LiMn₂O₄ nanotube as cathode material of second-level charge capability for aqueous rechargeable batteries’, was listed as one of China’s 100 most influential academic papers in 2013 by the Institute of Scientific and Technical Information of China. The highest individual WFCs in life sciences at Fudan are from Yanhui Xu and Qunying Lei, both from the department of biochemistry and molecular biology. Xu contributed to three articles (WFC = 2.5) — including one in *Cell* — on crystal structures of important proteins. Lei’s

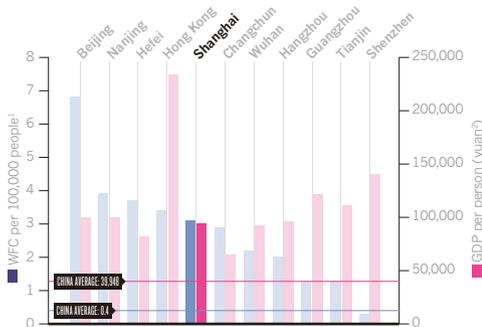
NEARLY ONE THIRD OF SHANGHAI’S RESEARCH OUTPUT IS IN THE LIFE SCIENCES

Fudan is Shanghai’s premier institution for higher education and has the highest WFC of any institution in the city. In 2013, the 109-year-old establishment published 255 articles (WFC = 129.2), including three (WFC = 0.8) in *Nature* and *Science* (see ‘Nature and Science ratio’).

SHANGHAI ANALYSIS

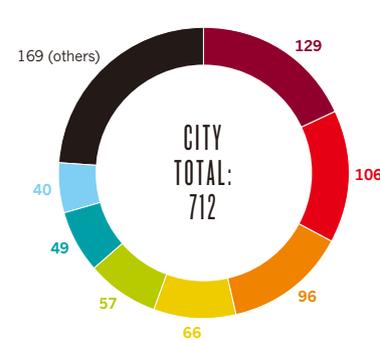
Shanghai data

Because of Shanghai’s large population, both WFC and GDP rates are diluted



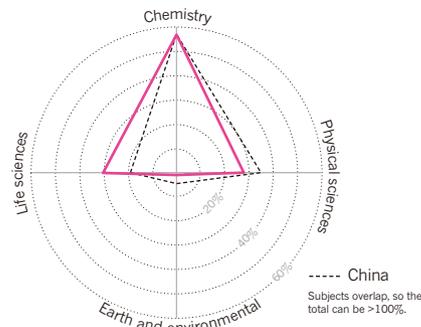
City WFC breakdown

Fudan University is top of Shanghai’s 63 research institutions in the index, including many CAS institutes.



City subject spread

Shanghai is one of China’s stronger cities in the index for the life sciences.



■ Fudan University ■ Shanghai Institute of Organic Chemistry* ■ Shanghai Jiao Tong University ■ East China Normal University ■ East China University of Science and Technology



The dizzying heights of the Guanhua Twin Towers at high-flying Fudan University

three articles (WFC = 2.3) were on the molecular mechanisms behind several biological processes, including lipid biosynthesis, tumour growth and cancer development.

SJTU is a comprehensive university with a 117-year history. The index shows that in 2013, the institution had a wide range of research across chemistry, physical sciences and life sciences. There are four articles in *Science*, but because of their collaborative nature, these only earned SJTU a WFC of 0.2. Indeed, the institution also stands out as the Shanghai university most open to collaboration: its AC/FC ratio is the highest among the city's ten top contributors (see 'Collaboration rate').

Wanbin Zhang from the school of chemistry and chemical engineering is SJTU's largest contributor in chemistry. He wrote six articles (WFC = 5.7) on the development of catalysts for use in asymmetric synthesis. "We discovered one of the best catalysts for promoting the hydrogenation of pentacyclic compounds," says Zhang. Pentacyclic compounds are important precursors for the synthesis of natural products and pharmaceuticals, he explains.

Other major contributors from the same school include Yong Cui, who wrote four articles with SJTU colleagues (WFC = 4) on the development of porous materials for separating chiral molecules. Shun'ai Che also co-authored

four articles (WFC = 3.7) on inorganic materials exhibiting optical activity, including one in *Nature Communications*. Che explains that, prior to her research, the only materials known to perform optical rotation for linearly polarized light were organic polymers. "We discovered that titanium dioxide is an inorganic material exhibiting this type of optical activity," she says. The advantage of inorganic material is that it can more easily be incorporated into devices made of metals or into semiconductors, she adds.

In the physical sciences, Zhengming Sheng from the Ministry of Education Key Laboratory for Laser Plasma has four articles in the index (WFC = 1.9) on laser wakefields, a technique for accelerating charged particles to high energies. But Chong Lei from the department of physics and astronomy, had a higher WFC (2), with two articles co-authored with colleagues from the same university on tiny sensors for detecting microbeads and antigens.

Life sciences comprise just over a quarter of SJTU's output — one of the highest proportions among Shanghai universities. In this realm, the most prolific researcher is Saijuan Chen from the Shanghai Center for Systems Biomedicine. Chen, who researches leukaemia, published four articles (WFC = 2.6) in 2013 in *PNAS*. Other major contributors in the life sciences include Guang Ning from the laboratory of

endocrine and metabolic diseases, who published two articles (WFC = 1.4): one in *Nature Cell Biology* on white-to-brown fat transition; and one in *Nature Communications* on a special class of pancreatic tumours. Dabing Zhang, from the school of life sciences and biotechnology, also co-authored two papers (WFC = 1.3) — including one in *Nature Communications* — on hybrid rice. "We discovered a novel mechanism for controlling flowering development," says Zhang. This knowledge could be useful for improving rice yield.

ECNU and ECUST are the two Shanghai universities that concentrate most on chemistry. In 2013, ECNU published 123 articles (WFC = 65.6) in the index, and derives 63% of its WFC from chemistry journals. ECUST has fewer articles overall, at 95 (WFC = 56.8), but as it is almost entirely focused on chemistry it has a higher WFC than ECNU in this field.

Wenhao Hu, from ECNU's Institute for Advanced Interdisciplinary Research in Science and Technology, is the university's most prolific contributor; he co-authored eight articles (WFC = 7.4) on organic synthesis. "We discovered several three-component reactions for synthesizing small-molecule drugs," says Hu.

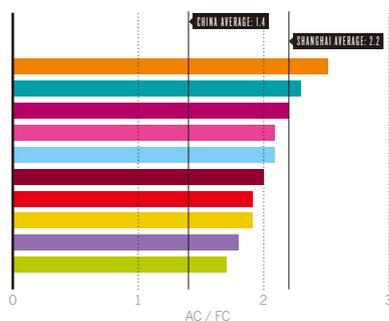
At ECUST, the most prolific contributors were Yitao Long and Huagui Yang from the school of chemistry and biomolecular engineering. Long contributed five articles (WFC = 4.1) on nanoparticles, and Yang wrote five articles (WFC = 3.6) on solar cells.

Although Tongji's output is only the fifth largest by WFC of Shanghai universities (excluding CAS institutes), it is first in terms of the proportion of publications in *Nature* and *Science*. In 2013, the 110-year-old establishment published five articles (WFC = 1.1) in these two journals, representing 2.8% of its WFC. One of these was a paper entitled 'Thin crust as evidence for depleted mantle supporting the Marion Rise' by Huaiyang Zhou — and is notable for being the first *Nature* paper in the field of marine geology with a Chinese lead author. ■

SHANGHAI ANALYSIS

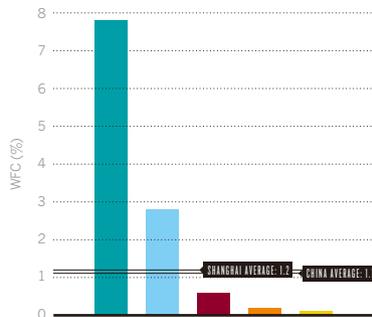
Collaboration rate

SJTU has the highest collaboration ratio of the top ten Shanghai research establishments.



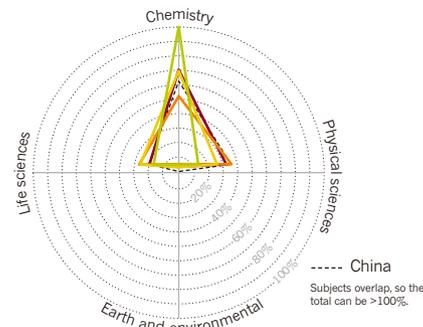
Nature and Science ratio

SIBS has one of the highest ratios for publications in *Nature* and *Science* of any Chinese institution.



Institutional subject spread

Excluding specialist CAS institutes, ECUST is the Shanghai institution most dedicated to chemistry.



*CAS institute. 1. 360doc.com; 2. cnpop.org; yuan = US\$0.16

■ Shanghai Institutes for Biological Sciences* ■ Tongji University ■ Shanghai Institute of Materia Medica* ■ Shanghai Institute of Ceramics* ■ Shanghai Institute of Microsystem and Information Technology*

Hong Kong

Hong Kong has enjoyed 17 years of prosperity and academic freedom since the transfer of sovereignty from the UK to China. But with political unrest and increasing competition from mainland cities, it needs to rethink its long-term strategy.

ARTICLE COUNT (AC): **517**
 FRACTIONAL COUNT (FC): **250**
 WEIGHTED FRACTIONAL COUNT (WFC): **241**

Hong Kong, the former British colony turned special administrative region, has always been China's favoured city for science and technology (the city is ranked 10 among 143 economies worldwide in the Global Innovation Index 2014) because of its robust intellectual property protection and legal system. The city has transformed itself into an educational hub for serving the Asia-Pacific region. However, in recent years Hong Kong has faced a challenge — it must keep pace with China's scientific development or risk losing its competitive edge to nearby cities on the mainland, including Guangzhou and Shenzhen.

To give the city an edge, on 29 October 2014 the Hong Kong Legislative Council passed a resolution to establish the Innovation & Technology Bureau. The aim of the bureau is to support start-up companies and provide financial assistance for universities and research institutions to commercialize research.

While most cities in China have only one or two major contributing universities, Hong Kong has six — each comprising between 5% and 29% of the city's weighted fractional count (WFC; see 'City WFC breakdown'). In the index, WFC is a measure of the contribution of an institution to the papers its scientists have co-authored.

The University of Hong Kong (HKU) is the city's premier institution for higher education

and its largest contributor to high-quality journals — as shown by its WFC. In 2013 the 103-year-old establishment published five articles in *Nature* and *Science*, representing 1.2% of its WFC — a larger proportion than any other Hong Kong institution (see 'Nature and Science ratio'). HKU is responsible for half of Hong Kong's 10 articles in these two journals, but represents 71% of the city's WFC in this count.

“HKBU IS A SMALL UNIVERSITY BUT THE DEPARTMENTS WORK TOGETHER VERY CLOSELY”

Although it derives only 17% of its WFC from the life sciences (see 'Institutional subject spread'), HKU is strong in the field of microbiology/virology. A closer look at the index data reveals that Yi Guan and Joseph Sriyal Malik Peiris from HKU's school of public health are the most significant contributors in this area, with three articles in the index on the infectivity and transmission of avian and swine influenza viruses (including one in *Nature* and one in *Science*). “We have identified the source and

provided a detailed assessment on the infectivity, transmissibility, and pathogenicity of H7N9 influenza viruses,” says Guan. An avian flu virus, H7N9 caused 130 human infections and 40 deaths in China in March 2013. “Our work is thus far the most comprehensive piece of research on H7N9 influenza viruses.”

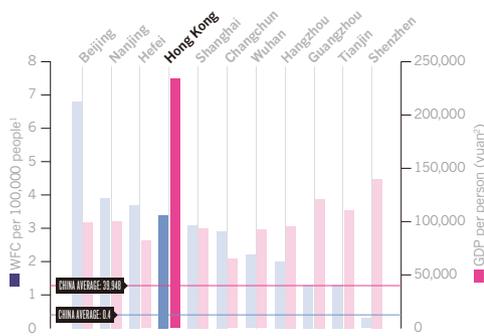
HKU also has the highest WFC of any Hong Kong institution in the physical sciences, having published 70 articles in this area (WFC = 26) mostly concerning advanced materials. Prolific researchers in the index include Wallace Chik Ho Choy at the department of electrical and electronic engineering, with four articles on organic solar cells, and Shunqing Shen and Haizhou Lu from the department of physics, who published three articles on the quantum properties of topological insulators — novel materials whose interior behaves like an insulator but whose exterior behaves like a conductor.

The Hong Kong University of Science and Technology (HKUST) has Hong Kong's second highest WFC in the physical sciences, with 49 articles in this field (WFC = 22). Two researchers from the department of physics are responsible for many of these publications. Ping Sheng is the largest contributor, with four articles in the Nature Index on graphene and metamaterials (engineered materials with optical properties not found in nature). The second is Penger Tong,

HONG KONG ANALYSIS

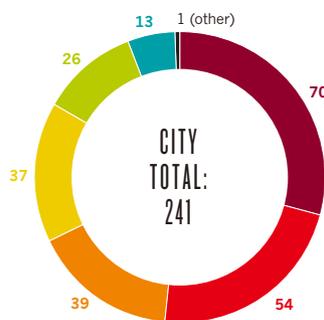
Hong Kong data

Hong Kong has the third highest GDP of any Chinese city, but the highest GDP per person.



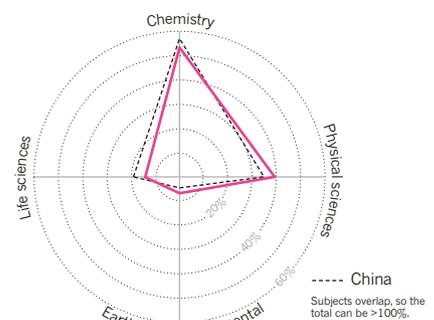
City WFC breakdown

Hong Kong has six major contributing institutions.



City subject spread

The distribution of Hong Kong's research is similar to that of China's overall.





Not yet 25 years old, yet HKUST is challenging much older institutions

who published three articles on colloidal monolayers, a model system for studying the structure and dynamics of complex fluids.

“This year we have developed acoustic metamaterials that can absorb low-frequency sound,” says Sheng. He adds that these types of materials will be useful in soundproofing homes and music studios from environmental noise.

The Chinese University of Hong Kong (CUHK) is also heavily focused on a range of physical sciences, and has many papers in the index published wholly by in-house researchers. The work of four researchers stands out from the data in 2013: Daniel Hock Chun Ong from the department of physics published two articles on the direct imaging of surface plasmon polaritons, which have important implications for Raman spectroscopy and hence molecular identification. Jianbin Xu from the department of electronic engineering published one article in *Nature Photonics* on graphene-based photodetectors with high responsivity, which increases the wavelengths of light that can be detected and hence widens the range of applications for such sensors. Qian Miao from the department of chemistry published four wholly authored articles on the synthesis of organic materials, while Zuowei Xie from the State Key Laboratory of Synthetic Chemistry published four articles on the preparation of derivatives of

carborane (a cluster composed of boron, carbon and hydrogen atoms).

Hong Kong Polytechnic University (Poly U) is the city’s institution most focused on geosciences, which account for 9% of its WFC. In 2013, it published five articles in this field, including astrogeologist Bo Wu’s landmark paper in *Earth Planetary Science Letters* on lunar topographic models. In physical sciences, which make up more than a third of Poly U’s output, the largest contributor to the Nature Index journals is Jianhua Hao from the department of applied physics. Working alone, Hao wrote three articles on functional thin films and heterostructures (all in *Applied Physics Letters*).

Poly U stands out in another measure in the Nature Index as the Hong Kong institution that has collaborated most actively, with an AC/FC ratio higher than the city’s other major universities.

City University of Hong Kong (City U) shows its strengths in physical sciences, with 44 articles in the index in this field — mainly from its department of physics and materials science. And it is in the materials science subset where it is particularly strong. Three researchers are responsible for the majority of these publications, led by Wenjun Zhang, who published four articles on nanowires and graphene. “Our materials help enhance the signals from surface-enhanced

Raman spectroscopy, a technique often used in bioimaging and medicine,” says Zhang.

The other two major contributors are Jensen Tsan Hang Li and Johnny Ho. Li has three articles on metamaterials and transformation optics, and Ho published three articles on the electronic properties of nanowires. “Our expertise has been traditionally in materials science, but in the future we would like to broaden our scope,” says Jian Lu, who is also vice-president of research and Technology at City U.

Of the Hong Kong institutions in the index, Hong Kong Baptist University (HKBU) has the highest proportion (66%) of publications in chemistry — well above the national average. Ricky Man Shing Wong from HKBU’s Institute of Advanced Materials is the largest contributor by WFC, with two articles on the development of fluorescent probes (WFC = 1.8). “We created an efficient multi-photon system for turning red light blue,” says Wong. “Such systems can serve as high-energy coherent sources for use in lasers and imaging applications.”

Edmond Dik Lung Ma from the department of chemistry published three articles (WFC = 1.7) in the related field of luminescent probes; work that came from an internal collaboration. “HKBU is a small university but the departments work together very closely,” he says. In 2013, Ma teamed up with researchers from the School of Chinese Medicine to detect proteins, measure enzyme activities and screen novel inhibitors. This collaboration ultimately led to the discovery of novel metal complexes for treating skin cancer.

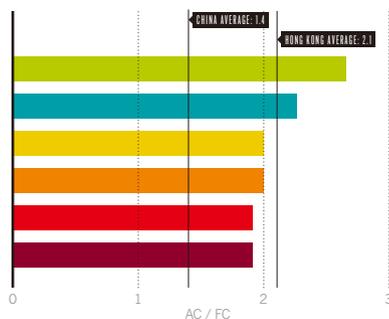
In 2011, HKBU established the Institute of Creativity in order to enhance interdisciplinary research and academic exchange. Chemist Raymond Wai Yeung Wong, associate director of this new institute, says it has helped him receive valuable advice from colleagues outside his field to help his research. Wong has six articles (WFC = 1.6) in the index covering heterometallic complexes, which are used in highly efficient organic solar cells and light-emitting diodes. ■

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HONG KONG ANALYSIS

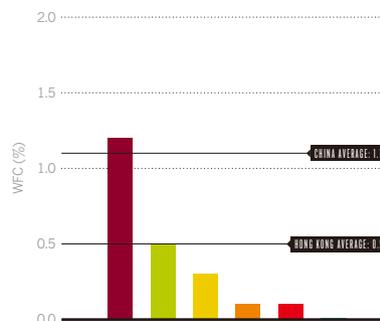
Collaboration rate

Hong Kong Polytechnic University has the highest collaboration rate.



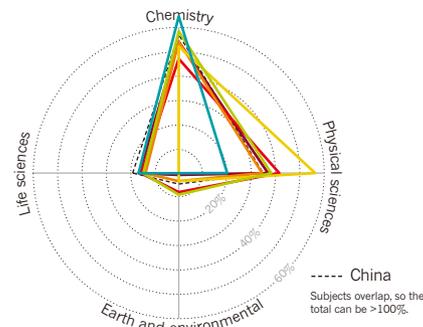
Nature and Science ratio

Only HKU exceeds the national average for papers in these two journals.



Institutional subject spread

Chemistry and physics are preferred across all institutions.



■ Hong Kong Polytechnic University ■ Hong Kong Baptist University

1. China Network; 2. HKTC Research; yuan = US\$0.16

Nanjing

Nanjing has long been a hotbed for scientific discovery and technological innovations. Now, through promoting materials science and astrophysics, the former capital city hopes to step out from the shadows of its neighbour and rival Shanghai.

ARTICLE COUNT (AC): 795
FRACTIONAL COUNT (FC): 362
WEIGHTED FRACTIONAL COUNT (WFC): 310

Nanjing, surrounded by green mountains and rivers, is the capital city of Jiangsu province. Though it has long been a popular destination for tourists, the ‘ancient capital’ is often overlooked by foreign investors who flock to nearby, and much larger, Shanghai.

Nanjing’s 2012 budget for scientific research and development was US\$1.5 billion, comprised of equal contributions from local government and industry. The city’s eight pillar industries in the high-tech sector are supported by more than 100 universities and research institutions, including the premier institution for education — Nanjing University (NJU).

NJU is by far Nanjing’s largest contributor to the Nature Index, and fourth overall in China by weighted fractional count (WFC). In 2013, the university published 391 articles (WFC = 194.6), accounting for 64% of the city’s WFC. Despite this output, NJU contributed only one article (WFC = 0.05) to *Science* and none to *Nature*.

NJU derives most of its WFC from chemistry. Huangxian Ju, Jingjuan Xu and Hongyuan Chen from the school of chemistry and chemical engineering are NJU’s largest contributors. Ju — also the director of the Ministry of Education Key Laboratory of Analytical Chemistry for Life Sciences — produced 13 articles (WFC = 11.8) on fluorescent sensors, which have applications in bioimaging. Xu and Chen co-authored nine

articles (WFC = 8.4) on electrochemiluminescence, a biosensing technology for detecting cell surface proteins and DNA.

NJU is also productive in astrophysics, which makes up 15% of its fractional count (FC). However, owing to the down-weighting of astrophysics journals in the index, these publications contribute a WFC of only 6.9. Jilin Zhou and Zigao Dai from the school of astronomy and space science contribute the most to this field. Zhou co-authored four articles on planetary formation, while Dai contributed to three on gamma-ray bursts — extremely energetic explosions observed in distant galaxies.

Nanjing also has six smaller research universities and one institute of the Chinese Academy of Sciences (CAS) that each contribute 2–10% of the city’s WFC. Southeast University (SEU) has the second largest output and is focused on the physical sciences, which make up two-thirds of its WFC. In 2013, the 112-year-old institution published 65 articles (WFC = 30.9), with Tiejun Cui, the vice president of the school of information science and engineering, being the most prolific contributor. Cui led 11 articles (WFC = 6.1) on transformation optics, a novel class of materials with potential use in stealth devices.

Nanjing Medical University (NJMU), founded in 1934, was one of the first institutions to offer postgraduate medical education

in China. In 2013, the university published 28 articles (WFC = 7.3), with life sciences research representing 81% of its output. It also has the highest proportion of papers in *Nature* and *Science* in the city, which comprise 4.6% of its WFC. NJMU’s president, Hongbing Shen, is the most active contributor to the index, having led five genome-wide association studies (WFC = 1.4), all published in *Nature Genetics*.

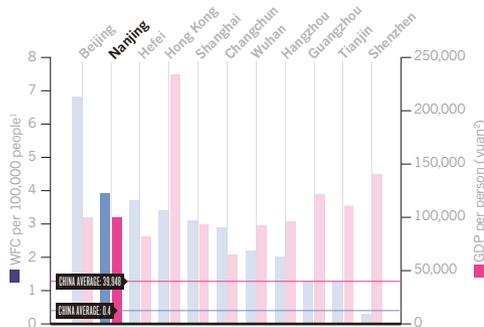
Nanjing is also the strongest city in China for astrophysics, which comprises 18% of its FC — ahead of Beijing (11%), Hefei (8%) and Hong Kong (5%). This knowledge base is largely due to the Purple Mountain Observatory (PMO), a CAS institute. Last year, PMO published 102 articles (WFC = 6.3), the majority from three contributors. Dejin Wu, the deputy director of the division of dark matter and space astronomy, published six articles on solar flares and coronal loops; Yizhong Fan published five articles on dark matter and gamma-ray bursts; and Xuefeng Wu contributed to seven articles on gamma-ray bursts.

PMO has a number of high-profile projects underway. “We are in the preparation stage of launching our own observation satellites into space, and a team of scientists will also be setting up an observatory in Antarctica,” says Xuefeng Wu. “China’s research capabilities in astrophysics have come a long way since the 1980s.” ■

NANJING ANALYSIS

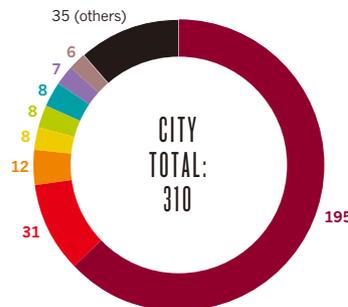
Nanjing data

Nanjing is second only to Beijing in terms of WFC per person, and in the top five for GDP per person.



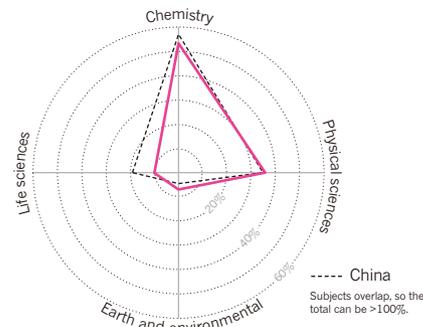
City WFC breakdown

Nanjing University dominates the city in terms of scientific output in the index.



City subject spread

The majority of Nanjing’s research is in chemistry.



■ Nanjing University ■ Southeast University ■ Nanjing University of Technology ■ Nanjing University of Posts and Telecommunications
 ■ Nanjing University of Information Science and Technology ■ Nanjing Normal University ■ Nanjing Medical University ■ Purple Mountain Observatory*

*CAS institute
 1. 360doc.com; 2. cnpop.org; yuan = US\$0.16

Wuhan

Wuhan is the booming capital of the eastern inland province of Hubei. The city is investing heavily in research and development and has become China's 'optics valley'.

ARTICLE COUNT (AC): **486**
 FRACTIONAL COUNT (FC): **222**
 WEIGHTED FRACTIONAL COUNT (WFC): **217**

Wuhan is an important centre for manufacturing, information technology, transportation and education. The optoelectronics industry in particular has enjoyed rapid growth in recent years; in 2013, Wuhan produced more than 127 million kilometres of fibre optic cables, the largest output of any Chinese city.

In November 2014, Wuhan initiated the eighth instalment of its highly selective '3551 optics valley talent program'. Launched in 2011, the programme aims to recruit global leaders and young researchers to work in five designated areas: information technology, biotechnology, energy and environment, specialized equipment, and a sector that China calls modern service (essentially, IT-enabled service industries). The latest instalment increases the funding available for top researchers to US\$16.3 million.

Of Wuhan's higher education institutions, Wuhan University (WHU) and Huazhong University of Science and Technology (HUST) are the two largest in the index. Together they account for two-thirds of the city's weighted fractional count (WFC) — a measure of the relative contribution of an institution to the papers it has published. WHU has 154 articles (WFC = 98.8) in the index. The 121-year-old establishment is strongest in chemistry, which accounts for 64% of its WFC. Aiwen Lei from the department of

chemistry was WHU's most prolific chemistry researcher by some distance, having led 20 articles (WFC = 16.4) on the use of free radical coupling reactions in organic synthesis. Lei explains that the reactions can be used to introduce various functional groups onto organic molecules. "The free radicals bind by forming carbon-carbon bonds and releasing hydrogen gas."

Hongbing Shu from the college of life sciences was the largest contributor in the life sciences, having published four articles (WFC = 3.4) on innate immunity. Specifically, Shu studied how enzymes suppress signalling molecules, including tumour necrosis factors and interleukins. The findings have important implications in the development of cancer treatments and for understanding inflammation. Xiangdong Fu from the same college is also a significant contributor to the index, with four articles (WFC = 1.8) — including two in *Cell* — on cell reprogramming. One of his articles, "Direct conversion of fibroblasts to neurons by reprogramming PTB-regulated RNA circuits", was listed as one of China's 100 most influential academic papers in 2013 by the Institute of Scientific and Technical Information of China.

HUST's research strengths lie in physics and material sciences. Last year, the university had 109 articles (WFC = 43.6) in the index, of which 61 (WFC = 25.3) were in this field. Xiangshui

Miao and Jingping Xu from the school of optical and electronic information are HUST's largest contributors. Miao published four articles (WFC = 2.9) on ultrathin films, while Xu published two (WFC = 1.5) on metal oxide semiconductors.

Wuhan has four other national key universities in the index: Central China Normal University (CCNU), China University of Geosciences (CUG), Huazhong Agricultural University and Wuhan University of Technology. Each of these institutions contributed between 4% and 7% of the city's WFC.

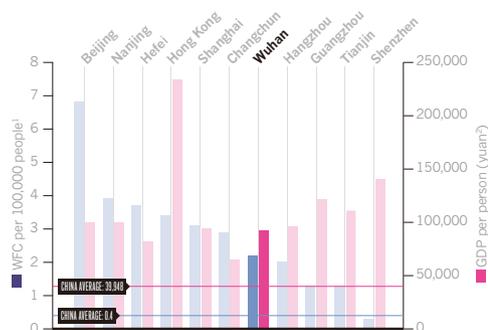
Of CCNU's 43 articles (WFC = 15.9), 84% were in chemistry. The largest contributor was Anxin Wu from the department of chemistry, with four papers (WFC = 3.9) on drug design and development. "We have made much progress in the synthesis of natural products," says Wu. He adds that 40 natural compounds were made through one-pot synthesis — multiple reactions in a single reactor.

CUG is Wuhan's largest contributor to earth and environmental sciences. This highly specialized institution has 65% of its WFC in this field. The work was broadly shared, with no CUG researcher contributing to more than one article in the index. CUG does have one wholly authored paper (WFC = 1) in *Earth and Planetary Science Letters*, led by Yongfeng Wang from the department of geology. ■

WUHAN ANALYSIS

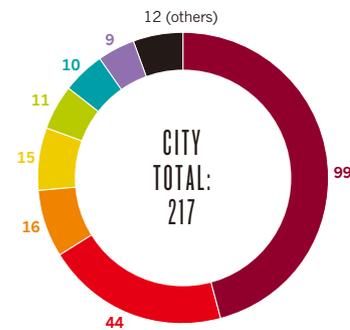
Wuhan data

Wuhan's large population dilutes its ratios of gross domestic product (GDP) and WFC per person.



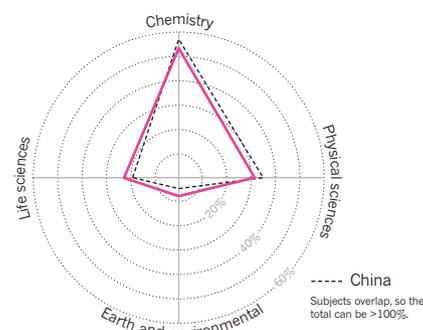
City WFC breakdown

Wuhan has 33 institutions (including CAS) in the index, the third largest after Beijing and Shanghai



City subject spread

Wuhan's subject spread is similar to China's overall.



■ Wuhan University ■ Huazhong University of Science and Technology ■ Central China Normal University ■ China University of Geosciences
 ■ Huazhong Agricultural University ■ Wuhan Institute of Physics and Mathematics* ■ Wuhan University of Technology

*CAS institute; 1. 360doc.com; 2. cnpop.org; yuan = US\$0.16

Hefei

Hefei has kept a low profile for many years. However, as the University of Science and Technology of China continues to break new ground in the physical sciences, the city is moving into the global spotlight.

ARTICLE COUNT (AC): **530**
 FRACTIONAL COUNT (FC): **226**
 WEIGHTED FRACTIONAL COUNT (WFC): **212**

Hefei, the capital city of the eastern Anhui province, is the smallest of the cities profiled in this supplement. But it is growing rapidly in population, disposable income levels and gross domestic product (GDP) — and when it comes to the pursuit of basic science, it holds its own among much larger cities.

Hefei is home to the University of Science and Technology of China (USTC), one of three universities affiliated with the Chinese Academy of Sciences (CAS). When USTC's first president Moruo Guo laid its foundation stone in 1958, he set out its mission to focus on basic research and to nurture world-class talent. Ever since, the institution has been faithful to this ideal.

USTC is by far Hefei's largest contributor to the Nature Index, and fifth overall in China by weighted fractional count (WFC) — a measure of the relative contribution of an institution to the papers it has published. In 2013, USTC accounted for 83% of Hefei's WFC (see 'City WFC breakdown'). In addition, USTC made a strong showing in *Nature* and *Science* journals, with eight articles (WFC = 1.7) representing 1% of its WFC — well above other Hefei institutions.

Most of USTC's WFC is in chemistry. Yi Xie from the division of nanomaterials and nanochemistry is the university's most prolific

researcher in this field, with 17 articles (WFC = 13.2) in the index, mostly on graphene-like materials. "Graphene comprises carbon atoms only, so its structure and chemical properties are rather simple," she says. "We are developing graphene-like inorganic materials with unusual properties that may find applications in photocatalysis and biomedicine." Another successful chemistry researcher from the same division, Shuhong Yu co-authored 12 articles (WFC = 11.4) in 2013 on aerogels. His team manufactured carbon aerogels by freeze-drying bacterial cellulose and attaching CH groups, Yu explains. The resultant hydrophobic material "can be used to remove organic pollutants from water," he adds.

However, it is physics for which USTC is most renowned. The strongest contributor in this field is Guangcan Guo from the Key Laboratory of Quantum Information. Guo has 11 articles (WFC = 8.7) on quantum optics, quantum communication and topological superfluids in the index. His team developed a technique to record the orbital angular momentum of a single photon. An advance that Guo says "represents an important first step towards the realization of long-distance quantum communication." USTC's president, Jianguo Hou, from the division of atomic and molecular sciences, is another active researcher. In 2013, Hou contributed to six

articles (WFC = 5.73) — including one in *Nature* — about molecular and surface imaging.

USTC also hosts the CAS Key Laboratory for Research in Galaxies and Cosmology in its department of physics. Tinggui Wang is the biggest contributor in astrophysics, with seven articles on quasars and active galactic nuclei. However, owing to the down-weighting of astrophysics journals in the index, these papers only add a WFC of 1 to the institution (see 'A guide to the Nature Index', page S76).

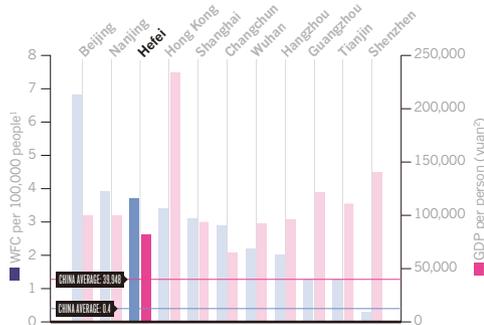
Life-science research comprises only 11% of USTC's output. Much of the university's best research in this field is carried out by Zhigang Tian from the division of structure and function of biomacromolecules. Tian's six articles (WFC = 4.2) on the regulatory functions of natural killer cells represent more than 13% of USTC's total life science WFC.

Hefei is also home to Hefei University of Technology (HFUT), an older but smaller institution with a focus on engineering. Linbao Luo from the laboratory of micro/nano functional materials and devices and Ruzhong Zuo from the school of materials science and engineering are HFUT's top two contributors, both publishing almost exclusively in *Applied Physics Letters*. Luo led two papers on nanowires — both authored wholly in-house — while Zuo contributed to two papers (WFC = 1.7) on lead-free ceramics. ■

HEFEI ANALYSIS

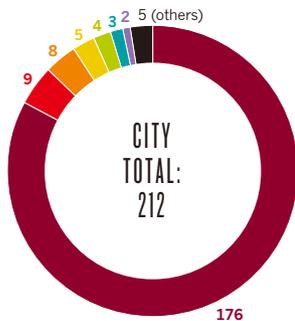
Hefei data

Hefei's WFC per person is the third highest in the index, indicating a strong concentration of research.



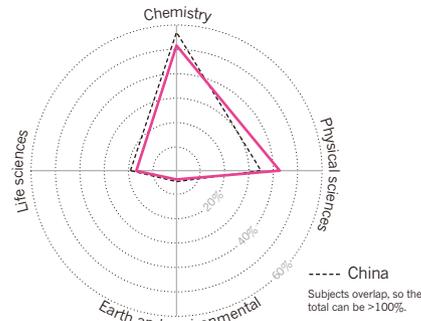
City WFC breakdown

University of Science and Technology of China is by far Hefei's largest contributing institution.



City subject spread

Hefei is focused on the broad range of physical sciences.



■ University of Science and Technology of China ■ Hefei University of Technology ■ Institute of Solid State Physics*
 ■ Institute of Intelligent Machines* ■ Anhui University ■ Institute of Plasma Physics* ■ Anhui Medical University

*CAS institute: 1.360doc.com; 2.cnpop.org; yuan = US\$0.16

Hangzhou

Hangzhou, a tourist hotspot best known for its historical relics and natural scenery, has long been a source of inspiration for Chinese artists. Today the city is home to a new generation working at the intersection of science and e-commerce.

ARTICLE COUNT (AC): **377**
 FRACTIONAL COUNT (FC): **178**
 WEIGHTED FRACTIONAL COUNT (WFC): **178**

Hangzhou, an important manufacturing base and East China's regional logistic hub, is fast becoming the world's largest e-commerce centre. The city is home to the Alibaba Group, China's leading e-commerce service provider with more than 300 million customers and an estimated market value of US\$231 billion. In September 2014, Alibaba raised US\$25 billion from its initial public offering (IPO), making it the largest IPO in US history.

The presence of this commercial giant is shaping local infrastructure. In 2008, Alibaba and Hangzhou Normal University (HZNU) co-founded Alibaba Business College, a centre for education and training on e-commerce, data mining and modern logistics. And in 2013, they established the Alibaba Research Center for Complexity Sciences for research into econometrics and the physics of complex systems. The college has already published several papers in scientific journals.

Hangzhou's weighted fractional count (WFC) and fractional count (FC) are the same, which shows the city has no astrophysical research. It does, however, have several institutions engaged in other areas of physical sciences. The most famous is Zhejiang University (ZJU), which is the city's largest contributor to the Nature Index, and

sixth overall in China by WFC — a measure of the relative contribution of an institution to the papers it has published. In 2013, ZJU published 289 articles (WFC = 150.4), accounting for 85% of the city's WFC (see 'City WFC breakdown'). In addition, ZJU has a strong representation in *Nature* and *Science* journals, with seven articles (WFC = 1.7) representing 1.1% of its WFC — well above other Hangzhou institutions.

ZJU is strong in both chemistry and the physical sciences. Feihe Huang from the department of chemistry was the largest contributor in this field, with a total of 14 papers (WFC = 13.1) in a range of journals. Last year in particular, his paper "A supramolecular cross-linked conjugated polymer network for multiple fluorescent sensing" — published in *Journal of the American Chemical Society* — was listed by the Institute of Scientific and Technical Information of China as one of 'China's top 100 most influential academic papers' in 2013. "We have developed a special polymer that fluoresces in the presence of ammonia," says Huang. The technology can be used to detect gas leaks in refrigeration systems among other applications, he explains.

Chao Gao from ZJU's department of physics was the largest contributor in the physical sciences. Last year, Gao published three

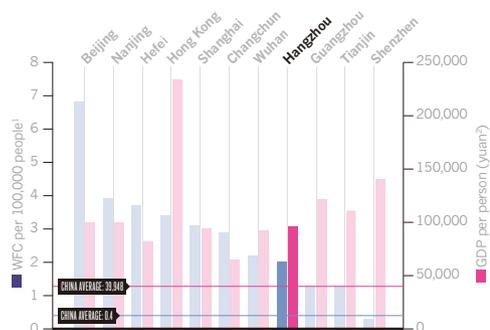
articles (WFC = 3) on graphene and carbon aerogels in the journal *Advanced Materials*. "Our carbon aerogel, with a density of 0.16 mg/cm, is currently the lightest material in the world," says Gao, adding that this ultra-light, porous, synthetic material has potential applications in thermal insulation, oil adsorption and gas sensing.

Hangzhou is also home to HZNU, a smaller and younger university specializing in education, literature and mathematics. The institution contributes approximately 5% of the city's WFC. According to the index, HZNU is strong in both physics and chemistry. Zhifang Li from the laboratory of organosilicon chemistry and material technology is HZNU's largest contributor in chemistry. Li led two articles (WFC = 2) on silylenes — highly reactive intermediates to which a broad range of functional groups can be added. Zujin Zhao from State Key Laboratory of Luminescent Materials and Devices is another top contributor, with two articles in the index (WFC = 1) on novel luminescent materials. "We showed that by decorating a tetraphenylethene core with four aromatic groups, the material displays enhanced emission and fluorescence efficiencies," says Zhao. The finding has implications for the development of organic light-emitting diodes. ■

HANGZHOU ANALYSIS

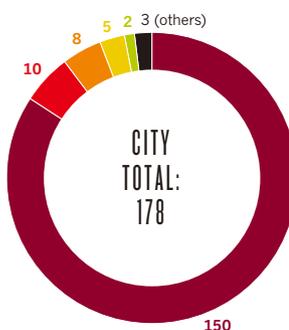
Hangzhou data

Hangzhou's relative prosperity doesn't translate into a high WFC per person.



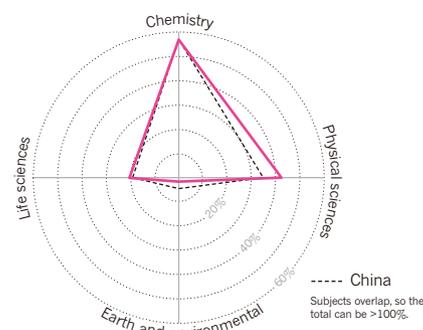
City WFC breakdown

Zhejiang University is Hangzhou's dominant research institution in the index.



City subject spread

Hangzhou's subject spread is similar to China's with a focus on physical sciences.





THE UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA PURSUING EXCELLENCE IN SCIENCE

The University of Science and Technology of China (USTC) is one of the most important innovation centres in the country, and is always ranked among its best universities. It is particularly strong in fields such as quantum manipulation, nanotechnology, high-temperature superconductivity, speech processing, fire science and life sciences.

The USTC takes the lead in many major science projects, such as quantum satellite research and dark-matter detection. It is also an active contributor to significant international projects, such as the International Thermonuclear Experimental Reactor (ITER) and the European Organization for Nuclear Research (CERN).

In 2013, the USTC won more than 20 renowned awards in science and technology. For example, a team of USTC physicists led by Professor Xianhui Chen received the first prize in Chinese Natural Science for their contributions to the field of superconducting materials; for the previous three years, there had been no recipients of this prize.

Some of the latest research highlights are described below.

PHYSICS AND CHEMISTRY High-energy physics at the particle colliders

A team led by Professor Zhengguo Zhao in the School of Physical Sciences made weighty contributions to the study of

diboson production, triple-gauge boson couplings and the discovery of Higgs particles via the ATLAS experiment at the Large Hadron Collider (LHC) of CERN. Zhao also greatly contributed to the observation of the Z_c particles that were suggested to represent the charmed multiquark states, using the Beijing Spectrometer (BESIII) at the Beijing Electron Positron Collider (BEPCII), and, for the first time, observed over 10 new decay modes of the charmonium states cJ and c . As a result of these outstanding achievements, Zhao was elected as an academician of the Chinese Academy of Sciences (CAS), which is the highest academic honour in the country.

Inorganic solid-state chemistry

Professor Yi Xie and her group at the Hefei National Laboratory for Physical Sciences at the Microscale (HFNL) pioneered research into the design and synthesis of inorganic functional solids with efforts to modulate their electron and phonon structures. Xie established the methodology known as the "synergetic use of binary characteristic structures" for the synthesis and assembly of inorganic functional materials, proposed a strategy for modulating the electron and phonon transport properties with phase transitions at the nanoscale, developed new high-efficiency thermoelectric materials systems, and discovered the relationship between the fine/electronic structures and the thermoelectric/optoelectronic properties of two-dimensional semiconductor crystals. As a female scientist, Xie is the youngest academician of the CAS among those elected in 2013.

Carbon aerogels sop up hydrocarbons

A team led by Professor Shuhong Yu at the HFNL is pursuing carbon aerogel



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production from biomass. The team selected bacterial cellulose pellicles — a commonly used, inexpensive, nontoxic form of biomass consisting of a tangled network of cellulose nano fibres — as a precursor for the production of ultralight carbon nanofibre aerogels on a largescale. This biomass can easily be produced on an industrial scale through microbial fermentation.

QUANTUM INFORMATION AND QUANTUM TECHNOLOGY

The Synergetic Innovation Centre for Quantum Information and Quantum Physics (SIC-QIQP), head by Professor Jianwei Pan, was established and financially supported by the Chinese Ministry of Education. It focuses on bringing together teams of multi-disciplinary researchers to form a dynamic national network for developing scalable quantum technologies.

Foiling quantum hackers

A research team led by Professor Qiang Zhang and Professor Tengyun Chen at the SIC-QIQP successfully demonstrated the measurement-device-independent

quantum key distribution by developing up-conversion single-photon detectors with high efficiency and low noise. The new quantum-encryption method provides the ultimate security against hackers in real-world cryptography applications, and greatly improves the security of quantum-encryption systems. This research was selected as one of the Highlights of the Year in *Physics* by the American Physical Society.

A milestone in satellite-based quantum communication

A collaborative team led by Professor Chengzhi Peng at the SIC-QIQP achieved comprehensive and direct verification of quantum communication between satellites and ground stations. This research lays the necessary technical foundations for a global quantum-communication network based on ground-satellite quantum communication by launching the quantum science experimental satellite of China.

Optical spectroscopy goes intramolecular

A team led by Professor Zhenchao Dong at the SIC-QIQP reported an optical spectroscopic-imaging approach that achieves subnanometre resolution and resolves the internal structure of single molecules. This development could lead to new techniques for probing and controlling nanoscale structure, dynamics, mechanics and chemistry. This research was listed among China's top 10 science news stories in 2013.

ENVIRONMENTAL AND EARTH SCIENCES

Penguins thrived in Antarctica during the Little Ice Age

New research led by Professor Liguang Sun in the School of Earth and Space Sciences showed that penguin populations in the Ross Sea of Antarctica spiked during the short cold period, called the Little Ice Age, which occurred between AD1500 and 1800. These results run contrary to previous studies that found increases in Antarctic penguin populations during warmer periods and decreases during

colder periods, suggesting that populations living at different latitudes in the Antarctic might respond differently to climate change.

Uncovering the mystery of subduction zone earthquakes

Based on analytical data from four of the highest magnitude subduction zone megathrust earthquakes, the conclusion was drawn that low-frequency radiation is closer to the trench at shallower depths and high-frequency radiation is farther from the trench at greater depths, in general. This scientific breakthrough was achieved by a team led by Professor Huajian Yao.

LIFE SCIENCES

New evidence for curing type 2 diabetes

Research teams led by Professor Rongbin Zhou and Professor Zhigang Tian in the School of Life Sciences revealed a new mechanism through which omega-3 fatty acids inhibit inflammation and prevent type 2 diabetes. The research results were published in *Immunity* in June 2013 and highlighted in the same issue of the journal.

Identifying liver-resident natural-killer cells with immune memory

A team also led by Professor Zhigang Tian identified liver-resident natural-killer (NK) cells that possess unique immune memory characteristics absent from normal NK cells.

LincRNA-p21 as a novel key player in regulating the Warburg effect

A research team led by Professor Mian Wu and Professor Yide Mei, at HFNL and the School of Life Sciences, has revealed a novel mechanism whereby lincRNA-p21 regulates the Warburg effect under hypoxic conditions. They demonstrated, for the first time, that lincRNA-p21 is an important regulator of the Warburg effect, and also identify lincRNA-p21 as a valuable therapeutic target for cancer.



Guo Moruo Square. USTC was established by the Chinese Academy of Sciences (CAS) in 1958 in Beijing. The director of CAS, Mr. Guo Moruo was appointed the first president of USTC.

Changchun

Changchun has traditionally been a manufacturing centre, producing goods ranging from cars to processed food. In line with China's growth and reform, the city is diversifying its economy by leveraging its research base.

ARTICLE COUNT (AC): **394**

FRACTIONAL COUNT (FC): **226**

WEIGHTED FRACTIONAL COUNT (WFC): **224**

Changchun, the capital and largest city of the northeastern province of Jilin, is home to many production industries. Its government estimates that output reached US\$150 billion in 2013, of which well over 90% came from the manufacture of cars, food, bio pharmaceuticals and construction materials.

However, Changchun wants to become an innovation-based economy. On 21 January 2014, the provincial governor announced the city would invest heavily in four new areas — photonics, chemical engineering, biochemistry and fine chemicals — and build on research from its four major research institutions: Jilin University (JLU); Northeast Normal University (NENU); and the two institutes of the Chinese Academy of Sciences (CAS) — the Changchun Institute of Applied Chemistry (CIAC) and the Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP). Collectively, these institutions account for more than 98% of the city's weighted fractional count (WFC).

JLU is responsible for most of these papers. Jihong Yu and Guangshan Zhu from the State Key Laboratory of Inorganic Synthesis and Preparative Chemistry are the two largest contributors. In 2013, Yu published eight articles (WFC = 6.6), and Zhu seven (WFC = 6.2). Both researchers study the design and synthesis of porous materials, which have diverse applications

including carbon sequestration, water purification, catalysis and chromatography.

Myongsoo Lee, from the State Key Laboratory of Supramolecular Structure and Materials, is JLU's third highest contributor by WFC to chemistry. Lee joined JLU in 2013 but has already published three papers (WFC=2.1), on the self-assembly of nanomaterials.

CIAC is Changchun's powerhouse for high-quality chemistry research. Husband-and-wife team Xiaogang Qu and Jinsong Ren from the State Key Laboratory of Rare Earth Resource Utilization — who have been inseparable since graduating from the California Institute of Technology — have made the largest contribution by WFC. They published 20 articles (WFC = 16.3) on topics including artificial enzymes, catalysis, gene delivery and cell imaging. "We have developed novel biomimetics that could simulate cellular processes," says Ren. "We have made artificial enzymes that could serve a range of industrial applications that are cheaper and more rugged than their natural counterparts."

Another CIAC couple, Erkang Wang and Shaojun Dong from the State Key Laboratory of Electroanalytical Chemistry, are the third and fourth largest contributors with 24 articles (WFC = 16.0) on nanomaterials and G-quadruplexes (specific formations of nucleic acids). "We are working on enzymatic fuel cells that can produce

energy from bioavailable substrates," says Dong. In implants, such devices could power memory and electrical circuits in pacemakers.

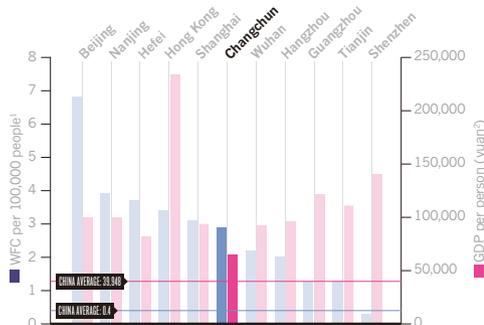
NENU is Changchun's top institution in the life sciences, which represent more than a fifth of its WFC. Notable contributors include palaeontologist Dongyu Hu, from the Ministry of Education Key Laboratory of Vegetation Ecology, who co-authored two articles — including one in *Nature* — on feathered dinosaurs. Hu sheds light on the evolution of birds and the origins of flight. It is chemistry where NENU excels. Zhongmin Su and Qian Zhang from the faculty of chemistry are its most prolific contributors. Su co-authored six articles (WFC = 5.1) on the synthesis of polyoxometalates (large metal clusters) and metal-organic frameworks, which have applications from catalysis to data storage. Zhang produced five articles (WFC = 4.9) on metal catalysts, notably on methods for introducing functional groups under mild conditions.

CAS institute CIOMP is the most dedicated to the physical sciences. Dezhen Shen and Jialong Zhao, from the State Key Laboratory of Luminescence and Applications, are the top two contributors with two articles each. Shen's are on the photocatalytic properties of titanium dioxide and manganese-doped zinc oxide, while Zhao's articles focus on the synthesis and application of zinc sulphide quantum dots. ■

CHANGCHUN ANALYSIS

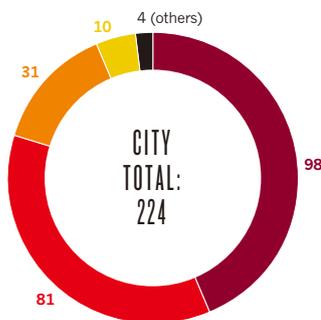
Changchun data

Per person, Changchun has the lowest gross domestic product (GDP) of the cities profiled, but an average WFC.



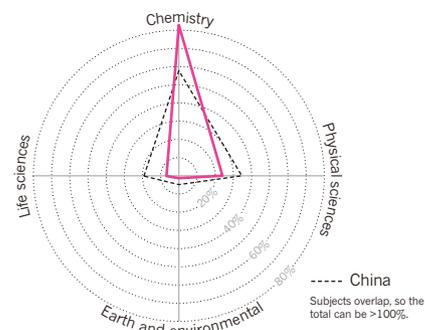
City WFC breakdown

Changchun has four major institutions, led by Jilin University.



City subject spread

Changchun is exceptionally focused on chemistry.



■ Jilin University ■ Changchun Institute of Applied Chemistry* ■ Northeast Normal University
■ Changchun Institute of Optics, Fine Mechanics and Physics*

*CAS institute: 1.360doc.com; 2.cnpop.org; yuan = US\$0.16

Guangzhou

Prone to infectious disease outbreaks, Guangzhou this year experienced one of its worst for dengue fever. By exploiting the data from thousands of clinical cases, researchers hope to reveal new approaches for prevention and control.

ARTICLE COUNT (AC): **374**
 FRACTIONAL COUNT (FC): **175**
 WEIGHTED FRACTIONAL COUNT (WFC): **170**

Guangzhou, capital city of the Guangdong province and China's fourth most populous city, is a dynamic metropolis on the southern coast. It attracts more than 150 million tourists and business travellers every year. And, because of heavy human traffic and subtropical climate — compounded by the popularity of live animal markets and a local penchant for wild meat, Guangzhou regularly experiences outbreaks of infectious disease, most recently severe acute respiratory syndrome (SARS; 2002–3), H1N1 influenza (swine flu; 2009) and dengue fever (2014).

This propensity for disease provides opportunities for new research. In November 2014, the Zhongshan School of Medicine, part of Sun Yat-sen University (SYSU), held its first symposium on dengue fever control using *Wolbachia* — a bacterium that infects mosquitoes and stops the dengue virus from replicating. Researchers hope that a collaborative effort between China, Australia and the United States will lead to safe, low-cost and environmentally sound methods for eradicating the disease. Guangzhou will conduct its first field trial of the technique next year.

SYSU is Guangzhou's leader. Last year it contributed to 158 articles, accounting for 47% of the city's WFC. Qinfen Zhang co-authored an article on the protein structure of a dengue virion in *Nature Structural & Molecular Biology*.

Two-thirds of SYSU's output is in chemistry, and there are three major contributing researchers from SYSU's school of chemistry and chemical engineering. Jiepeng Zhang co-authored three articles on metal-organic frameworks, a class of porous composite materials that have wide-ranging applications from catalysis to water decontamination. Chengyong Su and Hsiuyi Chao each published two articles (WFC = 4): Su wrote about metal-organic frameworks for use in gas adsorption, while Chao's were on metal complexes for use in luminescent sensors and cell imaging. "The school has provided us with great experimental facilities, but the financial support has been limited," says Chao. "SYSU still has much to learn from the world's top universities."

From the school of physics and engineering, Biao Wang and Baojun Li each published three wholly authored articles. "We have developed fibre optic probes for use in the non-invasive control of microbes," says Li. "Our light-based technology has implications for unblocking clots and manipulating single cells in blood vessels."

South China University of Technology (SCUT) also has a strong focus on chemistry. Huanfeng Jiang from the school of chemistry and chemical engineering is responsible for half of SCUT's chemistry WFC, with 16 articles on metal-catalysed organic synthesis. From the same school, Fei Huang published two articles

on polymer solar cells. "Our polymer solar cells have high energy conversion efficiency, even at high thickness," says Huang. "Thick solar cells are a lot easier to make, so this will lower the requirements for large-scale production."

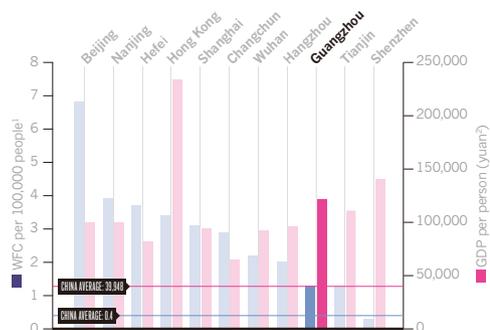
The focus of Guangzhou Institutes of Biomedicine and Health (GIBH) is medical research, so its index output is split between chemistry and life science. It also has the lowest ratio of AC to FC, indicating that many of its papers are authored by its own scientists. Duanqing Pei, the dean of GIBH, is the most prolific contributor, with six articles on novel techniques for reprogramming somatic cells (WFC = 6). Also notable are Qiang Zhu from GIBH's State Key Laboratory of Respiratory Diseases, who published four articles on organic synthesis, and Lingwen Zeng from the Key Laboratory of Regenerative Biology, also with four articles, on biosensors.

The South China Sea Institute of Oceanology (SCSIO) is a Chinese Academy of Sciences institute devoted to marine research. Ten of its 18 articles are in earth and environmental sciences, representing 43% of the city's output in this field. Jianhua Ju from the Key Laboratory of Tropical Marine Bio-resources and Ecology was the lead author on three, about the biosynthesis of marine alkaloids by bacteria. "The deep sea is full of undiscovered metabolites that can be used against antibiotic-resistant bacteria," he says. ■

GUANGZHOU ANALYSIS

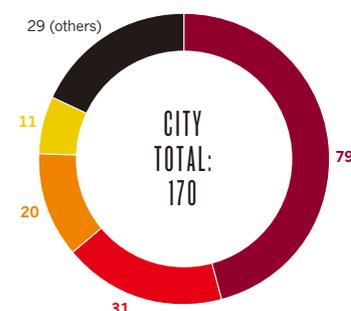
Guangzhou data

Per person, Guangzhou has one of China's highest rates of gross domestic product (GDP), but one of the lowest rates for WFC.



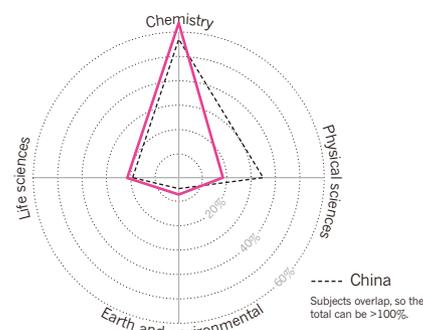
City WFC breakdown

Guangzhou has 27 institutions in the index. The largest contributor is Sun Yat-sen University.



City subject spread

Guangzhou is stronger than average in chemistry and earth and environmental sciences.



■ Sun Yat-sen University ■ South China University of Technology ■ Guangzhou Institutes of Biomedicine and Health* ■ South China Sea Institute of Oceanology*

*CAS institute
 1. 360doc.com; 2. cnpop.org; yuan = US\$0.16

Tianjin

Tianjin, a major transport hub 120 kilometres southeast of Beijing, is one of four municipalities under the direct administration of central government. By leveraging the innovation of its top universities, the city hopes to lead the nation in two emerging research areas.

ARTICLE COUNT (AC): **341**
 FRACTIONAL COUNT (FC): **169**
 WEIGHTED FRACTIONAL COUNT (WFC): **168**

Over the last four years, Tianjin has positioned itself as an incubator for innovation. It spent US\$7 billion — or 2.98% of its GDP — on research and development in 2013 — a percentage surpassed only by Beijing and Shanghai. Through the provision of start-up subsidies, the city has increased its number of innovation-based companies to 50,000, which now account for 20% of its small- and medium-sized enterprises.

In January 2014, the Tianjin Co-Innovation Center for Chemical Science and Engineering — established by the city’s two leading universities of Nankai (NKU) and Tianjin (TJU) — held a meeting of 70 distinguished scientists to explore better ways to leverage its discoveries. As a result, the centre will focus on two research areas, advanced functional materials and renewable energy. The goal will be to streamline the product development cycle, from research to patenting to technology transfer. Both universities have published work in these fields in 2013, including two articles (WFC = 2) on solar cells for NKU; and four articles on technologies including hydrogen production, solar cells and microbial fuel cells (total WFC = 2.24) for TJU.

Tianjin is strong in chemistry and though both leading universities focus on this field, NKU is historically strong in basic research, while TJU is better known for applied research.

Founded in 1919, NKU is Tianjin’s premier higher education institution and the city’s largest contributor to the index. In 2013, the university published 190 articles (WFC = 113.8), accounting for 68% of the city’s WFC. Three researchers from its college of chemistry are responsible for most of these publications. Xiuping Yan is the most prolific, having published 12 articles (WFC = 10.5) on metal-organic frameworks, a class of porous composite materials with applications in catalysis, sensing and separation. Yan explains that these materials are significant because of their long-lasting fluorescence.

Qilin Zhou and Jun Chen are the second and third largest contributors by WFC. Zhou led eight articles — all co-authored by NKU researchers (WFC = 8) and all pertaining to asymmetric synthesis. The highlight, he says, was a chiral catalyst with a ‘turnover number’ (the number of molecules a catalyst converts before it is exhausted) exceeding 4.5 million — way above the typical value of the order of one thousand. Chen, meanwhile, co-authored eight articles (WFC = 6.9) on nanomaterials.

Founded in 1895, TJU is Tianjin’s second largest research institution in the index with 66 articles (WFC = 33.7), representing 20% of the city’s WFC. Jinlong Gong from the school of chemical engineering and technology is the largest contributor in chemistry, with seven

articles (WFC = 4.8) — including one in *Nature Communications* — on nanomaterials.

Also notable is Jun’an Ma from the department of chemistry, who published three articles (WFC = 2.8) on the synthesis of organo-fluorine compounds. “We found a way of constructing trifluoromethyl pyrazoles,” says Ma. This can be used to treat HIV or arthritis, he says.

There are eight other Tianjin universities in the Nature Index. These include Tianjin Medical University (TMU), Tianjin University of Technology (TUT) and Tianjin University of Science and Technology (TUST). Among these, TMU stands out as the most collaborative. Its AC/FC ratio is the highest among the city’s six major contributing universities.

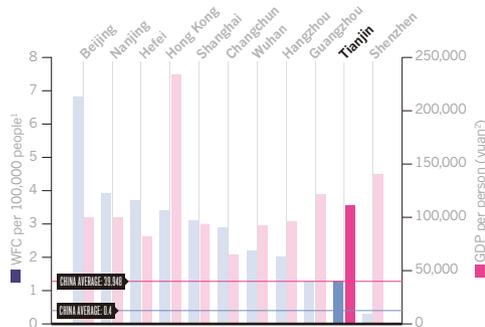
Of TUT researchers, Xianshun Zeng, in the school of materials science and engineering, is the most prolific. He co-authored three articles (WFC = 1.9) on fluorescent chemosensors which have big implications for detecting and monitoring environmental contaminants, such as palladium and bisulfate species.

TUST is the only Tianjin institution with earth and environmental science research, which represents more than 41% of its WFC. The top contributor is Hao Wei, dean of the college of marine science and engineering. Wei published two articles (WFC = 1.1) on mechanisms driving interannual ocean variability. ■

TIANJIN ANALYSIS

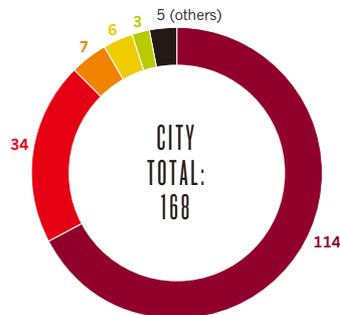
Tianjin data

Tianjin has a high rate of GDP per person, but one of the lowest rates of WFC of the cities profiled.



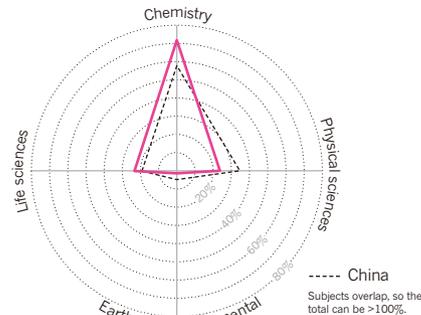
City WFC breakdown

Of Tianjin’s 19 institutions in the index, Nankai is dominant by WFC.



City subject spread

Nearly three-quarters of Tianjin’s WFC is derived from chemistry, way above the national average.



Shenzhen

Shenzhen, a former fishing village, is something of a miracle in China's scientific development. It has become a dominant force in genomics, proteomics and bioinformatics, and is now heading for new frontiers.

ARTICLE COUNT (AC): **107**
 FRACTIONAL COUNT (FC): **35**
 WEIGHTED FRACTIONAL COUNT (WFC): **35**

Until recently, Shenzhen was best known for factories in which cheap labour churned out counterfeit goods. The city has repositioned itself as one of the world's leading centres for genetics research. Shenzhen is home to BGI Shenzhen (formerly the Beijing Genomics Institute, now known as BGI), a prolific gene-sequencing organization that accounts for 50% of global sequencing capacity. In 2013, BGI acquired Complete Genomics, a US-based bioinformatics company and its closest rival — a move that will further secure BGI's dominance in the 'omics' realm.

However, BGI's success is only one aspect of Shenzhen's transformative journey. In 2011, the Shenzhen Municipal People's Government set out its twelfth 'five-year plan' to support research and innovation within six strategic emerging industries: biotechnology, internet, renewable energy, advanced materials, cultural creativity and information technology. It is hoped that by 2015, the total output value of these industrial sectors will be US\$49 billion — which equates to 20% of the city's current GDP. For comparison, the current output value of BGI is approximately US\$16 billion.

For now, Shenzhen's research strength is still predominantly in the life sciences. The city has grown its output in chemistry, although

the Nature Index shows that its WFC for this subject is still 15% below the national average.

BGI remains the largest contributing institution, with 51 articles (WFC = 15.3) in the Nature Index, accounting for 44% of the city's WFC. Included in these are seven in *Nature* and *Science* (WFC = 1.8), representing nearly 12% of its output. This means that the gene-sequencing organization has the second highest percentage WFC in *Nature* and *Science* of all Chinese research institutions, topped only by the Institute of Vertebrate Paleontology and Paleoanthropology, of the Chinese Academy of Sciences (CAS, page S56).

Jun Wang, the founder and director of BGI, led most of these publications. Last year, he contributed to 35 articles (WFC = 11.7), the most notable of which were on the genomes of bread wheat, bats and the rock pigeon. "Comparative analysis of bat genomes provides insight into the evolution of flight and immunity" published in *Science* was listed as one of China's most influential papers of 2013.

The next two major contributors from BGI are Xun Xu and Guojie Zhang, with three articles each. Xu's three (WFC = 1) were on the genomes of domestic goats, Chinese pears and upland rice; Zhang's (WFC = 0.9) were on the genomes of soft-shell turtles, green-shell turtles and one comparing the genomes

of modern domestic horses to that of a horse from the late Pleistocene.

The remainder of Shenzhen's output in the index comes mostly from the Shenzhen Institutes of Advanced Technology (SIAT) and Shenzhen University (SZU), accounting for 32% and 14% of the city's WFC, respectively.

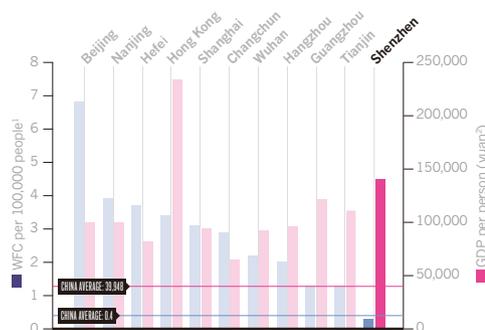
The Nature Index shows that all of SIAT's output is in chemistry. The CAS institute published 13 articles (WFC = 11.4), accounting for more than three-quarters of the city's total chemistry WFC. Most of these articles were led by analytical chemist Chunyang Zhang, who last year contributed to ten articles (WFC = 9.5) on quantum dots and amplification binding assays — tools for detecting transcription factors, enzymes and microRNAs.

Established only 31 years ago, SZU is Shenzhen's leading institution in the physical sciences. In 2013 it published seven articles in these fields (WFC = 3), most of which were in *Applied Physics Letters*. Xiacong Yuan is SZU's largest contributor, having published three articles (WFC = 0.7) on optical tweezers. "We are the first to use surface plasmon polaritons in the confinement of metal nanoparticles," says Yuan. The experiment has important implications for Raman spectroscopy, a surface imaging technique widely used in chemistry and solid-state physics. ■

SHENZHEN ANALYSIS

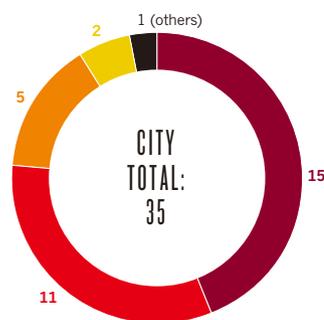
Shenzhen data

Shenzhen is the second most prosperous city after Hong Kong but lacks a comparable research base.



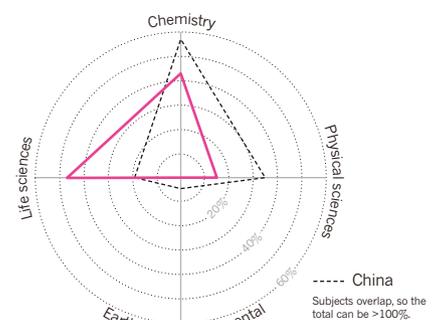
City WFC breakdown

BGI and CAS institute SIAT contribute most of the city's WFC.



City subject spread

BGI's influence means that life-science research is a substantial part of Shenzhen's WFC.



A guide to the Nature Index

A description of the terminology and methodology used in this supplement, and a guide to the functionality available online at natureindex.com.

The Nature Index is a database of author affiliations and institutional relationships, used to track contributions to articles published in a small group of highly selective journals that have been chosen by an independent group of working scientists.

Data in the Nature Index are updated monthly, with the most recent 12 months of data available under a Creative Commons licence at natureindex.com. The database is compiled by Nature Publishing Group (NPG) in collaboration with sister company Digital Science.

NATURE INDEX METRICS

There are three measures provided by the Nature Index to track affiliation data. The simplest is the article count (AC). A country or institution is given an AC of 1 for each article that has at least one author from that country or institution. This is the case whether an article has one or a hundred authors, and it means that the same article can contribute to the AC of multiple countries or institutions.

To get a better sense of a country or institution's contribution to an article, and to remove the issue of double-counting of articles, the Nature Index uses the fractional count (FC). FC takes into account the relative contribution of each author to an article. The total FC available per paper is 1, and this is shared between all authors under the assumption that each contributed equally. For instance, a paper with 10 authors means that each author receives an FC of 0.1. For authors with joint affiliations, the individual FC is then split equally between each affiliation.

The third measure is the weighted fractional count (WFC), which applies a weighting to the FC in order to adjust for the over-representation of papers from astronomy and astrophysics. The four journals in these disciplines publish about 50% of all papers in international journals in this field — approximately five-times the equivalent figures for other fields. Therefore, although the data for astronomy and astrophysics are compiled in exactly the same way as for all other disciplines, articles from these journals are assigned one-fifth the weight of other articles (i.e. the FC is multiplied by 0.2 to derive the WFC).

Users of natureindex.com can search for specific institutions or countries and generate their own reports, ordered by article count (AC), fractional count (FC) or weighted fractional count (WFC).

Each query will return a profile page that lists the country or institution's recent research outputs, from which it is possible to drill down for more information. For example, articles can be displayed by journal, and then by article title. As in the supplement, research outputs are organized by subject area. The profile page also lists the institution or country's top collaborators, as well as its relationship with other research organizations.

The total FC or WFC for an institution is derived by summing the FC or WFC for individual authors. The process is similar for countries, although complicated by the fact that some institutions have overseas labs that will be counted towards the host country totals. What's more, there is great variability in the way authors present their affiliations. Every effort is made to count affiliations consistently, making reasonable assumptions. For more information on how the affiliation information is processed, please see the frequently asked questions at natureindex.com.

THE SUPPLEMENT

Nature Index 2014 China is based on a snapshot of data from natureindex.com, covering articles published between 1 January and 31 December, 2013.

Most analyses within the Nature Index 2014

China supplement use the WFC as the primary metric, as it provides a more even basis for comparison across multiple disciplines, and in determining the relative contribution of each country/institution.

Additional layers of information concerning funding levels, numbers of researchers, size of population and so on, are taken from publicly available sources. In several places, we use altmetrics as a supporting data source. Altmetrics is an alternative way to measure the impact of a paper by tracking different online sources (newspaper stories, tweets, blog posts, comments) that mention the paper. The altmetric score for an article gives an idea of the attention that it has received. Our data are from altmetric.com, provided by the start-up company Altmetric — which is supported by Digital Science. To see more about how this score is calculated, please visit support.altmetric.com. ■

NATUREINDEX.COM

A global indicator of high-quality research



Nature Index China tables

China's leading institutions for high-quality science, ordered by weighted fractional count (WFC) for 2013. Also shown are the total number of articles, and the change in WFC from 2012. Articles are from the 68 natural science journals that comprise the Nature Index (see 'A guide to the Nature Index', page S76).

TOP 200 INSTITUTIONS

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	1,209.46	2,661	1,119.75	8.0%
2	Peking University (PKU)	275.53	743	209.58	31.5%
3	Tsinghua University	194.87	474	177.74	9.6%
4	Nanjing University	194.57	391	168.10	15.7%
5	University of Science and Technology of China (USTC)	175.73	427	147.75	18.9%
6	Zhejiang University (ZJU)	150.42	289	123.20	22.1%
7	Fudan University	129.23	255	121.36	6.5%
8	Nankai University	113.77	190	85.85	32.5%
9	Wuhan University	98.80	154	74.27	33.0%
10	Jilin University	97.90	179	65.76	48.9%
11	Shanghai Jiao Tong University (SJTU)	95.99	247	80.03	19.9%
12	Sun Yat-sen University	79.41	158	80.04	-0.8%
13	Sichuan University	76.82	130	44.88	71.2%
14	Xiamen University	76.02	142	77.84	-2.3%
15	University of Chinese Academy of Sciences (UCAS)	71.18	434	64.84	9.8%
16	The University of Hong Kong (HKU)	70.43	149	50.45	39.6%
17	Lanzhou University	69.99	123	67.58	3.6%
18	East China Normal University (ECNU)	65.56	123	35.55	84.4%
19	Soochow University	65.30	128	55.27	18.1%
20	Dalian University of Technology (DUT)	61.42	104	51.85	18.5%
21	East China University of Science and Technology (ECUST)	56.75	95	67.33	-15.7%
22	Hunan University (HNU)	54.57	80	50.22	8.7%
23	Hong Kong University of Science and Technology (HKUST)	54.45	103	55.07	-1.1%
24	Huazhong University of Science & Technology (HUST)	43.62	109	46.44	-6.1%
25	Xi'an Jiaotong University	42.98	93	30.27	42.0%
26	Tongji University	40.08	86	20.29	97.5%
27	Beijing Normal University	39.60	121	36.73	7.8%
28	The Chinese University of Hong Kong	39.39	82	40.20	-2.0%
29	Shandong University	39.17	94	63.60	-38.4%
30	City University of Hong Kong	36.51	72	37.02	-1.4%
31	Harbin Institute of Technology	36.22	73	19.30	87.6%
32	Tianjin University	33.73	66	38.57	-12.6%
33	Southeast University (SEU)	30.93	65	25.77	20.0%
34	South China University of Technology	30.89	60	32.05	-3.6%
35	Northeast Normal University	30.73	48	35.43	-13.3%
36	Fuzhou University	26.76	39	29.64	-9.7%
37	The Hong Kong Polytechnic University	25.94	69	26.09	-0.6%
38	University of Science and Technology Beijing (USTB)	25.79	46	16.71	54.3%
39	Chinese Academy of Medical Sciences & Peking Union Medical College (CAMS & PUMC)	24.63	75	23.32	5.6%
40	Beijing University of Chemical Technology	23.45	40	16.63	41.0%
41	Beijing Institute of Technology	20.11	40	15.20	32.3%
42	Beihang University (BUAA)	17.69	67	18.59	-4.8%

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
43	Second Military Medical University	16.96	44	10.84	56.4%
44	Shanghai University	16.49	41	21.87	-24.6%
45	National University of Defense Technology	16.24	29	12.00	35.3%
46	Southwest University	16.11	33	18.37	-12.3%
47	Central China Normal University	15.93	43	25.10	-36.5%
48	BGI	15.34	51	10.56	45.2%
49	China Agricultural University	14.65	41	8.49	72.6%
50	China University of Geosciences	14.52	40	13.48	7.7%
51	Zhengzhou University	13.77	38	7.78	77.1%
52	Ocean University of China	13.06	35	13.20	-1.1%
53	Northwestern Polytechnical University (NWPUP)	12.90	18	1.82	610.4%
54	Chongqing University	12.90	22	3.00	329.9%
55	Xiangtan University	12.87	27	12.92	-0.4%
56	Hong Kong Baptist University (HKBU)	12.77	30	10.60	20.4%
57	Shandong Normal University (SDNU)	12.73	18	8.83	44.2%
58	Henan University	12.53	18	8.14	53.9%
59	Henan Normal University	12.42	27	9.95	24.9%
60	Northwest University	12.04	25	11.48	4.9%
61	University of Electronic Science and Technology of China (UESTC)	12.00	32	12.42	-3.3%
62	Nanjing University of Technology	11.92	28	16.16	-26.3%
63	Shaanxi Normal University	11.80	24	3.51	236.5%
64	National Institute of Biological Sciences (NIBS)	11.73	30	15.84	-26.0%
65	Yunnan University	11.39	27	7.36	54.9%
66	Hunan Normal University	11.12	24	10.10	10.1%
67	Shanxi University	10.82	18	16.00	-32.4%
68	Qingdao University of Science and Technology (QUST)	10.66	17	14.16	-24.7%
69	Huazhong Agricultural University	10.57	20	8.38	26.2%
70	Central South University (CSU)	10.15	35	6.46	57.3%
71	Nanchang University	10.06	20	3.69	172.3%
72	Northwest A & F University	9.90	21	3.57	177.1%
73	Hangzhou Normal University	9.52	36	6.55	45.3%
74	China Earthquake Administration	9.50	20	4.43	114.4%
75	Hefei University of Technology	8.97	18	3.48	157.9%
76	Jiangnan University	8.91	17	8.03	10.9%
77	Renmin University of China	8.89	20	10.51	-15.4%
78	Wuhan University of Technology	8.59	16	7.78	10.4%
79	Zhejiang Normal University (ZJNU)	8.44	21	6.04	39.9%
80	Nanjing University of Posts and Telecommunications (NUPT)	8.28	18	3.00	176.1%
81	Wenzhou University	8.05	15	5.17	55.7%
82	Zhejiang University of Technology	8.03	15	6.50	23.5%
83	Chinese Academy of Agricultural Sciences (CAAS)	7.87	30	4.90	60.7%
84	Hebei University	7.86	12	3.42	129.9%
85	Nanjing University of Information Science & Technology (NUIST)	7.86	30	6.67	17.9%
86	Nanjing Normal University	7.75	23	9.95	-22.1%
87	Beijing University of Technology	7.67	16	7.45	3.0%
88	Ningbo University	7.56	20	3.52	114.9%
89	China Academy of Engineering Physics (CAEP)	7.32	21	5.79	26.4%
90	Nanjing Medical University	7.27	28	7.97	-8.7%
91	China University of Petroleum (CUP)	7.15	16	5.25	36.0%
92	Shantou University	7.13	14	5.76	23.7%
93	South China Normal University	6.87	18	12.13	-43.4%
94	Tianjin Medical University (TMC)	6.73	26	5.70	18.1%
95	China Meteorological Administration (CMA)	6.69	26	4.50	48.6%
96	Heilongjiang University	6.67	14	5.46	22.1%
97	Capital Normal University	6.65	16	5.18	28.6%
98	Nanjing University of Aeronautics and Astronautics (NUAA)	6.58	10	15.17	-56.6%
99	North China Electric Power University (NCEPU)	6.50	13	2.16	201.3%
100	Nanjing University of Science and Technology (NUST)	6.43	18	7.77	-17.2%

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
101	Donghua University	6.34	18	1.78	257.1%
102	Anhui Normal University	5.96	9	8.81	-32.4%
103	Beijing Computational Science Research Center (CSRC)	5.95	24	2.37	151.6%
104	State Oceanic Administration (SOA)	5.93	20	9.74	-39.1%
105	Changzhou University	5.93	13	0.56	967.3%
106	Third Military Medical University	5.91	25	3.81	55.0%
107	Jiangsu Normal University	5.61	11	2.17	158.8%
108	University of Jinan	5.57	6	4.58	21.5%
109	Tianjin University of Technology (TUT)	5.53	13	1.06	420.3%
110	Huaqiao University	5.51	11	2.48	121.7%
111	Hunan University of Science and Technology	5.06	8	-	-
112	Shenzhen University (SZU)	5.05	15	2.43	108.0%
113	Chinese Academy of Geological Sciences (CAGS)	5.00	16	4.11	21.6%
114	Zhejiang Sci-Tech University	4.94	9	3.37	46.9%
115	Huaibei Normal University	4.78	7	5.20	-8.2%
116	Yangzhou University	4.67	9	3.94	18.4%
117	Guangxi Normal University	4.60	12	10.13	-54.6%
118	Taiyuan University of Technology (TUT)	4.54	8	1.38	230.0%
119	Jinan University	4.31	21	9.90	-56.5%
120	Chongqing Medical University (CQMU)	4.31	14	2.60	66.0%
121	University of Shanghai for Science and Technology (USST)	4.15	11	2.25	84.6%
122	Beijing Jiaotong University	4.15	7	1.81	129.2%
123	Yanshan University	4.03	7	6.62	-39.2%
124	China University of Mining and Technology (CUMT)	3.95	8	3.19	24.0%
125	China Pharmaceutical University (CPU)	3.88	10	8.66	-55.2%
126	Fourth Military Medical University	3.80	14	5.17	-26.4%
127	Xidian University	3.78	8	3.52	7.5%
128	Shanghai Normal University (SHNU)	3.75	20	9.11	-58.8%
129	Anhui University	3.71	11	1.83	102.9%
130	Academy of Military Medical Sciences (AMMS)	3.67	13	4.74	-22.4%
131	Qufu Normal University (QFNU)	3.63	7	-	-
132	Hubei University	3.63	10	1.83	98.0%
133	Inner Mongolia University	3.61	9	0.74	386.1%
134	Fujian Normal University	3.48	11	3.84	-9.3%
135	Southern Medical University	3.47	12	1.78	94.3%
136	Jiangsu University	3.42	13	3.39	0.9%
137	Beijing University of Posts and Telecommunications (BUPT)	3.42	8	4.11	-16.9%
138	China Medical University (PRC)	3.32	16	1.08	207.0%
139	Linyi University	3.19	6	0.63	411.1%
140	Guizhou University	3.18	8	1.48	115.4%
141	Jiangxi Normal University	3.14	6	3.58	-12.3%
142	Hohai University	3.04	9	0.84	263.5%
143	Kunming University of Science and Technology	3.04	7	0.06	5,214.6%
144	Institute of Applied Physics and Computational Mathematics (IAPCM)	3.00	11	5.20	-42.3%
145	PLA University of Science and Technology	3.00	4	1.43	110.5%
146	Nantong University	2.99	9	2.12	41.2%
147	Capital Medical University (CMU)	2.98	16	2.28	30.5%
148	Henan University of Technology (HUT)	2.92	6	1.10	165.6%
149	Chinese Center for Disease Control and Prevention (China CDC)	2.91	17	2.46	18.4%
150	Qingdao University	2.89	8	2.05	40.9%

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
151	Beijing Institute of Biotechnology	2.81	8	1.40	100.9%
152	Sichuan Agricultural University (SAU)	2.70	5	0.65	316.3%
153	Tianjin University of Science and Technology (TUST)	2.69	6	1.11	143.0%
154	Nanjing Agricultural University	2.59	11	3.69	-29.7%
155	Harbin Medical University (HMU)	2.58	11	1.73	48.7%
156	Chinese Academy of Meteorological Sciences (CAMS)	2.53	9	5.06	-50.0%
157	Harbin Engineering University (HEU)	2.52	5	0.44	467.3%
158	China Jiliang University	2.38	8	2.03	17.1%
159	Henan University of Science and Technology	2.37	9	0.43	454.2%
160	Liaocheng University (LCU)	2.29	6	0.80	185.0%
161	South University of Science and Technology of China (SUSTC)	2.24	22	0.62	260.8%
162	Nanjing National Laboratory of Microstructures	2.18	5	2.41	-9.5%
163	Xi'an University of Technology (XUT)	2.15	4	1.10	96.7%
164	Beijing Institute of Pharmacology and Toxicology	2.13	4	1.75	21.5%
165	Changchun University of Science and Technology (CUST)	2.12	8	2.63	-19.4%
166	Northeastern University	2.10	4	6.25	-66.4%
167	South China Agricultural University	2.02	6	1.68	20.6%
168	Guangzhou Medical University (GMU)	2.01	7	1.25	61.4%
169	Shanxi Datong University (SDU)	2.00	2	-	-
170	Dalian National Laboratory for Clean Energy (DNL)	1.99	4	-	-
171	Inner Mongolia University of Science and Technology	1.95	3	0.33	485.0%
172	Yunnan University of Nationalities	1.93	3	0.78	147.5%
173	Yunnan Normal University (YNNU)	1.91	11	0.79	143.5%
174	JiangXi University of Science and Technology (JUST)	1.91	4	-	-
175	China West Normal University (CWNU)	1.82	3	3.29	-44.7%
176	Shanghai Second Polytechnic University	1.81	3	-	-
177	Hebei Semiconductor Research Institute	1.77	2	0.30	489.7%
178	Anhui Medical University	1.77	13	1.92	-8.1%
179	Shenyang Normal University	1.75	6	0.64	172.2%
180	Nanchang Hangkong University (NCHU)	1.73	4	1.18	46.1%
181	Gannan Normal University	1.71	2	0.63	174.3%
182	Shanghai Institute of Technology	1.71	4	-	-
183	Fujian Medical University	1.71	4	1.08	57.7%
184	Guangzhou University (GU)	1.70	9	0.36	369.1%
185	Qingdao Agricultural University	1.68	5	-	-
186	Harbin University of Science and Technology (HUST)	1.67	5	-	-
187	Hebei University of Technology (HEBUT)	1.65	8	0.34	378.6%
188	Xinjiang University	1.59	11	2.61	-39.1%
189	Guilin University of Electronic Technology (GUET)	1.56	6	1.54	1.2%
190	Changshu Institute of Technology (CIT)	1.55	5	1.51	2.6%
191	Wuyi University	1.54	2	0.68	125.9%
192	The General Hospital of Chinese People's Liberation Army	1.54	11	1.58	-2.8%
193	Wenzhou Medical College	1.49	9	3.81	-60.9%
194	Guangdong University of Technology (GDUT)	1.48	7	0.36	307.9%
195	Guilin University of Technology	1.48	6	3.14	-53.0%
196	Guangdong Medical College	1.45	5	0.76	90.2%
197	Jiangxi Science & Technology Normal University	1.43	3	1.25	14.0%
198	Changchun University of Technology (CCUT)	1.42	4	0.40	255.7%
199	Hebei Normal University	1.40	12	1.86	-24.6%
200	Shandong Agricultural University (SDAU)	1.38	6	2.00	-31.3%

TOP INSTITUTIONS: LIFE SCIENCES

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	238.91	478	201.26	18.7%
2	Peking University (PKU)	64.01	152	42.93	49.1%
3	Tsinghua University	30.65	87	34.02	-9.9%
4	University of Science and Technology of China (USTC)	30.21	62	14.98	101.7%
5	Zhejiang University (ZJU)	29.29	68	27.26	7.5%
6	Nankai University	27.74	54	20.83	33.2%
7	Shanghai Jiao Tong University (SJTU)	24.82	94	24.08	3.1%
8	Fudan University	24.72	68	29.10	-15.1%
9	Wuhan University	22.07	40	16.80	31.4%
10	Chinese Academy of Medical Sciences & Peking Union Medical College (CAMS & PUMC)	20.51	66	22.34	-8.2%
11	Lanzhou University	19.26	33	25.75	-25.2%
12	Sun Yat-sen University	17.74	55	18.81	-5.7%
13	East China Normal University (ECNU)	16.26	34	5.62	189.0%
14	Sichuan University	16.14	34	8.21	96.6%
15	BGI	14.82	49	10.09	46.9%
16	Second Military Medical University	14.77	38	9.38	57.5%
17	University of Chinese Academy of Sciences (UCAS)	14.46	84	9.84	46.9%
18	Soochow University	13.24	30	9.50	39.4%
19	Nanjing University	12.67	37	11.00	15.1%
20	The University of Hong Kong (HKU)	12.03	31	17.81	-32.4%
21	Tongji University	10.76	32	3.90	175.9%
22	Huazhong University of Science & Technology (HUST)	10.51	30	10.16	3.4%
23	Xiamen University	10.26	25	14.95	-31.4%
24	National Institute of Biological Sciences (NIBS)	9.77	26	15.22	-35.8%
25	East China University of Science and Technology (ECUST)	9.67	17	9.98	-3.1%
26	South China University of Technology	9.33	15	5.66	64.9%
27	China Agricultural University	9.16	28	6.06	51.1%
28	Northeast Normal University	8.99	17	4.06	121.4%
29	Shandong University	8.90	18	17.22	-48.3%
30	Hong Kong University of Science and Technology (HKUST)	8.48	15	14.31	-40.7%
31	Huazhong Agricultural University	7.61	15	5.32	43.1%
32	Dalian University of Technology (DUT)	6.51	14	5.18	25.7%
33	Chinese Academy of Agricultural Sciences (CAAS)	6.39	24	4.63	37.9%
34	Wenzhou University	5.90	8	2.61	126.3%
35	Nanjing Medical University	5.86	23	5.71	2.7%
36	Tianjin Medical University (TMC)	5.79	21	4.95	17.0%
37	Beijing Normal University	5.79	21	8.80	-34.2%
38	The Chinese University of Hong Kong	5.60	19	10.89	-48.6%
39	Tianjin University	5.06	8	3.59	40.8%
40	Central China Normal University	4.16	5	6.00	-30.7%
41	Third Military Medical University	4.12	19	2.81	46.6%
42	Jiangsu Normal University	4.03	5	0.75	437.8%
43	Zhengzhou University	3.89	11	2.42	60.7%
44	The Hong Kong Polytechnic University	3.89	14	2.74	41.7%
45	Northwest A & F University	3.70	12	1.83	102.9%
46	Fourth Military Medical University	3.42	12	4.17	-18.0%
47	Yunnan University	3.11	7	2.78	12.1%
48	Southern Medical University	3.10	10	1.45	113.6%
49	Huaqiao University	3.08	4	0.08	3,600.0%
50	Henan University	3.02	5	1.59	89.9%

TOP INSTITUTIONS: CHEMISTRY

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	679.85	1,148	654.95	3.8%
2	Peking University (PKU)	142.80	268	113.77	25.5%
3	Nanjing University	115.65	160	97.50	18.6%
4	University of Science and Technology of China (USTC)	93.78	150	82.17	14.1%
5	Tsinghua University	92.00	169	90.79	1.3%
6	Zhejiang University (ZJU)	86.42	133	69.32	24.7%
7	Nankai University	86.25	124	59.50	44.9%
8	Fudan University	79.94	122	71.59	11.7%
9	Jilin University	74.06	129	40.87	81.2%
10	Sichuan University	68.45	92	33.30	105.5%
11	Wuhan University	63.22	84	42.23	49.7%
12	Xiamen University	59.87	95	58.89	1.7%
13	East China University of Science and Technology (ECUST)	53.04	84	64.81	-18.2%
14	Sun Yat-sen University	52.10	75	42.79	21.8%
15	Hunan University (HNU)	51.90	68	43.66	18.9%
16	Lanzhou University	50.35	74	47.97	5.0%
17	University of Chinese Academy of Sciences (UCAS)	47.85	229	42.67	12.1%
18	Dalian University of Technology (DUT)	47.16	75	42.72	10.4%
19	Shanghai Jiao Tong University (SJTU)	45.14	72	35.41	27.5%
20	East China Normal University (ECNU)	41.54	71	20.52	102.4%
21	The University of Hong Kong (HKU)	38.04	52	21.38	77.9%
22	Soochow University	34.75	70	37.77	-8.0%
23	South China University of Technology	28.89	51	26.26	10.0%
24	Fuzhou University	26.51	37	28.48	-6.9%
25	Hong Kong University of Science and Technology (HKUST)	25.71	44	29.59	-13.1%
26	Northeast Normal University	25.69	37	31.95	-19.6%
27	Tianjin University	25.43	47	26.03	-2.3%
28	The Chinese University of Hong Kong	21.18	34	22.56	-6.1%
29	Beijing University of Chemical Technology	20.35	31	14.71	38.3%
30	Shandong University	19.69	32	24.70	-20.3%
31	Tongji University	19.01	32	9.74	95.3%
32	City University of Hong Kong	18.84	36	15.60	20.8%
33	Beijing Institute of Technology	16.95	28	10.87	55.9%
34	The Hong Kong Polytechnic University	15.16	37	21.26	-28.7%
35	Harbin Institute of Technology	14.15	34	10.18	39.1%
36	Central China Normal University	13.30	18	21.92	-39.3%
37	Huazhong University of Science & Technology (HUST)	13.11	27	18.82	-30.4%
38	Southwest University	12.51	23	17.92	-30.2%
39	Shandong Normal University (SDNU)	11.33	13	7.73	46.6%
40	Zhengzhou University	11.29	20	6.61	70.9%
41	Chinese Academy of Medical Sciences & Peking Union Medical College (CAMS & PUMC)	11.22	22	7.36	52.5%
42	Nanjing University of Technology	11.04	24	15.67	-29.5%
43	Henan University	10.73	14	4.69	128.9%
44	Xi'an Jiaotong University	10.72	26	6.97	53.8%
45	Qingdao University of Science and Technology (QUST)	10.66	17	14.05	-24.1%
46	Beijing Normal University	10.56	23	12.71	-16.9%
47	Northwest University	10.29	17	7.18	43.3%
48	Southeast University (SEU)	9.78	21	11.15	-12.3%
49	Shaanxi Normal University	9.14	17	2.36	286.7%
50	Beihang University (BUAA)	8.60	22	8.94	-3.8%

TOP INSTITUTIONS: PHYSICAL SCIENCES

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	412.33	1,234	399.92	3.1%
2	Peking University (PKU)	105.35	388	86.35	22.0%
3	Tsinghua University	88.12	262	87.16	1.1%
4	University of Science and Technology of China (USTC)	71.66	242	63.63	12.6%
5	Zhejiang University (ZJU)	65.02	136	44.46	46.2%
6	Nanjing University	64.94	193	68.24	-4.8%
7	Fudan University	40.00	92	41.84	-4.4%
8	Shanghai Jiao Tong University (SJTU)	34.39	104	29.26	17.5%
9	Xi'an Jiaotong University	32.74	56	24.34	34.5%
10	Jilin University	29.09	54	25.59	13.7%
11	Soochow University	27.31	45	22.45	21.6%
12	The University of Hong Kong (HKU)	25.81	70	15.56	65.9%
13	Huazhong University of Science & Technology (HUST)	25.28	61	26.04	-2.9%
14	Nankai University	23.56	46	17.53	34.4%
15	Harbin Institute of Technology	22.37	40	9.59	133.3%
16	Hong Kong University of Science and Technology (HKUST)	22.11	49	18.87	17.2%
17	Sun Yat-sen University	21.84	40	21.84	0.0%
18	University of Science and Technology Beijing (USTB)	21.29	38	11.55	84.4%
19	City University of Hong Kong	20.40	44	24.73	-17.5%
20	Southeast University (SEU)	20.02	42	14.59	37.2%
21	Beijing Normal University	19.47	63	15.69	24.1%
22	Dalian University of Technology (DUT)	18.98	35	8.83	114.8%
23	Wuhan University	18.52	37	17.49	5.9%
24	East China Normal University (ECNU)	17.17	37	13.07	31.3%
25	University of Chinese Academy of Sciences (UCAS)	16.51	158	17.51	-5.7%
26	National University of Defense Technology	16.16	28	11.98	34.8%
27	Shandong University	14.13	49	28.93	-51.2%
28	Tongji University	13.22	25	7.70	71.7%
29	Lanzhou University	13.15	30	14.36	-8.4%
30	The Chinese University of Hong Kong	13.12	30	11.06	18.6%
31	Xiamen University	12.86	35	11.09	15.9%
32	Northwestern Polytechnical University (NWPU)	11.74	16	1.27	826.8%
33	University of Electronic Science and Technology of China (UESTC)	11.41	26	12.16	-6.2%
34	Beihang University (BUAA)	10.08	50	12.89	-21.8%
35	Tianjin University	9.98	23	14.49	-31.1%
36	The Hong Kong Polytechnic University	9.80	26	9.24	6.0%
37	Chongqing University	9.50	17	2.00	374.8%
38	Shanghai University	8.28	25	9.82	-15.7%
39	Henan Normal University	7.91	21	3.60	119.9%
40	Beijing Institute of Technology	7.84	21	7.10	10.5%
41	Sichuan University	7.74	25	9.90	-21.8%
42	East China University of Science and Technology (ECUST)	6.99	15	1.61	333.7%
43	Shanxi University	6.06	12	8.06	-24.8%
44	Wuhan University of Technology	5.78	11	4.09	41.3%
45	North China Electric Power University (NCEPU)	5.54	10	2.09	164.7%
46	Beijing University of Technology	5.46	10	6.10	-10.5%
47	Xiangtan University	5.39	14	5.76	-6.5%
48	China Academy of Engineering Physics (CAEP)	5.36	14	4.89	9.6%
49	Beijing Computational Science Research Center (CSRC)	5.13	20	2.03	152.5%
50	Ningbo University	5.07	14	3.52	44.2%

TOP INSTITUTIONS: EARTH AND ENVIRONMENTAL SCIENCES

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	68.50	133	44.78	53.0%
2	China Earthquake Administration	9.50	20	4.27	122.3%
3	China University of Geosciences	9.40	20	7.80	20.6%
4	Ocean University of China	9.35	23	7.92	18.1%
5	Nanjing University	9.33	18	2.31	304.2%
6	China Meteorological Administration	6.52	23	4.32	51.1%
7	University of Science and Technology of China (USTC)	6.52	15	2.32	180.5%
8	Nanjing University of Information Science & Technology (NUIST)	6.30	22	6.59	-4.5%
9	Wuhan University	5.93	12	3.93	50.8%
10	Beijing Normal University	5.76	19	3.70	55.7%
11	Peking University (PKU)	5.61	16	6.00	-6.5%
12	State Oceanic Administration (SOA)	5.18	14	9.74	-46.9%
13	Lanzhou University	5.18	11	3.21	61.4%
14	Hong Kong University of Science and Technology (HKUST)	4.54	8	2.29	98.2%
15	Chinese Academy of Geological Sciences (CAGS)	3.77	12	3.96	-4.6%
16	University of Chinese Academy of Sciences (UCAS)	2.96	20	3.75	-21.1%
17	PLA University of Science and Technology	2.80	3	1.43	96.5%
18	Chinese Academy of Meteorological Sciences (CAMS)	2.53	9	4.89	-48.3%
19	Tsinghua University	2.46	5	0.11	2,083.4%
20	Sun Yat-sen University	2.29	10	2.90	-21.3%
21	The Hong Kong Polytechnic University	2.25	5	0.96	134.2%
22	Zhejiang University (ZJU)	1.88	5	1.63	15.2%
23	Xiamen University	1.80	6	2.21	-18.6%
24	Hohai University	1.44	5	0.84	71.6%
25	The Chinese University of Hong Kong	1.15	4	2.33	-50.9%

TOP INSTITUTIONS IN NATURE AND SCIENCE

2013	INSTITUTION	WFC	ARTICLE COUNT	2012 WFC	2012-2013 CHANGE IN WFC
1	Chinese Academy of Sciences (CAS)	18.64	54	6.26	197.5%
2	Tsinghua University	5.43	12	5.56	-2.2%
3	Peking University (PKU)	4.10	14	3.56	15.2%
4	Chinese Academy of Agricultural Sciences (CAAS)	2.84	7	0.74	282.8%
5	BGI	1.78	7	1.33	33.6%
6	Zhejiang University (ZJU)	1.70	7	0.53	221.1%
7	University of Science and Technology of China (USTC)	1.69	8	2.13	-20.8%
8	Chinese Center for Disease Control and Prevention (China CDC)	1.27	6	-	-
9	China Agricultural University	1.17	6	0.32	269.6%
10	National Institute of Biological Sciences, (NIBS)	1.12	5	2.60	-56.8%
11	Tongji University	1.11	5	0.06	1,717.6%
12	Linyi University	1.05	3	-	-
13	Chinese Academy of Geological Sciences (CAGS)	0.98	2	0.10	876.9%
14	The University of Hong Kong (HKU)	0.82	5	0.23	263.4%
15	Yunnan University	0.80	2	0.38	113.3%
16	Fudan University	0.76	3	0.42	81.8%
17	Yanshan University	0.73	1	-	-
18	Shantou University	0.67	2	-	-
19	Shenyang Normal University	0.58	2	0.17	250.0%
20	Dalian University of Technology (DUT)	0.55	3	0.02	2,326.2%
21	Southeast University (SEU)	0.55	1	0.29	90.9%
22	University of Chinese Academy of Sciences (UCAS)	0.50	5	0.41	24.4%
23	Shandong Tianyu Natural History Museum	0.49	3	-	-
24	China University of Petroleum (CUP)	0.48	1	-	-
25	China Medical University (PRC)	0.43	1	0.13	242.9%

Weighted fractional count (WFC) for each institution is shown to two decimal places only. When two or more institutions have the same WFC, their positions are determined by the thousandth place (or beyond).

These results are based on the most recent data available as of 11 September 2014. Owing to continual refinements of the data, the figures in the database are liable to change and might differ to those printed in the supplements.



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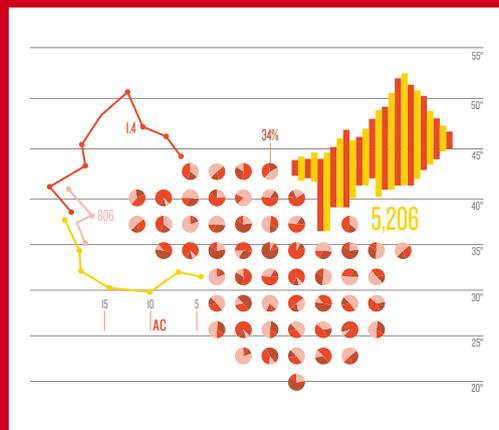
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