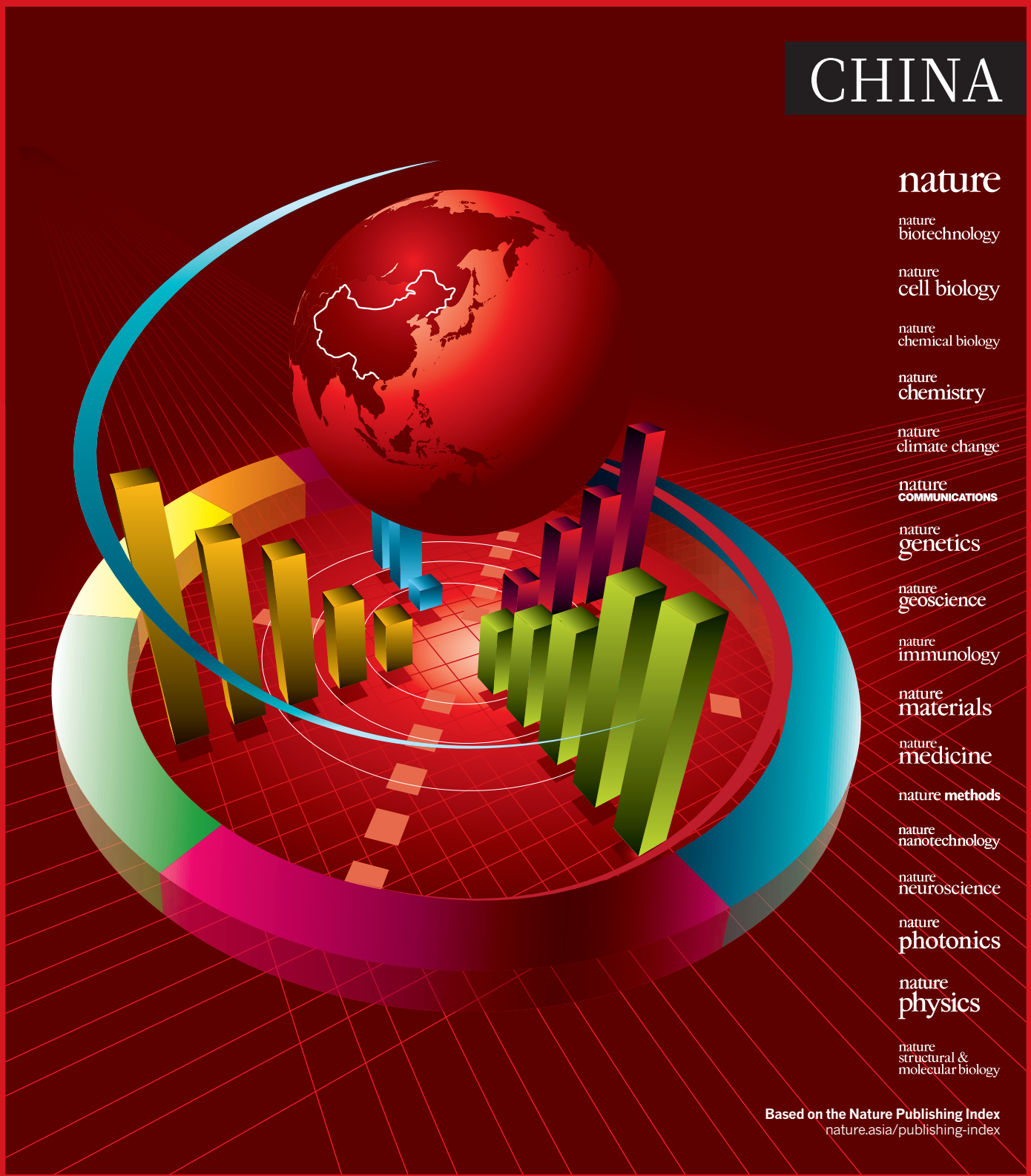
A SUPPLEMENT TO NATURE

nature PUBLISHING INDEX 2012

CHINA



nature

nature biotechnology

nature cell biology

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nature genetics

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nature structural & molecular biology

Based on the Nature Publishing Index
nature.asia/publishing-index

nature.asia/publishing-index-china
30 May 2013

nature publishing group npg

Ghent, Belgium

June 25 - 28

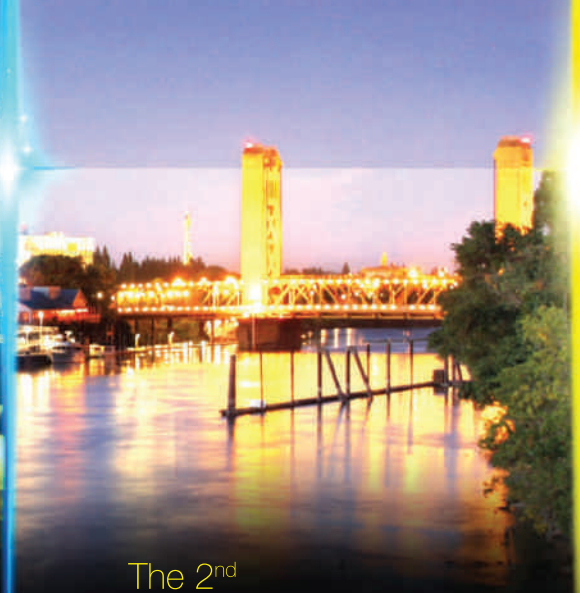
The 2nd International Conference on Genomics in

Europe

Co-organizer : VIB

Sacramento, USA

September 12 -13



The 2nd International Conference on Genomics in the

Americas

Co-organizer : UC DAVIS

Shenzhen, China

October 30 - November 1

The 8th International Conference on Genomics

Co-organizer : GigaScience

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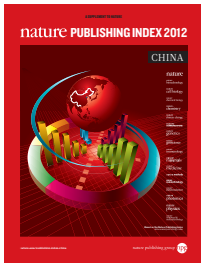
nature PUBLISHING INDEX 2012

CHINA



Cover art: Takeshi Murakami

Editorial
Michelle Grayson,
Herb Brody,
Rebecca Dargie,
Peng Tian,
Tony Scully

Editorial support
Felix Cheung,
Nobuko Miyairi,
Takeshi Murakami

Art & design
Alisdair Macdonald,
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Web & data
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Sachiyo Ikeda

Sales
Gloria To,
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Project Manager
Christian Manco

Publishing
Nick Campbell,
Richard Hughes,
David Swinbanks

Winners and losers. It is in these terms that regular rankings like the Nature Publishing Index (NPI) are often perceived, with the rise of one institution, city or country inevitably leading to the slide of another.

Yet this might be too simplistic a picture. Given the vast number of researchers in China, even a small uniform increase in the quality of their research output will have a huge effect on global progress in science and technology.

So with the rest of the science world looking on, where are the biggest strides being made in this burgeoning powerhouse? The Chinese Academy of Sciences (CAS) continues to be the dominant force (page 10), with the University of Science and Technology of China, Tsinghua University (page 11), Peking University and Shanghai Jiao Tong University (page 12) rounding out China's top 5. These institutions have dominated NPI China for many years (page 8).

In terms of the cities, Beijing and Shanghai still account for the lion's share of the country's high-quality research output (page 16). Meanwhile other major Chinese cities jostle for positions in the top 10, with Shenzhen, Guangzhou and Tianjin (pages 19 & 20) notching up significant achievements this year.

The general landscape of Chinese research is healthy. But there is considerable scope for improvement. Academics have expressed a need to continue the expansion of funding for basic science and to improve the processes for prioritizing to which projects these funds are allocated. There have also been calls for the establishment of a coordinated approach to training and retaining of good researchers as well as more clarity in how the best scientists are recognized (page 2).

In addition, the level of collaboration with international researchers illustrates the direct contribution China is already making to improve its own output alongside that of other nations.

So in many ways, China's rise means that this is one game that is not zero-sum: in science, everyone wins.

Nick Campbell
Head of Nature Publishing Group, Greater China

CONTENTS

NATURE PUBLISHING INDEX 2012 CHINA
The Nature Publishing Index 2012 China, a supplement to Nature, was produced by Macmillan Science Communication, a division of Macmillan Publishers Ltd, for NPG. This publication is an excerpt of weekly updated Nature Publishing Index data researched and produced by NPG Nature Asia-Pacific and accessible online at nature.asia/publishing-index.

Macmillan Science Communication
Nature Editorial Offices
The Macmillan Building
4 Crinan Street,
London N1 9XW, UK
Tel: +44 (0)20 7833 4000 Fax: +44 (0)20 7843 4596/7

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A larger slice of the pie

With a third more papers than last year and a host of new institutions, China's performance in the 2012 Nature Publishing Index is its strongest to date. Our numbers show that the quality of research has improved, but more support for basic science is encouraged.

A recurrent criticism of Chinese science in recent years concerns the quality of research. While there might still be room for improvement, the country's reputation is gaining strength. The growth in China's contribution to the Nature Publishing Index since 2011 is a clear indication of the increase in top-notch scientific output.

This growth is reflected both in the number of institutions represented and in the number of papers in Nature journals they produced. There are 43% more Chinese institutions in the NPI than there were in 2012; 217 institutions contributed to 303 papers — a 35% increase.

Over the past five years, the NPI has grown by more than 40%. Within that, the share attributable to researchers from the Asia-Pacific region has increased from 19% to more than 28%. But China's growth rate has outpaced it all; the country accounts for 30% of all Asia-Pacific articles (see China's growth in the NPI). In 2008, articles featuring China-based authors accounted for 3.6% of the whole NPI; in 2012 it was 8.5%. The Chinese share of corrected count (CC) has similarly risen, from 1.5% in 2008 to 4.2% last year. When articles published in the flagship journal *Nature* alone are considered, the Chinese share of the CC has risen from 1.5% to 2.5%.

GOVERNMENT SUPPORT

These gains can largely be attributed to increased funding. The Chinese government plans to increase research and development (R&D) spending from its 2012 level of 1.75% of GDP to at least 2.5% by 2020. The proportion is small compared with other developed nations (the United States, for example, spends 2.9% of GDP on R&D), but the country's sheer size and rapid economic growth (just less than 10% per annum as of 2011) means China is a scientific force to be reckoned with. The last decade has seen spending on R&D increase by around 20% per year, putting the country in second place — behind only the United States — in total science expenditures.

Private funds are also pouring in. At the end of 2011, US pharmaceutical giant Merck announced it would spend US$1.5 billion over the next five years on R&D in Beijing. Domestic companies are increasingly joining forces with foreign organizations for drug discovery and clinical development. Healthcare policies allocating billions of dollars to drug development are encouraging China's life sciences institutions to become bigger global players.

Look beyond the surface, however, and not all science priorities are optimized. For example, investment in basic science might have grown, but it is still a modest 4.6% of R&D spend. Most developed nations allocate 15–25% of R&D funds to basic science. And in the last ten years, the percentage spend on public institutions has fallen by more than a third, indicating greater reliance on the private sector.

Regulations governing the capacity of institutions to fund research also hinder progress. There is a limit on payments to graduate students and postdocs so that, in most cases, less than 15% of a project's funding can be spent on salaries. These Ministry of Finance-imposed rules are ostensibly to prevent corruption and misuse of state funds, but our interviewees suggest that many good scientists are lost to better-paying jobs elsewhere.

Money is not the only prerequisite for a healthy research sector. There is also the issue of scientific culture. In 2010, Shi Yigong, dean of Tsinghua University's School of Life Sciences, and his opposite number at Peking University, Rao Yi, published an editorial in *Science* criticizing the "unhealthy" research systems of China. They said science was controlled by bureaucrats and elite scientists, and that in order to obtain grant funding, good research was "not as important as schmoozing with powerful bureaucrats and their favorite experts". Others have criticized the scientific elitism in China: in the run-up to the last elections for the Chinese Academy of Sciences in 2011, Gu Haibin, an economist at the Renmin University of China in Beijing, is quoted in a *Nature* article as saying that current academician system reflects '*guan ben wei*' — an entrenched cultural acceptance that political power and status override any other achievement. In those 2011 elections, Shi and Rao were nominated to become new academicians of CAS but failed to get elected.

HEALTHCARE POLICIES ALLOCATING BILLIONS OF DOLLARS TO DRUG DEVELOPMENT ARE ENCOURAGING CHINA'S LIFE SCIENCES INSTITUTIONS TO BECOME BIGGER GLOBAL PLAYERS

SUBJECT STRENGTHS

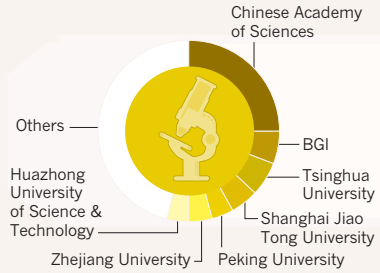
China has a long history of strength in engineering and is traditionally strongest in the physical sciences. Nevertheless, the NPI 2012 shows its growing prowess in life sciences. China was the top Asia-Pacific nation in five Nature journals in 2012: *Nature Biotechnology, Nature Cell Biology, Nature Genetics, Nature Structural & Molecular Biology* and *Nature Methods*. Its strongest showing was in *Nature Genetics*, where China's share of the total CC for the journal was 17%.

Among the institutions, the CAS leads all four NPI subject categories (see 'Subject strengths'). In the life sciences — the biggest component — genetics-focused BGI comes in second. BGI also performed surprisingly well (eighth place) in earth & environmental science — owing to its work in sequencing species such as cotton, maize and tomato (page 13). The earth & environmental sciences is the smallest category in the NPI, and is where some of the more specialized institutions are ranked. For example, the China University of Geosciences and Yunnan University are ranked comparitively highly in this field yet have never made it near China's top ten. Chemistry is perhaps the most evenly spread subject, with 11 institutions claiming at least a 4% share of the corrected count. One reason is that in the NPI, chemistry includes biological chemistry and some structural biology — two key areas for the National Institute of Biological Sciences, Beijing and Tsinghua University (page 11).

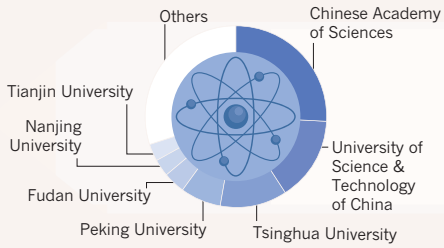
The NPI also reveals the nationalities of China's collaborators. More of China's CC comes from papers co-authored with US researchers than those produced solely by China-based authors. The second biggest collaborator was the UK. As the United States and the UK are the top science nations according to the Global NPI (see nature.asia/publishing-index-global), there are worse countries on which China could model its scientific endeavours. ■

SUBJECT STRENGTHS

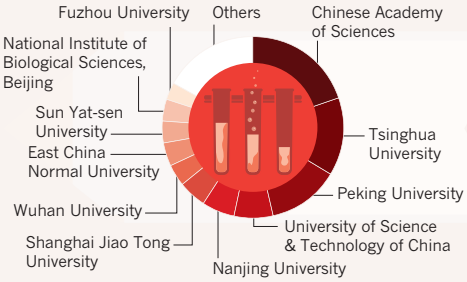
The total corrected count for each subject area, and the split by institution.



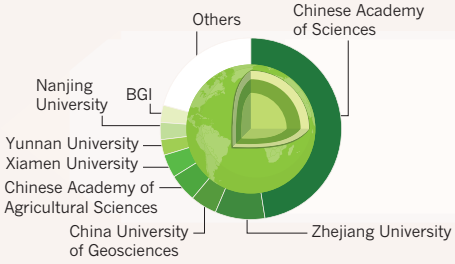
Life sciences
Corrected count:
100.66



Physical sciences
Corrected count:
45.76



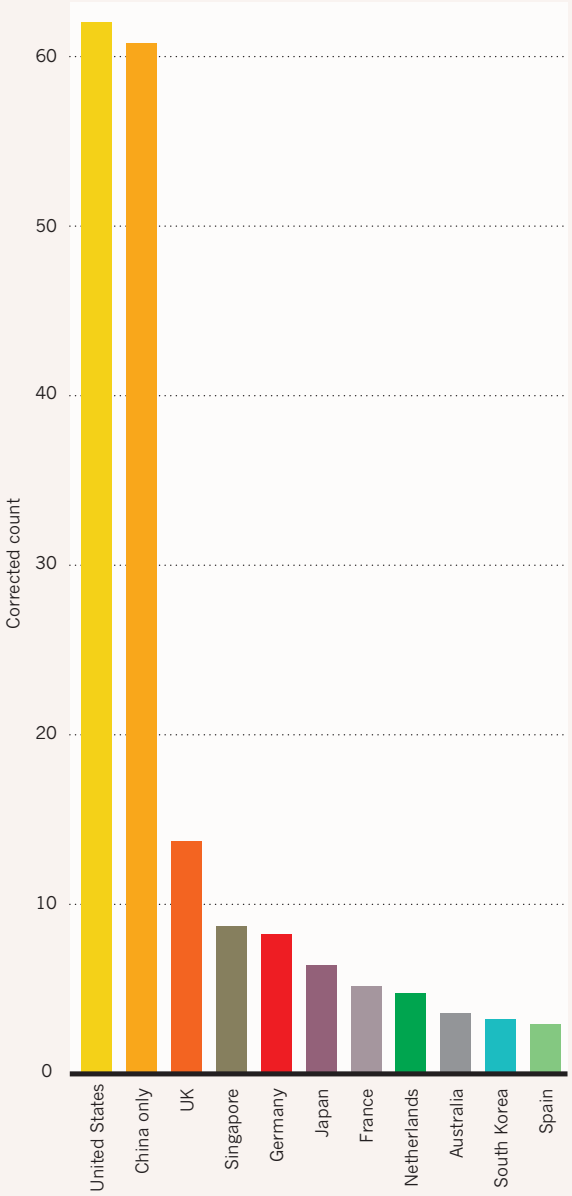
Chemistry
Corrected count:
27.44



Earth & environmental sciences
Corrected count:
20.29

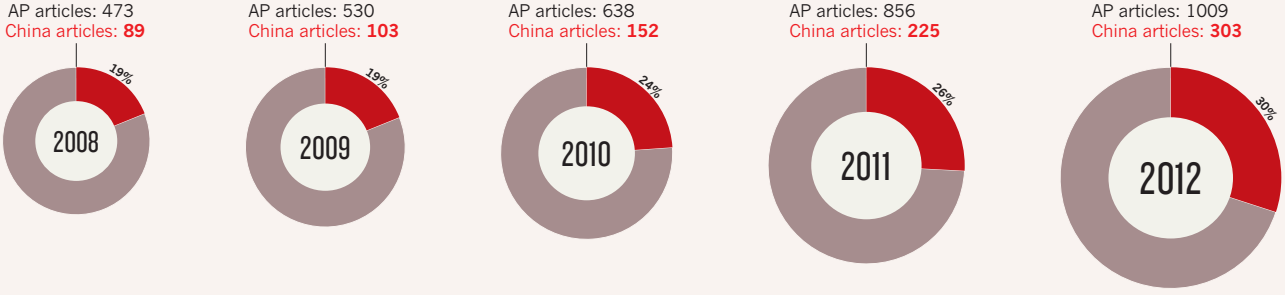
COLLABORATIONS

China's corrected count split by nationality of co-authors. Corrected count from papers with more than one nationality will be double counted. Papers with only China-based authors shown for comparison.



CHINA'S GROWTH IN THE NPI

Along with an increase in the number of articles by Asia-Pacific institutions, the share attributable to China-based researchers also grew.






Chinese Academy of Sciences

ENGINE OF INNOVATION

The Chinese Academy of Sciences (CAS) is the linchpin of China's drive to explore and harness high technology and the natural sciences for the benefit of China and the world. Comprising a comprehensive research and development network, a merit-based, learned society and a system of higher education, the CAS brings together scientists and engineers from China and around the world to address both theoretical and applied problems using world-class scientific and management approaches.

Since its founding, the CAS has fulfilled multiple roles — as a national team and a locomotive driving national technological innovation, a pioneer in supporting nationwide S&T development, a think tank delivering S&T advice and a community for training young S&T talent.

Now, as it responds to a nationwide call to put innovation at the heart of China's development, the CAS has further defined its development strategy by emphasizing greater reliance on democratic management, openness and talent in the promotion of innovative research. With the adoption of its Innovation 2020 programme in 2011, the academy has committed to delivering breakthrough science and technology, higher calibre talent and superior scientific advice. As part of the programme, the CAS has also requested that each of its institutes define its "strategic niche" — based on an overall analysis of the scientific progress and trends in their own fields both in China and abroad — in order to deploy resources more efficiently and innovate more collectively.

As it builds on its proud record, the CAS aims for a bright future as one of the world's top S&T research and development organizations.

History of achievement

The CAS was established on 1 November, 1949, in Beijing, where it is headquartered. It was formed from several existing scientific institutes and soon welcomed over 200 returning scientists who contributed to the CAS the high-level expertise they had acquired abroad.

Since its early years, the CAS has been key to China's S&T planning. In 1956, the central government asked the CAS to oversee preparation of the country's first 12-year national programme for S&T development, which propelled China's drive for modernization of science and technology. Since then, it has participated in the preparation of all national S&T development plans, serving as a national think tank.

With the launch of China's reform and opening-up programme in the late 1970s, the CAS assumed a key role in reforming the country's S&T efforts by encouraging academic openness, scientific collaboration, a multidisciplinary approach and the intensive cultivation of talent. CAS proposals have resulted in the launch of a number of key national scientific programmes including the '863 Program' in 1986, which has propelled China's overall high-tech development, and the '973 Program', or National Basic Research Program, in 1997, which called for the development of science and technology in various fields. Its goal was to align basic scientific research and innovation with national priorities in economic and social development.

In its early years, the CAS contributed to China's economic construction and recorded several important scientific achievements including the synthesis of bovine insulin. It also conducted a comprehensive study of the rise of the Qinghai–Tibetan Plateau. Both key projects proved that the science and technology gap between China and the most advanced countries in the world had already been narrowed. It also made other breakthroughs in basic research at an international, advanced level, such as the development of the function theory

中國科學院 CHINESE ACADEMY OF SCIENCES

of several complex variables in classical domains, the study of the Goldbach conjecture, and engineering control theory. The CAS also took credit for the award of the first PhD in China.

In the early years of opening up, the CAS took the lead in international cooperation as well. For example, the cooperative partnership between Chinese and US scientists in high energy physics that developed during those years has continued up to today. With US assistance in the early stages of the partnership, Chinese scientists quickly developed a high-quality Chinese electron positron collider and related research capabilities. In recent years, the focus of the partnership has centred on the Daya Bay Reactor Neutrino Experiment, which resulted in the discovery of a new kind of neutrino oscillation in 2012, widely believed to be the best physics done in China in the past 30 years.

In 1998, the CAS implemented its National Knowledge Innovation Program (KIP), which ran from 1998 through 2010. As part of KIP, CAS scientists recorded numerous scientific achievements, including sequencing one per cent of the human genome; sequencing the rice genome and isolating important functional genes; developing the Godson general purpose CPU chip; building the Dawning and Shenteng supercomputers; developing coal liquefaction techniques and the technology to convert methanol to light olefins; developing permafrost roadbed technology crucial to the construction of the Qinghai–Tibet Railway; conducting research on climate and environmental changes over the past 2,000 years in environmentally sensitive zones in China; and realizing efficient and long-lived quantum memory with cold atoms inside a ring cavity, among others.

Research strength

CAS scientists conduct research in most areas of basic science and technology as well as strategic advanced technologies and areas related to the public welfare and the development of emerging industries. The CAS comprises over 100 research institutes, 12 branch academies, 2 universities and 11 supporting organizations in 23 provincial-level areas throughout the country. These institutions are home to more than 100 national key labs and engineering centres as well as nearly 200 CAS key labs and engineering centres. Altogether, the CAS comprises 1,000 sites and stations across the country.

The CAS is home to over 85 per cent of China's large-scale science facilities. Eleven of them are currently in operation, including the Beijing Electron Positron Collider (BEPCII), the Experimental Advanced Superconducting Tokomak (EAST), the Shanghai Synchrotron Radiation Facility (SSRF), and the Large Sky Area Multi-Object Fiber Spectroscopic Telescope (LAMOST), among others. CAS is also developing the China Spallation Neutron Source (CSNS) and the 500-metre Aperture Spherical Telescope (FAST), as well as other facilities. The academy also hosts the Chinese Ecosystem Research Network (CERN), which has about 50 core field stations and 100 other stations across the country. CERN conducts monitoring and research involving ecological systems and the environment. The CAS is also home to 13 botanical gardens and 26 herbaria, as well as a 150-TB scientific data storage facility. Environmental research is one of the CAS's traditional strengths. In addition, the CAS publishes 267 academic journals.

The CAS has a staff of 60,700, including about 48,500 professional researchers. Of these, approximately 19,000 are research professors or associate professors. By 2020, the CAS hopes to have a few thousand leading scientists working for the organization. It has long been a CAS strategy to emphasize the combination of research and education and interdisciplinary and cross-sector cooperation in innovation.

Academy scientists now implement about 22 per cent of China's Key Basic Science Projects under the nation's 973 Program. In addition, CAS researchers have won 19 first-class National Natural Sciences Prizes of the 32 awarded. Also, 32 per cent of all researchers named as National Excellent Young Scholars are affiliated with the CAS. Furthermore, 40 per cent of the principle investigators for

key natural science projects funded under the National Natural Science Foundation of China are affiliated with the CAS.

The CAS' most recent achievements include a series of breakthroughs in quantum communication and computing, new progress in the study of re-emerging superconductivity, major breakthroughs in stem cell research and the discovery of a key factor in regulating the development of brain intelligence.

Emphasis on talent

Cultivating, recognizing and deploying talent is a key feature of the CAS — accomplished through the CAS's roles as an educational institution and academic society.

The CAS nurtures young S&T talent through two affiliated universities, the University of Science and Technology of China (USTC) and the University of the Chinese Academy of Sciences (UCAS). The USTC, based in Hefei, capital of east China's Anhui Province, has about 17,800 students, including about 10,000 graduate students. The UCAS, located in Beijing, has about 38,300 graduate students. It is China's first and largest graduate school focusing on the cultivation of next-generation scientists, engineers and innovators. The universities are closely tied with the rest of the CAS. Academy researchers serve — on a visiting basis — as professors at the universities. Similarly, graduate students conduct their research in institutes affiliated with the CAS. As of 2012, 52,000 PhD students have graduated from the CAS.

CAS membership is the highest academic accolade in the field of science and technology in China. Membership is a lifelong honour conferred by the presidium of the CAS, based on a rigorous and limited biennial election process. The three types of Members — Full, Emeritus and Foreign — are grouped into six academic divisions: Mathematics and Physics; Chemistry; Biological and Medical Sciences; Earth Sciences; Information Technology Sciences; and Technological Sciences. These divisions function as a national scientific think tank in partnership with the whole academy. Members provide advice to the government and society on major issues concerning China's economy, social development and S&T progress. In addition, they provide guidance on the development of individual scientific disciplines and on the development of the academy itself. Furthermore, they promote public understanding of science and technology through public lectures and domestic and international cooperation. Currently, there are 727 Full and Emeritus Members, as well as 64 Foreign Members. Fifteen CAS Members have received China's highest national science award — of 20 total recipients.

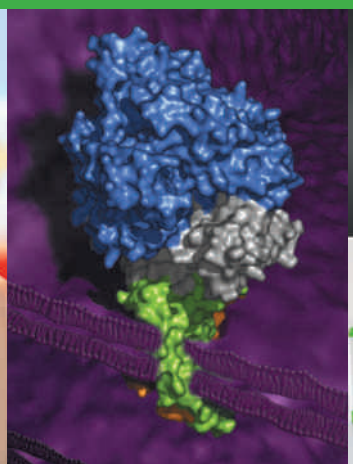
International collaboration

The CAS attaches great importance to international cooperation and has established many productive partnerships with research institutes, universities and corporations around the world. These partnerships include joint research centres, partner groups, research projects, conferences and training programmes, as well as personnel exchanges.

For example, the CAS has set up 20 collaborative groups with the German Max Planck Society (MPG) in areas including astronomy, life sciences and materials science, and has also established the CAS–MPG Partner Institute of Computational Biology. In addition, the CAS and the French Institut Pasteur have jointly established the Institut Pasteur of Shanghai.

CAS scientists have also initiated international science programmes, such as the Third Pole Environment (TPE) Program, the Northwestern Pacific Ocean Circulation and Climate Experiment (NPOCCE) and the International Meridian Project on space weather (IMP). In addition, CAS researchers have taken an active part in global science programmes such as the Human Genome Project (HGP) and the International Thermonuclear Experimental Reactor (ITER) Program, as well as various international programmes on climate change, including IGBP, IHDP, WCRP and DIVERSITAS.

The CAS has implemented several international talent programmes since 2009 such as the CAS Fellowship Program for Senior International Scientists and the CAS Fellowship Program for Young International Scientists. Through these two programmes alone, the CAS has attracted

over 1,000 foreign scientists to conduct research at its institutes. Furthering internationalizing research at the CAS is a firm policy of the organization.

The CAS also attaches great importance to promoting scientific progress in the developing world. Through the CAS–TWAS Fellowship, initiated in 2004, the CAS annually invites about 50 scientists from developing countries to study and undertake research at CAS institutes. It is scheduled to start a PhD training programme for the developing world in 2013 with an annual enrolment of no less than 150.

Innovation 2020: building tomorrow

The CAS' Innovation 2020 aims to further promote innovation and try to turn scientific discoveries into technologies that power economic growth and sustainable development. The programme, which builds on the achievements of KIP, seeks to improve the academy's capacity for innovation and to make a significant contribution to the development of emerging industries.

As part of this initiative, the CAS has pledged to enhance interdisciplinary and cross-sector research. It also aims to improve the quality of research by supporting risky and long-term projects and encouraging scientists to study the frontiers of knowledge, among other things. Importantly, the CAS has pledged to ensure the welfare of its scientists in all practical matters, so they can devote more time and effort to research.

At the same time, the academy's evaluation system, which was previously based in large part on the number and quality of scientific papers, has shifted toward assessing research based on its innovativeness and potential to benefit society.

The academy has collaborated with 30 provincial-level authorities to set up research and development programmes to further regional economic development. It has also established science parks — in Beijing, Shanghai and Guangzhou — to turn basic research into marketable technologies, especially in the areas of information technology, space science, renewable energy and health.

The CAS has strengthened ties with the industrial sector to conduct joint research and commercialize discoveries and has adopted procedures to better protect intellectual property rights. The CAS has established 29 technology transfer or incubation centres and over 250 joint research entities. In 2011 alone, technology transfer contracts for 1,800 technologies generated revenue of RMB 1.7 billion (US$270 million). In addition, over 700 CAS spin-off companies have grossed RMB 263 billion (US$41.7 billion) to date, with pretax profits of RMB 8.7 billion (US$1.38 billion).

The academy continues to promote collaboration with developed nations while encouraging cooperation with developing nations, especially China's neighbours. It also promotes long-term, strategic partnerships with first-rate research institutions, international science organizations and multinational research and development corporations.

Among the key goals of Innovation 2020 is the development of a world-class stem cell research and regenerative medicine programme, which is being undertaken by research centres in Beijing, Shanghai, Guangzhou and Kunming as well as several other institutes across the country. Innovation 2020 has already launched projects on nuclear fusion and nuclear-waste management, materials science, information technology, public health and the environment. Furthermore, it has commenced research to calculate the flux of carbon between land, oceans and the atmosphere. In its drive to develop clean nuclear energy, the CAS has also started a project to develop a thorium-fueled molten-salt nuclear reactor, which aims to offer an alternative, environmentally safe source of energy.

With Innovation 2020 and the academy's new management initiatives, the CAS is confident of being an innovation powerhouse for China as it meets the challenges of the twenty-first century. ■

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http://english.cas.cn/

Top Chinese institutions 2012

China's top ten institutions dominate the NPI, but the addition of more than 100 new entrants in 2012 shows the breadth of the country's scientific enterprise. Away from the mainland, however, the story is very different.

There were an unprecedented number of Chinese institutions in the Nature Publishing Index in 2012 — 217, up from 152 the year before. Nearly half of the total (107) were appearing for the first time, with 26 coming straight into the China Top 100 (page 26). Most debut institutions contributed a solitary paper, giving them a corrected count (CC) of less than 1. Of the 217 Chinese institutions, 51 are also in the Asia-Pacific Top 200 (page 38), and 4 are in the Global Top 100, up from 3 last year (page 42).

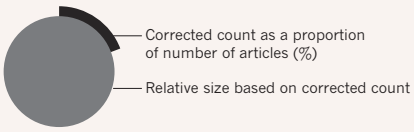
It is easy to be awed by the Chinese Academy of Sciences (CAS), with a CC four times that of the second-placed institution, the University of Science and Technology of China (USTC; which it also controls). CAS is by far the biggest research institution in the country, employing around 60,000 people across more than 100 institutes. CAS's output has been growing year on year: it published 50% more papers in Nature journals in 2012 than it did in 2011, lifting it from 23rd to 12th in the global rankings.

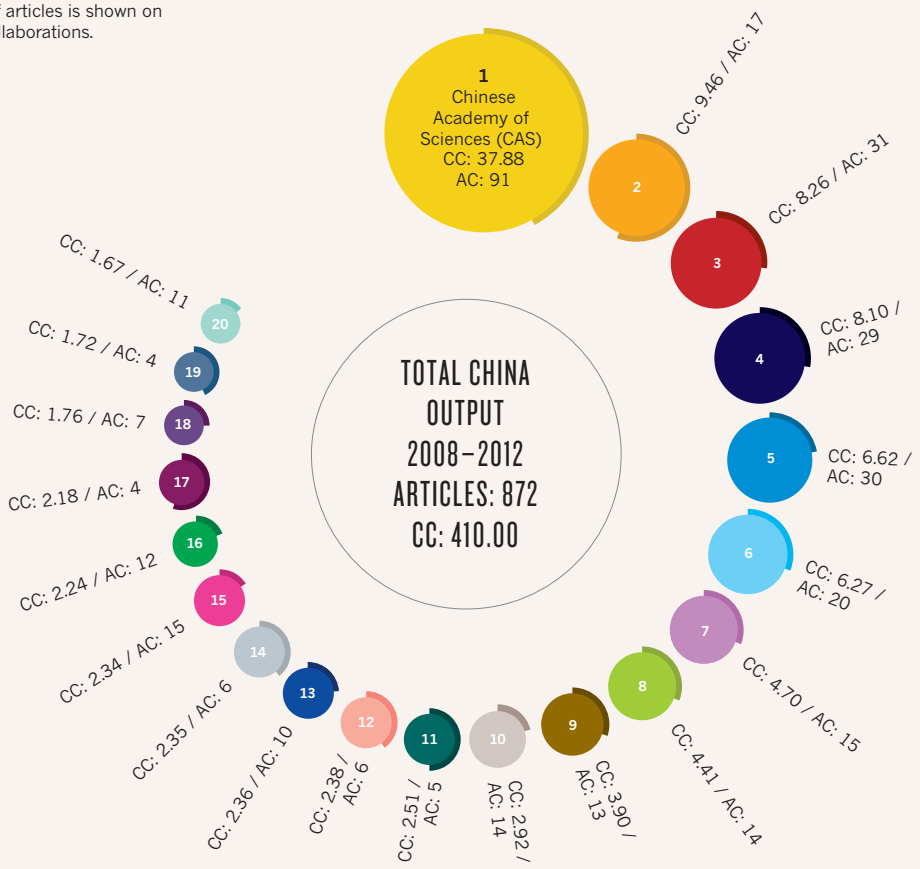
More traditional universities lie below CAS in the NPI. Six of the top 10 institutions are in the C9 League — a group of universities representing the elite research facilities in China. The three from the League that did not make it are Nanjing University (14th in China in 2012, although it did reach 9th place in 2011), and two specialist engineering and technology schools that do not focus on the type of basic research published as the Nature journals' core content: Xi'an Jiaotong University (30th) and Harbin Institute of Technology, which didn't make the NPI at all in 2012.

Comparing each institution's article count to its corrected count gives an average CC per paper and indicates how collaborative an institution is: the closer the two numbers are, the fewer external contributing

RESEARCH OUTPUT

The size of the bubble corresponds to each institution's corrected count for 2012. The ratio of corrected count to number of articles is shown on the circumference: a shorter line indicates more collaborations.





authors (for a description of the difference between article count and corrected count, see 'Guide to the NPI' on page 24). Institutions such as BGI, which do a lot of multinational sequencing projects, have a high ratio of article count to CC; one of the lower ratios is that of the USTC, which has strong in-house teams able pilot the studies with less outside input. Generally, the top ranking institutions tend to have lower article count-to-CC ratios.

CHANGING TIMES

China's top 10 represent about 60% of the country's total CC (see 'Institutional split'). These institutions have consistently ranked highly — though not always in the top 10 — over the past five years. However, the proportion of China's CC that is attributable to CAS alone has dropped from around 40% in 2008 to around 25% in 2012 — a testament to the increasing high-quality output of the other nine institutions.

To get a better indication of institutions' comparative performance unclouded by publishing blips, we can look at cumulative totals. While this supplement covers only the last five years (see page 26), there are historical data available online (nature.asia/publishing-index-china). For 2008 to 2012, the rankings of the top four institutions are the same as they are in 2012: CAS, with a fourfold lead over USTC, followed in quick succession by Tsinghua University and then Peking University. Shanghai Jiao Tong University (SJTU) and BGI are the next two, in reverse order to their 2012 positions. The outlier is the National Institute of Biological Sciences, Beijing, which is in 10th place in the five-year cumulative rankings but only comes in at 17th position in 2012.

There are many ways to graph the output of China's top 10 over the last five years, and the method chosen affects the trends that appear. Simply recording the CC for each institution ('Institutional publishing trends'; top graph) shows the dominance of CAS.

However, taking 2008 as the starting point and charting the relative change over time (bottom graph), two other star performers emerge: Zhejiang University (ZJU) and SJTU.

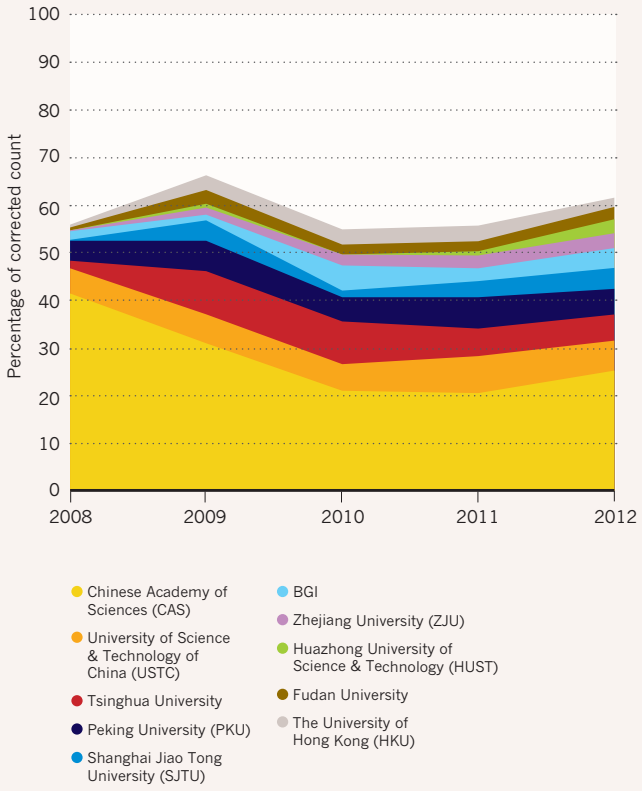
Over the past five years, these two have improved their CC by a factor of at least 60. While such a trajectory would be difficult to maintain, these institutions have a chance to reach the top four in coming years.

HONG KONG SLIPPING

Away from the mainland, it has not been a good year for Hong Kong. There are six institutions in the 2012 NPI; the Hong Kong Baptist University makes its debut at 91, while the other five have slipped down the ranking. There were two Hong Kong institutions in the top 10 in 2011: the Hong Kong University of Science and Technology (HKUST) was 5th but is now 11th; and the University of Hong Kong (HKU) fell from 8th to 10th, despite contributing to more articles. It is a similar picture further down the ranking: the Chinese University of Hong Kong has fallen from 18 to 22; the Hong Kong Polytechnic University has its lowest ever ranking at 41 (although it missed the NPI entirely in 2011); and the City University of Hong Kong, in only its second year in the NPI, has plummeted from 38 to 86. A contributing factor is the paucity of funding. Hong Kong's leaders allocate just 0.7% of GDP to R&D. And as mainland institutions rise, Hong Kong is looking like it is being left behind.

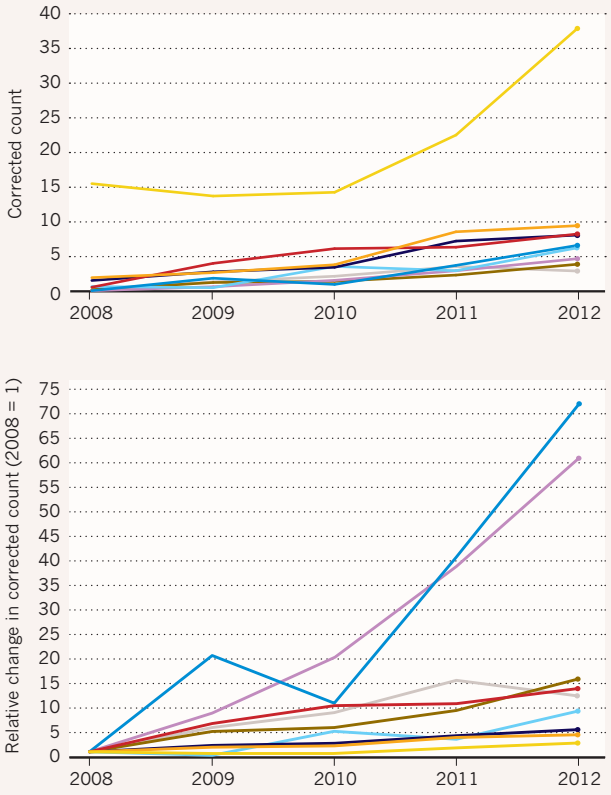
INSTITUTIONAL SPLIT

Over the past five years, the top ten institutions have accounted for 55–65% of China's total corrected count.



INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top nine institutions since 2008 (HUST is excluded for lack of data).



CHINESE ACADEMY OF SCIENCES

A behemoth with strength in all scientific areas, CAS has an iron grip on the number one rank.

1
CC: 37.88
AC: 91

Locations:
Beijing, Shanghai, Changchun, Chengdu, Dalian, Fuzhou, Guangzhou, Guiyang, Kunming, Lanzhou, Nanjing, Ningbo, Shenyang, Shenzhen, Suzhou, Taiyuan, Urumqi, Wuhan, Xi'an, Xiamen Xinjiang, Xining, Xishuangbanna and Yantai

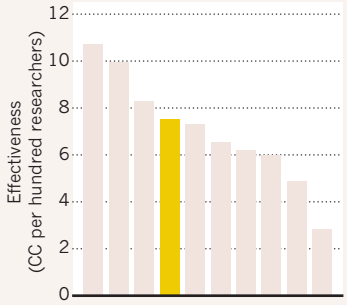
Established: 1949

Academic staff: 48,400

Students:
PhD candidates: 18,659
Master candidates: 19,661
Undergraduate students: 0

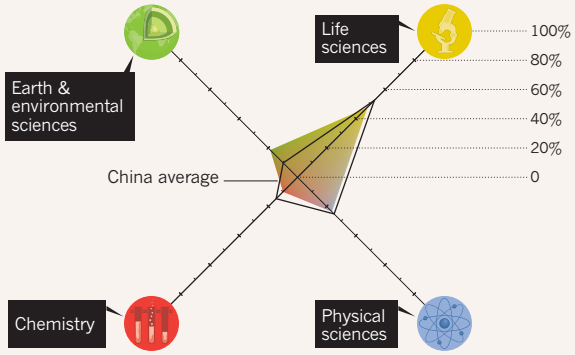
RESEARCHER EFFECTIVENESS

Corrected count divided by number of unique author names.



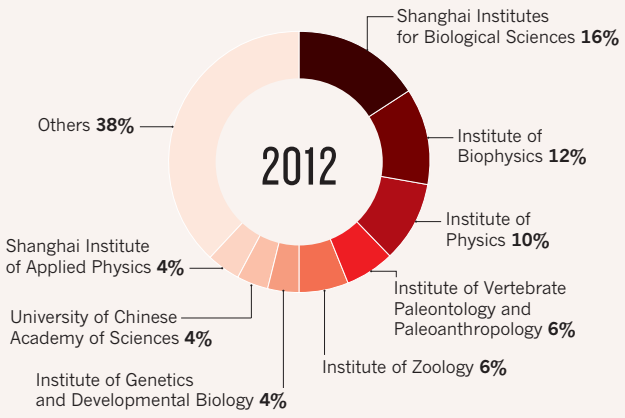
SUBJECT STRENGTHS

How the corrected count is split by subject category.



CAS INSTITUTE BREAKDOWN

CAS has more than 100 affiliated institutions, of which 47 are in the 2012 NPI. The affiliates making the largest contribution by corrected count are shown.



CHINESE ACADEMY OF SCIENCES (CAS)

Established in 1949, the same year as the People's Republic of China, CAS is the supreme research institution nationally and increasingly across the Asia-Pacific region. In the 2012 Asia-Pacific NPI it ranked second, but since January 2013 it has moved into first place on a rolling 12-month basis (see nature.asia/publishing-index).

CAS comprises two universities: the University of Science and Technology of China (USTC; ranked 2nd in the China NPI) and the University of Chinese Academy of Sciences (UCAS; known until July 2012 as the Graduate School of CAS). CAS's research strengths have traditionally been in physics, chemistry and palaeontology. It has more than 100 affiliated institutes across the country — 47 of which published in Nature-branded journals in 2012.

CAS institutes

The most prolific CAS affiliate in 2012 was the Shanghai Institutes for Biological Sciences (SIBS), which contributed to 14 articles for a corrected count (CC) of 6.02. SIBS is particularly strong in genomics, cell signalling pathways and neuroscience. In 2012 the institute had one wholly authored paper (CC: 1.0) in *Nature Cell Biology*, on the mechanisms that control cilia assembly.

The second CAS affiliate is the Institute of Biophysics (IBP) which also had 14 articles but has a lower corrected count than SIBS (4.50). IBP houses two national labs: the National Laboratory of Biomacromolecules and the State Key Laboratory of Brain & Cognitive Sciences, and is building a third: the National Laboratory of Protein Science. Structural biology is the specialism of the biomacromolecules lab; more than half of the IBP's corrected count in 2012 came from four articles in *Nature Structural & Molecular Biology*.

The third ranked CAS affiliate, the Institute of Physics (IOP) with nine articles (CC 3.6), had a paper about iron-based superconductors published in *Nature* in 2012.

The fourth affiliate is CAS's Institute of Vertebrate Palaeontology and Palaeoanthropology (IVPP), which published four articles in 2012. The IVPP benefits from access to China's extensive shale beds, which yield impressive specimens. Its most noteworthy paper, published in *Nature* in April, described fossil evidence for a giant feathered dinosaur.

Fifth is the Institute of Zoology (IOZ), which also published four papers in 2012, including one in *Nature* about the development of viable embryonic stem cells with only one set of chromosomes.

Young talent

A rising star at IOZ is Zhao Xiaoyang who, with a team that included his dissertation advisor Zhou Qi, published the *Nature* paper. Zhao graduated only two years ago, and is already a principal investigator (PI) with the Group of Pluripotency Regulation and Stem Cell Research.

Unlike many other young Chinese PIs, who further their post-graduate studies abroad, Zhao has no international experience. He considered a postdoc position in the US, but Zhou persuaded him to stay at IOZ, promising a fast-track career.

Zhao recalls Zhou's advice: "In the US, you will spend the most fruitful period of your life in a postdoc position. You will make better progress at home, building your own research team."

But, autonomy has a price. "Competition in stem cell research is very intensive; I have never had a chance to take a break," he says. These demands are compounded by a lack of investment from China in PhD students and post-docs. "I am frustrated that my team isn't getting good systematic training," Zhao says.

The incentives for young researchers to leave China are strong. The professional careers of Chinese researchers are greatly enhanced should they return, so even top institutions like CAS struggle to retain talent. "It is going to be a long-term problem if China cannot keep young scientists during their most creative years by providing better training, rewards and opportunities," Zhao says.

THE UNIVERSITY OF SCIENCE & TECHNOLOGY OF CHINA (USTC)

USTC was established in September 1958 in Beijing by the Chinese Academy of Sciences (CAS) and moved to its current location of Hefei, Anhui Province in the early 1970s. It houses a number of prominent and well-funded national and provincial laboratories, some which are operated in conjunction with CAS. Among these 'Key Laboratories' are the National Synchrotron Radiation Laboratory, Hefei National Laboratory for Physical Sciences at Microscale (currently under construction), the Laboratory of Particle Detection and Electronics — which was made a State Key Lab in 2011 — and the National High Performance Computing Centre.

Physicist Pan Jianwei leads one of the foremost groups for research into quantum information and communications. Last year was a particularly productive year for his team, which published two papers in *Nature* and one each in *Nature Photonics* and *Nature Physics*. An in-depth article describing his work on long-distance quantum teleportation was selected by *Nature* editors as one of the magazine's best features of the year in 2012.

Pan has been working with the China National Space Administration to develop a satellite dedicated to gathering information about quantum physics and teleportation. He describes the satellite — scheduled for launch in 2016 — as a major step in quantum communications, which may support secure, encrypted communication between Asia and Europe. He is proud of the fact that China can be a leader in quantum communication. "Not every nation can do this," he says. Along with support from China's space agency, Pan also acknowledges the support from USTC, which "is willing to put emphasis on basic research" — research that in this case has led to potential new applications, he says.

Pan is working to establish a co-operative centre for quantum communications, supported by China's current five-year plan, that will promote collaboration as well as supporting the most promising researchers. "The project will be exempt from regulations that limit the amount of funding each principal investigator can apply for," he says.

TSINGHUA UNIVERSITY

Founded in 1911 in Beijing, Tsinghua University is one of China's most prestigious universities. Its alma mater include China's current president and his predecessor who both studied engineering — Tsinghua's specialism during the mid-twentieth century. These days, the university is strong in most scientific areas, and is especially recognized for structural biology.

Shi Yigong is an eminent structural biologist. He graduated from Tsinghua University in 1989, before moving to the United States, for a period that culminated in 11 years at Princeton University's Department of Molecular Biology. He returned to Tsinghua in 2008 and in 2009 became dean of its School of Life Sciences.

Emulating Shi's achievements is Yan Nieng, who graduated from Tsinghua in 2000 and went to study at Princeton under Shi. Her stellar career has mirrored that of her mentor as she too returned to her old university in 2007 to become the youngest professor at Tsinghua. Yan was the lead author of two *Nature* papers last year that reported the crystal structures of a glucose transporter and a sodium channel.

Yan is happy to be back at Tsinghua. "I have a lot of young colleagues. It's easy to find a collaborator for brainstorming," she says. In terms of funding and mentoring, Yan doesn't see "much difference between Tsinghua and Princeton", but she is critical of the wider Chinese research culture.

"The community should provide better support to young researchers: to give us more tolerance and encouragement, to make us more confident, and to establish a credit-based (rather than seniority-based) evaluation system for scientific research."

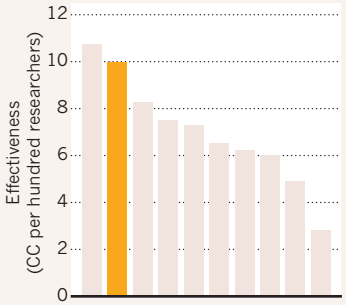
In 2012, Yan was among the first group of researchers to receive an International Early Career Award from the Howard Hughes Medical Institute (HHMI). The HHMI president, Robert Tjian, described the award, worth US$650,000 over five years, as being for "people who, in 10 years, we expect will be the scientific leaders in their countries".

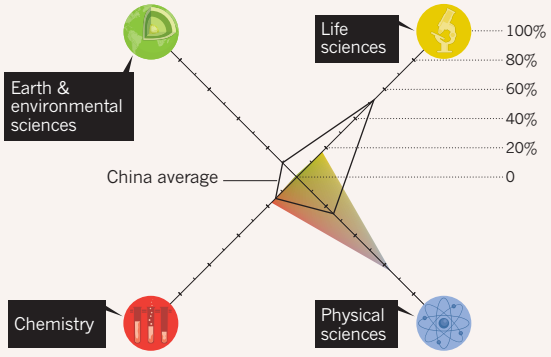
THE UNIVERSITY OF SCIENCE & TECHNOLOGY OF CHINA

Cementing its second place, USTC's efficient researchers are focused on the physical sciences.

2
CC: 9.46
AC: 17

Location: Hefei
Established: 1958
Academic staff: 1,553
Students:
PhD candidates: 1,900
Master candidates: 6,200
Undergraduate students: 7,400



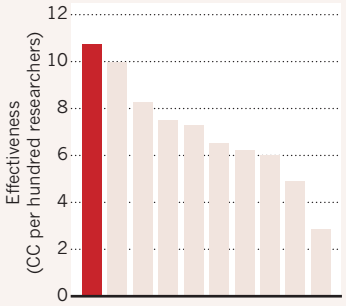


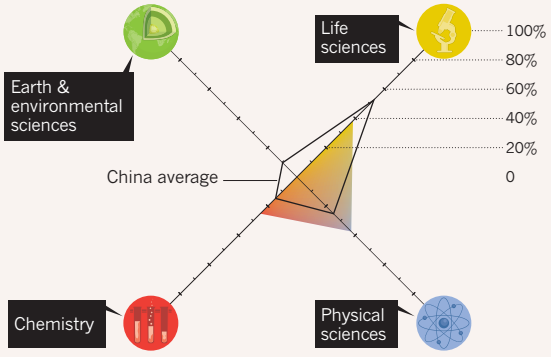
TSINGHUA UNIVERSITY

Top for researcher effectiveness and third overall, Tsinghua is strong in three of the four NPI subject categories.

3
CC: 8.26
AC: 31

Location: Beijing
Established: 1911
Academic staff: 3,196
Students:
PhD candidates: 9,357
Master candidates: 16,524
Undergraduate students: 15,184

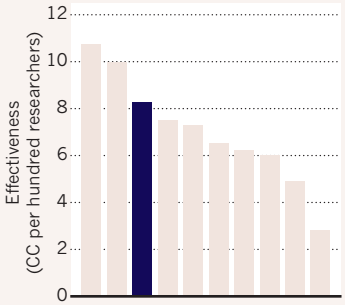


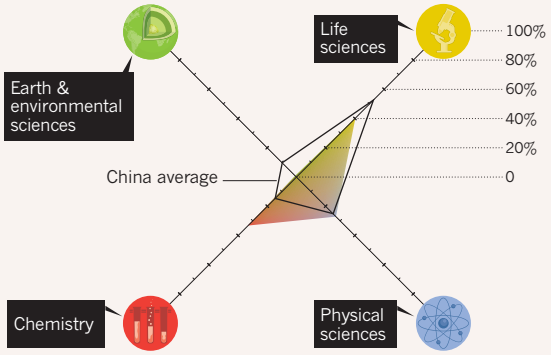


PEKING UNIVERSITY

PKU's research spans a wide range of disciplines, with particular strength in nanotechnology, materials science and structural biology.

Location: Beijing
Established: 1898
Academic staff: 4,146
Students:
PhD candidates: 5,088
Master candidates: 10,031
Undergraduate students: 15,128

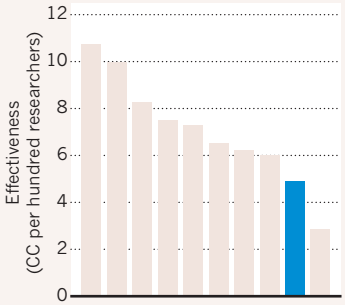


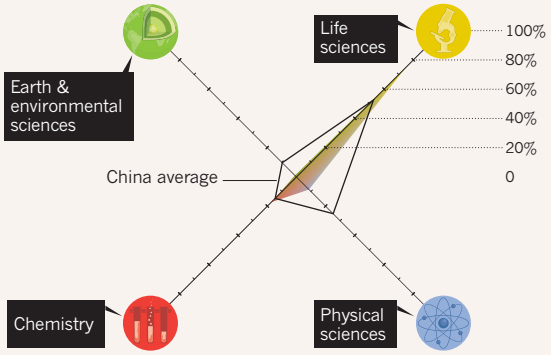


SHANGHAI JIAO TONG UNIVERSITY

Already pre-eminent in genetics, fifth-ranked SJTU is gaining a reputation in bone research.

Location: Shanghai
Established: 1896
Academic staff: 2,873
Students:
PhD candidates: 5,666
Master candidates: 12,851
Undergraduate students: 16,116





PEKING UNIVERSITY (PKU)

PKU's research spans a wide range of disciplines, with particular strength in nanotechnology, materials science and structural biology.

Peng Hailin, a physical chemist at PKU's College of Chemistry and Molecular Engineering, is a scientist with a typical background for a young researcher at the university. He completed a PhD at Peking University in 2005, followed by postdoctoral research at Stanford University in California before returning in 2009. In 2012, Peng published research on topological insulators in *Nature Chemistry* and on graphene in *Nature Communications*.

"The gap in the quality of research between the world's best institutions and China's best institutions, such as PKU, has become smaller," Peng says. And because of the sluggish US economy and constraints on the academic research budgets, Chinese scientists working in the United States might find that going back to China "is a good choice," he adds.

"The Chinese government has put huge investment into research: some young scientists can get more funding in China than in the States."

PKU published one paper in 2012 that was entirely authored by its own scientists — a study, detailing the crystal structure of an essential signalling adaptor of the immune system, that appeared in *Nature Structural & Molecular Biology*. PKU's life sciences output has increased over the past decade since it merged with the Beijing Medical University to create the Peking University Health Science Centre.

Physics is also well represented at PKU, which established the International Centre for Quantum Materials (ICQM) in 2010. Members of ICQM include a Nobel laureate in physics, Daniel Chee Tsui, who was enticed back to China from the United States to establish his own lab at PKU. In 2012, ICQM received 160 million yuan (US$26 million) in government funding to become the leading partner of the quantum materials part of 'Plan 2011', which aims to promote co-operation and creativity among Chinese universities.

SHANGHAI JIAO TONG UNIVERSITY (SJTU)

Having contributed to 30 papers in 2012, SJTU improved its NPI China ranking from 7th to 5th. The university traces its history back to Nanyang Public School, founded in 1896.

In the 1930s, the school became renowned for engineering research, being home to China's early aerospace and nuclear bomb development efforts. It lost a significant amount of its engineering faculty in the 1950s under a government scheme to create a specialist engineering school in Xi'an.

The departments remaining in Shanghai were renamed SJTU, and merged with Shanghai Second Medical University in 2005.

Now SJTU's greatest strength is in genetics research, complemented by work at its subsidiary hospital. A third of its NPI papers last year were published in *Nature Genetics*. Li Baojie, a developmental biologist in SJTU's Bio-X — an interdisciplinary institute similar to the one at Stanford University, California — explains how the duality works to make SJTU so effective.

"After discussing our research with a clinician, we can adjust our targets to give us better clinical problem-solving direction," he says. "It's very helpful to ensure our research is relevant since our aim is to save people's lives."

Beyond genetics, SJTU is rapidly establishing itself as a leader in research on bone disease. One of Li's key papers last year in *Nature Cell Biology* was the culmination of more than three years of research into the stem cell defects underlying ageing-related osteoporosis.

Four laboratories focus on different aspects of bone-related research, including genetics, stem cells (Li's group), skeletal development, functional genomics and signalling transduction. Bio-X is looking to recruit more investigators to further extend its capabilities. Says Li: "We want to be the centre of skeleton research — not only in China, but also competitive on the world stage."

BGI

BGI contributed to 20 papers in Nature research journals in 2012. Appropriately for an institution that was historically called Beijing Genomics Institute, these all covered genome sequencing and analysis. Some of this work looked at agriculturally and environmentally important species, which accounts for BGI's contribution to the earth & environmental sciences.

BGI was established in Beijing in 1999 to participate in the Human Genome Project. Some of the founders were staff members in the Human Genome Centre at CAS. However, under this auspice, its potential for commercial expansion was limited and, in 2007, some of the founders and other scientists left CAS and founded a new non-profit institution for genomic research in Shenzhen. A year later, they registered a private company at the same site to do the commercial 'omics' services.

In recent years, BGI has also established commercial subsidiaries in scientific services (BGI Tech), reproductive health (BGI Health) and agriculture (BGI Agro), in addition to its non-profit centres for research (BGI Research) and education (BGI College). The commercial and non-profit units work collaboratively: "Most of the committee members for the non-profit parts are also on the board of directors for the businesses," says Wang Jun, BGI's executive director.

2012 was a busy year for BGI. In September it announced ambitions to acquire Complete Genomics, a US manufacturer of genome sequencers. The move was contested by Illumina, another instrument maker, but the acquisition went ahead in March 2013.

Wang disagrees with critics who, he says, dismiss BGI's output as "simply data accumulation". He maintains his institution conducts well-designed experiments and analysis, citing as an example his *Nature* paper on gut microbiota in type 2 diabetes. BGI had responsibilities "from the idea, through the scientific hypothesis and experiment design to finishing the experiments and analysing the sequencing results; all of which provide clues for the treatment of type 2 diabetes," Wang says. "This work goes far beyond sequencing. This is the real strength of BGI."

ZHEJIANG UNIVERSITY (ZJU)

ZJU is one of the oldest universities in China, having been established in 1897 as Qiushi Academy. It has long been a cornerstone of Chinese higher education and scientific research.

In 1948, ZJU was one of the first Chinese universities to adopt the Soviet Union academic model by dividing into several colleges, each with a focused speciality — some of which became independent universities. Then, in 1998, these separate entities were re-aggregated into an extensive, comprehensive university.

While historically ZJU was focused on technology and engineering, the university's greatest strength today is in the medical and life sciences — notably immunology and neurobiology.

In 2012, ZJU's School of Medicine published two key papers: one in *Nature Neuroscience* on a potential new drug target for epilepsy, and one in *Nature Immunology* about a new signalling molecule involved in T cell maturation. And its College of Life Sciences published a paper about RNA alternative splicing mechanisms in *Nature Communication* (CC 1.0).

Lu Linrong was lead author on the *Nature Immunology* paper. He obtained his PhD in 1998 from the Shanghai Institute of Biochemistry (one of the predecessors of the Science Institute of Biochemistry and Cell Biology) and then, like many leading Chinese researchers, spent 10 years in the US before joining ZJU in 2008.

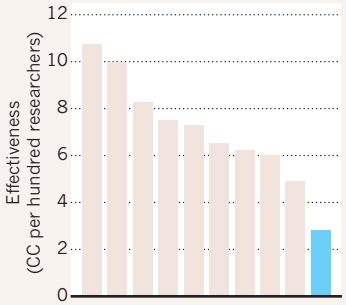
Lu is optimistic about the future of Chinese research institutes, which he says "could come to dominate in many areas." However, he calls for reform of the Chinese higher education system, which allows scientists to work for only two years at any institute, a limitation that he says is detrimental to a researcher's career path and to the institute's ability to attract and retain the best people. Lu says the two-year rule is one of the reasons so many Chinese scientists leave for the US.

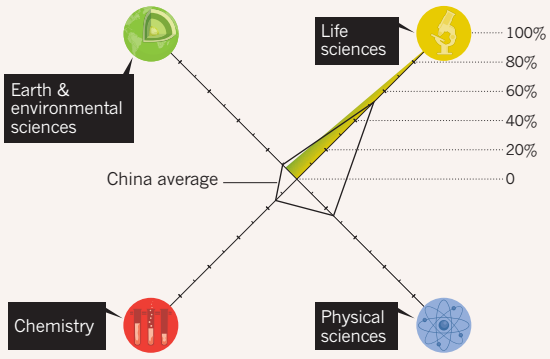
He adds that the limit on researcher's remuneration is another major factor in attracting and retaining good scientists.

BGI

In 2012, BGI rose to sixth place from tenth, having doubled its corrected count.

Location: Shenzhen
Established: 2007
Academic staff: 4,000*
(* estimated)

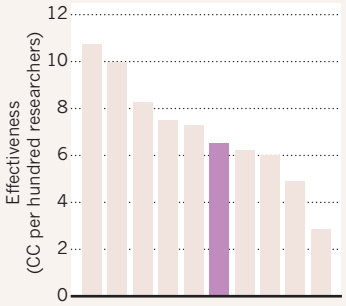


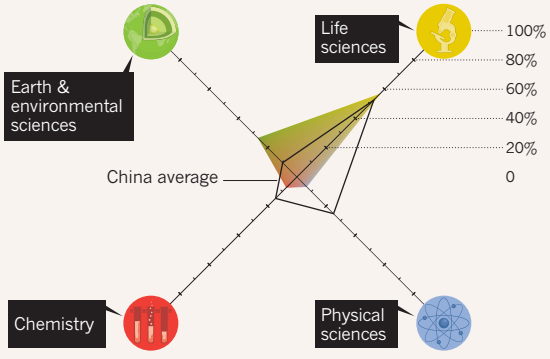


ZHEJIANG UNIVERSITY

A good year for ZJU, in which it nearly doubled its article count and climbed from 37th to 7th place.

Location: Hangzhou
Established: 1897
Academic staff: 3,146
Students:
PhD candidates: 7,737
Master candidates: 13,868
Undergraduate students: 22,664



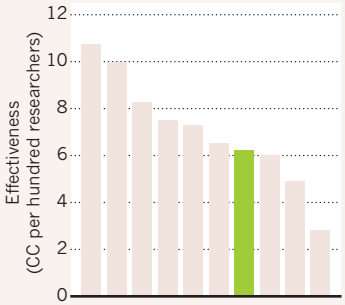


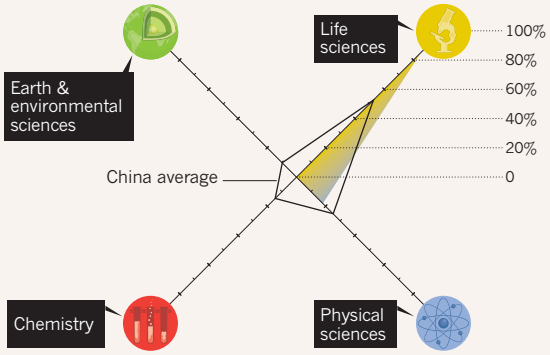
HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

HUST has made it into China's top ten for the first time, an impressive rise from 25th place in 2011, largely because of strong life science research.

8
CC: 4.41
AC: 14

Location: Wuhan
Established: 1952
Academic staff: 6,611
Students:
PhD candidates: 6,282
Master candidates: 16,493
Undergraduate students: 32,863



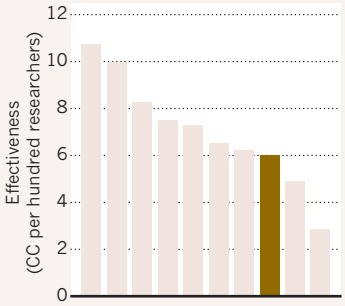


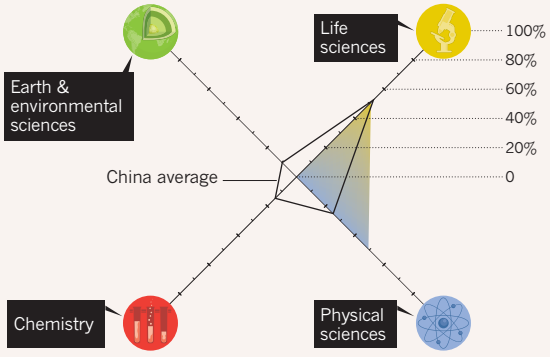
FUDAN UNIVERSITY

Breaking into the top ten this year, Fudan is stronger than average in the physical sciences.

9
CC: 3.90
AC: 13

Location: Shanghai
Established: 1905
Academic staff: 2,346
Students:
PhD candidates plus
Master candidates: 13,851
Undergraduate students: 13,237





HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY (HUST)

Located in Wuhan, Hubei province, HUST was founded in 1953 as the Huazhong Institute of Technology by merging the electrical and mechanical engineering departments of several universities, under the direction of the central government's first five-year plan.

Throughout most of its history, HUST has been prominent in technology and engineering, notably for its work on lasers. As well as hosting the State Key Laboratory for Laser Technology, the university also manages the Wuhan National Laboratories for Opto-electronics (WNLO). But since 2000, after merging with Tongji Medical University, HUST has had greater life sciences strength; life sciences papers account for around 80% of HUST's corrected count in 2012.

Of the 14 articles published last year by HUST scientists, 8 were in *Nature Genetics*. The lead author on one of these papers was Liu Jingyu, a geneticist in HUST's School of Life Science and Technology. Liu provides a rare example of success for a Chinese researcher who has not studied or worked in the West.

After earning her PhD in cell biology from Northeast Normal University in 2001, Liu did four years of postdoctoral research at Wuhan University. She was inspired to join HUST by geneticist Wang Qing, who had just returned from the US to become the director of HUST's Human Genome Research Center (and who is now the dean of its School of Life Science and Technology). "Professor Wang gave a presentation at Wuhan University, and I asked him several questions," Liu recalls. "He appreciated my ideas and invited me to HUST."

Aside from genetics, HUST also has notable achievements in the use of biomaterials for treating and studying cancer. In 2012, Huang Bo (then a researcher at HUST's Tongji Medical College) published two high-scoring papers in this area: one in *Nature Materials* (CC 0.75) in collaboration with Wang Ning, a visiting biomechanics professor at the University of Illinois at Urbana-Champaign; and the other in *Nature Communications* (CC 0.96).

FUDAN UNIVERSITY

Fudan University is one of China's oldest. It was founded in 1905 as a private university, called Fudan College. It became public in 1941, and was one of the first to adopt the Soviet education model in 1952.

Fudan specializes in fundamental scientific research and technology. Its main strengths lie in physics, material science and — since its merger with Shanghai Medical University in 2000 — medical research.

Fudan was one of the first universities in China to enrol international students and currently has almost 3,000 foreigners pursuing studies.

Zhou Lei, a respected physicist specializing in metamaterials who joined Fudan University in 2004, notes that there is still a big gap between famous universities like Harvard in Cambridge, Massachusetts, or specialist institutions like Purdue in Indiana (which is strong in engineering and metamaterials) and the output of Chinese science institutions.

"Their experience enables them to move faster than us," he says. But, he adds, China is catching up. "We have more and more outstanding researchers coming back to look for faculty membership."

Zhou says that one way for Chinese researchers to make a name for themselves is to identify niche areas and avoid fierce competition surrounding the hot topics.

Since 2005, he has pioneered a branch of photonics he calls gradient-index meta-surfaces — developing materials with unique and useful properties by varying their refractive indexes. Last year his team published a high-scoring Letter about this field in *Nature Materials* (CC 0.92).

Zhou has difficulty, however, in recruiting suitable researchers, especially postdocs. One problem, he says, is that the government puts a limit — of 15% per project — on how much he is allowed to spend on human resources (see page 2). These constraints are particularly detrimental to new fields in which the pool of experienced candidates is small.

THE UNIVERSITY OF HONG KONG (HKU)

HKU is the oldest university in Hong Kong. It has an excellent reputation in medical research, cultivated by its forerunner, the Hong Kong College of Medicine for Chinese, which was founded in 1887. HKU is particularly strong in genetics: 6 of its 14 papers in 2012 were published in *Nature Genetics*; its highest scoring publication was an article describing a new algorithm for fast and accurate detection of single nucleotide polymorphisms (SNPs), published in *Nature Communications* (CC 0.98).

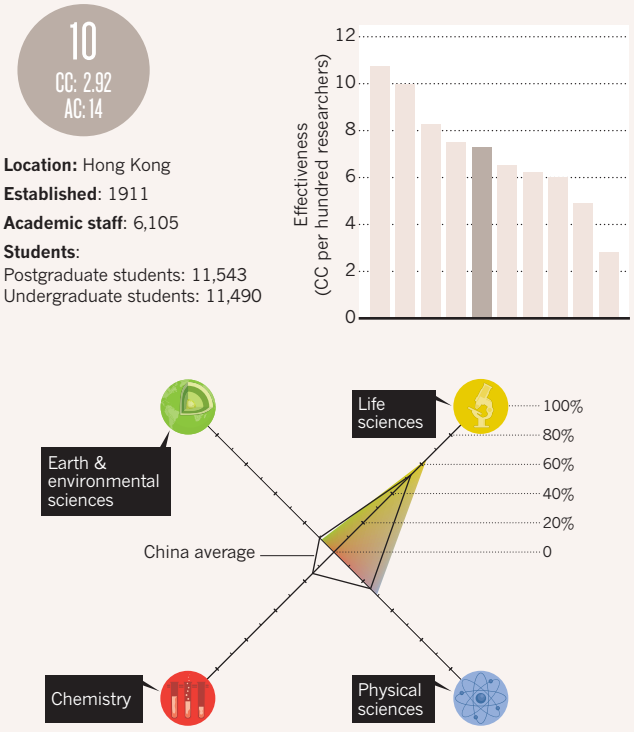
Life sciences are not its only focus. In 2012, HKU earned about 30% of its corrected count from papers in the physical sciences, slightly more than the average for Chinese institutions in the NPI. Yet investment in research in non-medical fields at HKU — and indeed at other Hong Kong institutions — appears weak in comparison with that in mainland China, which is now competing with well-established laboratories in the United States. "The mainland is spending a huge amount of money to attract overseas researchers," says Cui Xiaodong, a physicist at HKU. "Many of my Chinese friends are considering going to one of the top institutes on the mainland where they would have more support to build their own research team."

Last year, Cui's team published an Article in *Nature Nanotechnology* on 'valleytronics', the process of changing a material's electronic properties by using polarized light to manipulate electrons into one of two valleys in a crystal monolayer.

Because valleytronics is such a new and popular research area, many laboratories are competing. Cui's team, with resources limited by both HKU finances and under-investment from the Hong Kong government, struggles to compete, he says. His first PhD graduate and a co-author on the published paper, Dai Junfeng, recently left for the South University of Science and Technology in Shenzhen as he can get more research funding there. Now Cui has only four students and postdocs.

THE UNIVERSITY OF HONG KONG

HKU is the only Hong Kong-based institution left in the top ten, and has been sliding down the ranking for a couple of years.



JOSTLING IN THE RANKS

Outside the top ten, the rankings of China's institutions tend to be fluid. Institutions that lie below the 30th place have corrected counts of less than one — often derived from the publication of only a single article. Nevertheless, some of these institutions further down the ranking had notable achievements in 2012.

The Chinese Academy of Agricultural Sciences (CAAS) in Beijing (ranked 13th) had a very good year, setting a new high in the China NPI and halting a four-year slide from its previous top rank of 24. CAAS contributed to ten papers last year, including three in *Nature*. CAAS is strong in genetics, and its highest scoring paper was produced by its Institute of Crop Science and published in *Nature Communications* . The work concerned genetic regulation of shoot-branching in rice. CAAS also picked up eight awards in the China National Awards for Science and Technology 2012.

Guangzhou's **Sun Yat-sen University** (16th) also achieved its best position ever, quadrupling its CC from 2011. Its strong suit is chemistry, a field in which the university ranks ninth in the country. Sun Yat-sen's top-scoring paper was a wholly authored Article in *Nature Communications* describing a geometric analysis of a porous material. Sun Yat-sen's CC accounts for more than half of Guangzhou's city score (page 20).

Another Beijing institution, **Tsinghua-Peking Centre for Life Sciences**, attained 23rd position in 2012, a dramatic rise from its debut rank of 122 the year before. All except one of its papers had low corrected counts; the exception was a Brief Communication in *Nature Structural & Molecular Biology* concerning conformational changes in AMPK, an energy sensing kinase. Five of the eight authors of this paper are from Tsinghua-Peking.

However, for each ascendancy there must be a fall. Three institutions dropped out of the top ten in 2012, although they all remain in the cumulative top 10 for the five-year period 2008–2012. **The Hong Kong University of Science and Technology (HKUST)** fell from 5 to 11; **Xiamen University** dropped from 6 to 12; and **Nanjing University** from 9 to 14. The first two published the same number of papers as in 2011, yet earned a lower CC.

Sliding down is the **Second Military Medical University** in Shanghai. Having reached 8th place in 2008, this institution has fallen to 25th, despite increasing its article count each year. In 2012, seven of its eight articles contributed no more than 0.2 CC each. The bulk of its CC of 1.21 comes from one Article in *Nature Immunology* about regulatory pathways for the Toll-like receptor in the innate immune system.

Jilin University in Changchun dropped from 19th place in 2011 to 38th in 2012. Taking a broad view, however, Jilin's trajectory does not look so grim. Over the last five years it has averaged 29th position; its 2011 rank was anomalously high. Jilin scientists contributed to twice as many papers in 2012 as in 2011, but these publications resulted in half the CC. Of Jilin's six papers last year, only one scored a CC of more than 0.1: a *Nature* paper from its Institute of Virology and AIDS Research, on a mechanism by which HIV-1 can evade host detection.

There are 107 new entrants in this year's NPI China, including 38 in the Top 100 (page 26). The highest-ranking new entrant is the **Beijing Forestry University (BFU)** at 46. BFU is under direct control of the Ministry of Education and in 1995 was one of the first universities to be part of China's 211 Project, which aims to raise research standards for approximately 100 universities. BFU's debut paper, earning it a CC of 0.47, was an Article in *Nature Communications* concerning the genome of *Prunus mume*, commonly known as the Chinese plum. ■

Top Chinese cities in 2012

Scientific achievement means government funding in the competitive world of Chinese academia, and the country's many cities are determined to prove their worth. Universities improve their results and status through recruiting renowned researchers, so authorities need to make their cities accessible and attractive to the world's best scientists.

China's spend on research and development (R&D) in 2012 was 1 trillion yuan (US$160 billion), just less than 2.0% of gross domestic product (GDP). Of this, nearly 50 billion yuan (US$8 billion) was spent on basic research, a 20% increase over 2011.

In 2012 slightly more than half came from central government, but provincial governments also contributed to varying degrees. In descending order, the local governments that spent the most were: Jiangsu, Guangdong, Beijing, Shandong, Zhejiang, Shanghai, Liaoning and Hubei. Within these provinces are the cities that make the NPI China top ten by corrected count (CC), namely Beijing, Shanghai, Hefei, Hong Kong, Wuhan, Shenzhen, Nanjing, Hangzhou, Guangzhou and Tianjin.

Some analysts categorize Chinese cities within one of three tiers. There is a common consensus that the top tier includes Shanghai, Beijing, Guangzhou and Shenzhen, based on their size and income levels. Tier two cities include Hefei, Nanjing, Hangzhou, Wuhan and Tianjin, loosely defined as provincial capitals, but within the Nature Publishing Index (NPI) these tier-twos defy their secondary status with their academic reputations.

INSTITUTIONAL FOCUS

Most government funding is allocated to state-owned research institutes like the Chinese Academy of Engineering (CAE) and the regional branches of the Chinese Academy of Sciences (CAS), and the Chinese Academy of Agricultural Sciences (CAAS), as well as other universities, colleges and state-owned enterprises. Many universities are funded through Project 985 and Project 211, central government programmes set up to promote higher education. The projects administer the largest sums of money from both central and local governments. Project 985 aims to raise the standards of an elite 39 universities to world-class levels, while Project 211 was launched to improve the quality of 114 high-level universities. There is overlap between the two programmes: almost all Project 985 universities also belong to Project 211.

As funding is dependent on achievement, Chinese cities need to attract and retain world-class scientists. A central government scheme called the 1000 Talents programme targets high-flying researchers working abroad with enticements such as taxation breaks, insurance, housing allowances, and help with settlement for children and spouses. Prospects for Chinese nationals were historically complicated by the requirement for registration to live and work in certain cities. Known as a *Hukou*, these permits are needed for a resident to be eligible for public services including healthcare, public schooling, housing allowance and even the right to buy a flat or a car. Cities such as Beijing and Shanghai, where the cost of living is high, have introduced policies to grant *Hukous* to elite Chinese scientists returning from abroad, or coming from elsewhere in the country.

Chinese cities need to attract and retain world-class scientists

Cities that lack a strong international profile but have aspirations to become renowned research centres collaborate with high-profile institutions elsewhere. Shenzhen, for example, lured the Beijing Genomics Institute to create BGI-Shenzhen to attract top scientists through combined resources and reputation.

Here we analyse the competitive advantage of each of the top ten cities to give researchers, business leaders and policy-makers a broad picture of China's scientific landscape.

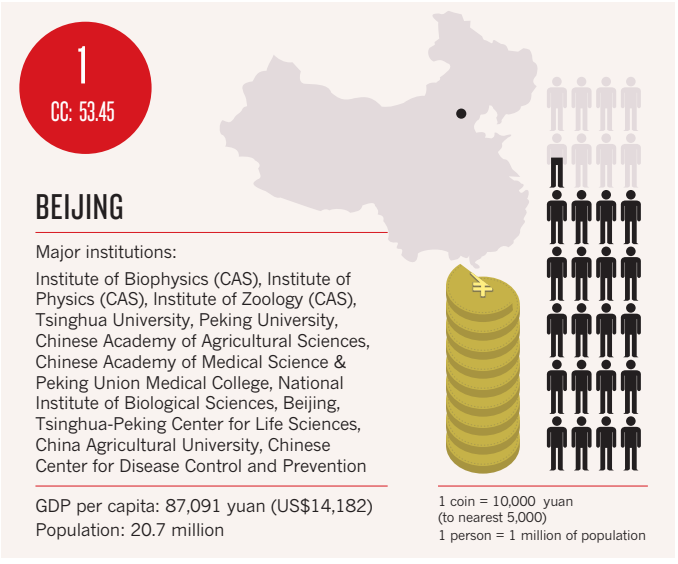
BEIJING

As the political and cultural centre of China, Beijing has distinct advantages when it comes to science and research. According to the 2012 Economic and Social Development Statistics Bulletin from the Beijing Municipal Bureau of Statistics, the capital has 56 public universities — 8 of which are supported by Project 985 and 26 are part of Project 211 — and 76 research institutes. There are 318,000 people who work in R&D. With such a concentration of academic firepower, it's hardly a surprise that the output from Beijing-based institutes represents more than a third of China's CC.

Beijing spent 103 billion yuan (US$17 billion) on R&D in 2012, 10% more than the previous year. The proportion of the city's GDP spent on R&D is 5.8%, the highest ratio of all China's cities.

Despite its dominance of Chinese science, Beijing still does not match many other cities internationally. Its shortcomings on a global scale were noted in a recent lecture by Song Xiaomei, the director of the Department of Society, Science and Technology at the Bureau. Song said: "Beijing still falls far behind its international counterparts in research output."

"We need to keep increasing the R&D expenditure, raising input in training talents and promoting research quality."



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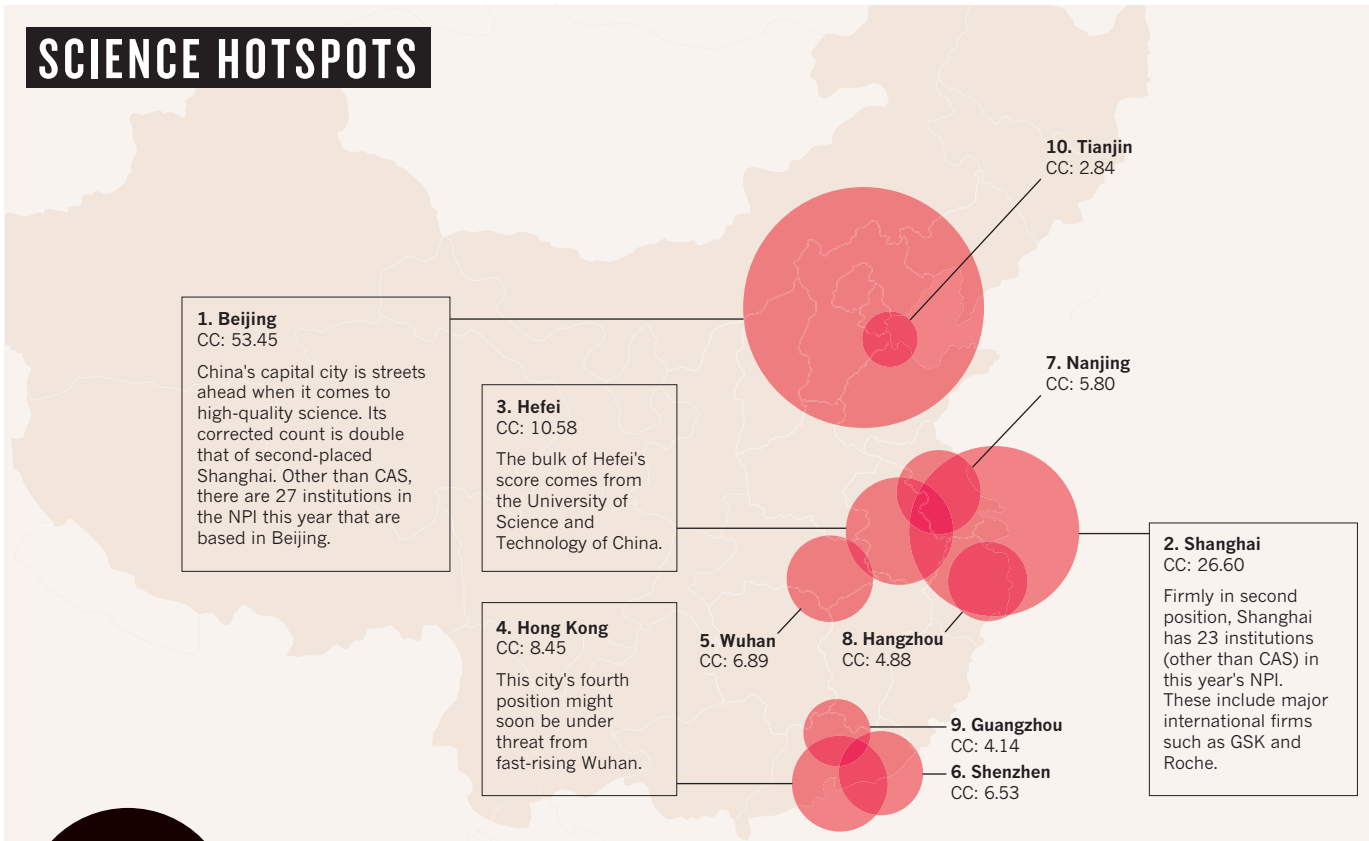
SCIENCE HOTSPOTS



TOP 20 CITIES

CITY	2012 RANK	2012 CORRECTED COUNT	2011 RANK	2011 CORRECTED COUNT	2010 RANK	2010 CORRECTED COUNT	2009 RANK	2009 CORRECTED COUNT	2008 RANK	2008 CORRECTED COUNT	2008–2012 RANK	2008–2012 CORRECTED COUNT
Beijing	1	53.45	1	39.25	1	23.99	1	18.81	1	16.76	1	152.27
Shanghai	2	26.60	2	15.94	2	9.38	2	10.17	2	8.66	2	70.74
Hefei	3	10.58	3	9.59	3	6.30	3	4.11	3	1.99	3	31.44
Hong Kong	4	8.45	4	9.15	4	5.74	4	2.27	4	1.97	4	26.36
Wuhan	5	6.89	5	5.36	5	5.19	5	1.88	5	1.91	5	19.27
Shenzhen	6	6.53	6	4.22	6	3.67	6	1.15	6	1.25	6	14.48
Nanjing	7	5.80	7	3.77	7	1.83	7	1.00	7	0.75	7	13.40
Hangzhou	8	4.88	8	3.24	8	1.63	8	0.66	8	0.71	8	12.98
Guangzhou	9	4.14	9	3.02	9	1.38	9	0.61	9	0.68	9	10.89
Tianjin	10	2.84	10	1.87	10	1.29	10	0.56	10	0.66	10	7.54
Xiamen	11	2.38	11	1.64	–	–	11	0.55	11	0.51	11	5.91
Xi'an	12	2.02	12	1.41	12	0.84	12	0.37	–	–	12	5.83
Changchun	13	1.97	13	1.28	13	0.84	–	–	13	0.45	13	5.18
Jinan	14	1.86	14	1.24	14	0.78	–	–	–	–	14	4.91
Dalian	15	1.67	15	1.12	–	–	–	–	15	0.19	15	3.65
Shenyang	16	1.36	16	1.11	16	0.56	–	–	16	0.17	16	3.11
Fuzhou	17	1.21	–	–	17	0.50	–	–	17	0.14	17	2.61
Kunming	18	1.20	18	0.88	18	0.47	–	–	–	–	–	–
Qingdao	19	1.11	19	0.86	–	–	19	0.14	–	–	19	1.91
Lanzhou	20	0.73	–	–	–	–	–	–	–	–	–	–

SHANGHAI

Shanghai is China's second city for high-quality basic research. It spent nearly 60 billion yuan (US$9.7 billion) on R&D in 2011, and its R&D/GDP ratio was an above-average 3.1%.

Shanghai has been highly successful in attracting and retaining scientific talents, through both the central government's 1000 Talents programme and its own Shanghai 1000. Under the centralized system it has recruited 412 Chinese and 13 foreign scientists, and through its own programme, it has attracted the services of another 310 researchers. Like Beijing, Shanghai has a high cost of living, and opportunities to live and work in the city from elsewhere in China are limited. In its bid to be a leading science city, local authorities have extended *Hukou* to elite scientists and researchers to help with housing and other welfare needs. "Whether it is the local government or the research institutes, they care for the leading talents a lot," said Li Lin, the deputy dean of Shanghai Institute for Biological Sciences of CAS, in a public statement.

These measures have attracted Nobel laureates like Luc Montagnier (physiology/medicine), who joined Shanghai Jiao Tong University in 2010, and Kurt Wüthrich (chemistry) who was appointed a professor at ShanghaiTech University in 2013. ShanghaiTech is jointly run by Shanghai's municipal government and CAS, but does not feature in the NPI.

HEFEI

Hefei is the largest city and capital of Anhui, a province with a largely rural population in China's central-east region. Hefei is a second-tier city, but its geographical position gave it strategic prominence in the historic animosity between China and the USSR, and consequently it has many research institutions. Hefei spent 21.5 billion yuan (US$3.5 billion) on science and technology in 2011.

The city is home to the University of Science and Technology of China (USTC), which is ranked second in NPI China and responsible for almost all of Hefei's CC. USTC is affiliated with CAS and was originally located in Beijing, but moved to Hefei in 1969. Hefei is also home to several other universities, the highest ranking of these is Anhui Medical University, 32nd in China with a CC of 1.03.

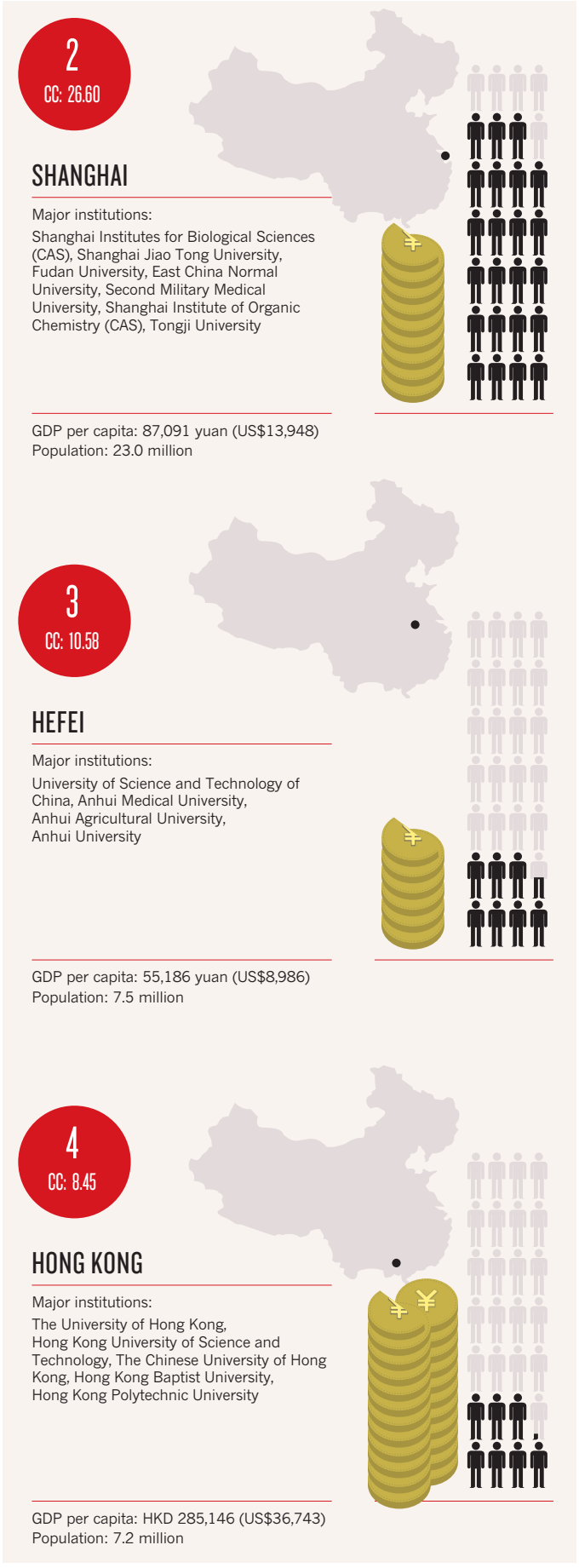
The city is second only to Beijing in the number of national laboratories situated there. It is home to the Hefei National Laboratory for Physical Sciences at the Microscale. It is also the location for the National Synchrotron Radiation Laboratory and the National Laboratory for Nuclear Fusion (Tokamak) Research. Hefei also hosts an experimental nuclear fusion reactor based on a superconducting magnetic tokamak run by the Institute of Plasma Physics under the auspices of CAS.

HONG KONG

Since British administration ended in 1997, Hong Kong has operated under a different system from that in mainland China. At one time Hong Kong's independence helped it attract many top-level talents, like Zhang Mingjie, a structural biologist at Hong Kong University of Science and Technology (ranked 11th) and an academician of CAS. Zhang was educated through his undergraduate years in mainland China and obtained his PhD at the University of Calgary in Canada.

But Hong Kong's research scene is going through a difficult period. The territory's spending on R&D — 13.9 billion Hong Kong dollars (HKD) (US$1.8 billion) in 2011 — has stagnated. As a senior statesman in Hong Kong science, Zhang sees the effect of a lack of resources. "Funding for science and research has stayed [at] the same level for almost 20 years. This has nibbled away its competitive advantage," Zhang has said publicly.

Hong Kong's ratio of R&D to GDP is 0.7%, about one-third that of mainland China. In a recent interview with the *Zhejiang Daily*, Yang Wei, the newly appointed director of the National Natural Science Foundation of China (on the mainland) and former president of Zhejiang University, observed that the total amount of research funding from the Hong Kong authority was less than that from Zhejiang University alone. "Now more and more of the Hong Kong faculty want to apply for research funding in the mainland."



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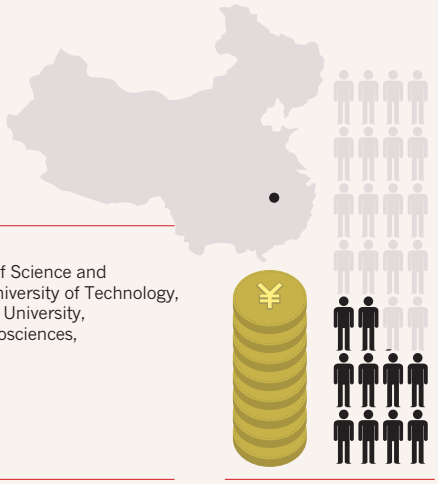
5
CC: 6.89



WUHAN

Major institutions:

Huazhong University of Science and Technology, Wuhan University of Technology, Huazhong Agricultural University, China University of Geosciences, Wuhan University

GDP per capita: 79,079 yuan (US$12,877)
Population: 10.1 million

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6
CC: 6.53

SHENZHEN

Major institutions:

BGI, Shenzhen University, South University of Science and Technology of China, Fourth People's Hospital of Shenzhen, Shenzhen People's Hospital

GDP per capita: 123,247 yuan (US$20,069)
Population: 10.5 million

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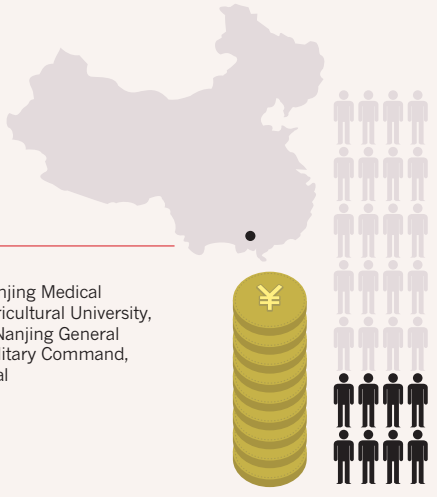
7
CC: 5.80



NANJING

Major institutions:

Nanjing University, Nanjing Medical University, Nanjing Agricultural University, Southeast University, Nanjing General Hospital of Nanjing Military Command, Nanjing Jinling Hospital

GDP per capita: 88,808 yuan (US$14,461)
Population: 8.0 million

WUHAN

The most populous city in central China, Wuhan improved its rank by one position in 2012 and is now the fifth city in NPI China. Wuhan is an important base for a variety of heavy industries, including automobile manufacturing (Dongfeng), steel processing (Wuhan Iron and Steel), and shipbuilding (Wuchang Shipbuilding Industry).

Wuhan is home to 79 colleges and universities, of which five are in the NPI, and the Wuhan Branch of the CAS, which includes nine independent institutes employing 1,450 staff. Most prominent among the universities is 8th place Huazhong University of Science and Technology (HUST), which contributes nearly two-thirds of Wuhan's total score. Two of the city's universities belong to Project 985 and 7 to Project 211.

In recent years, Wuhan has been widening its economy from traditional heavy industry and venturing into more high-tech areas, such as optical electronics, pharmaceuticals, bio-engineering and new materials. The local government aims to make Wuhan the centre for national innovation in China. Wuhan spent 17.5 billion yuan (US$2.8 billion) on science and technology in 2011. Its R&D/GDP ratio of 1.65% was lower than the Chinese average, but, in line with its scientific ambitions, it is raising its R&D spend: for 2012 it will be more than 20% higher.

SHENZHEN

Shenzhen moved three places up the NPI China rankings in 2012, overtaking Nanjing as the sixth most productive city. Although this progress was assisted by three of its institutions making a debut to the NPI, it was a significant improvement to BGI's score that made the biggest impact.

In 1980 Shenzhen was the first city to be designated a Special Economic Zone. This helped the city develop its high-tech economy, and Shenzhen is now host to many international companies, such as the telecommunications giants Huawei and ZTE and the internet service portal, Tencent.

Shenzhen is now putting increasing emphasis on innovative basic research. In 2010, the city's government launched the Peacock programme to attract elite talents. In 2012 the initiative led to the recruitment of 16 world-class research teams, comprising 104 scientists.

In the last few years, Shenzhen has opened several new high-profile facilities, including the Daya Bay Reactor Neutrino Lab (a multi-national project that includes collaboration by the CAS), a facility of the National Supercomputing Centre (also in co-operation with the CAS), the China National Genebank Programme (run by BGI), and the State Key Laboratory of Meta-RF Electromagnetic Modulation Technology (run by the Kuang-Chi Institute of Advanced Technology).

Shenzhen received 897 million yuan (US$146 million) from the central government in 2012. In 2011, Shenzhen's R&D/GDP ratio was 3.7% — higher than Shanghai's 3.1% — reaching 3.8% in 2012.

NANJING

Nanjing is one of the four ancient capitals of China (the others being Beijing, Luoyang and Xi'an) so is traditionally an important centre for politics, culture and commerce. These days its role continues as a manufacturing base for electronics, fine chemicals and construction materials as well as a major hub for transportation and communications.

Nanjing is the capital city of Jiangsu — one of the richest provinces. It is a major centre for tertiary education and scientific research and has two universities supported by Project 985 and eight in Project 211. The city also hosts a branch of the CAS, with nine subsidiary research institutes. In 2012 it had an undergraduate population of about 720,000 students attending 54 universities.

Nanjing has been criticized for failing to capitalize on its educational advantages by turning its research endeavours into economic success. To answer critics, Nanjing's government plans to invest more in innovative projects (aiming to reach a spend of 4.5% of its GDP) and to attract more creative talents. So far, the city has recruited 143 elite scientists through the 1000 Talents programme and is looking to lure more. Through an initiative called the 321 Programme, Nanjing has attracted 1,567 entrepreneurs whom it hopes will establish science and technology firms.

HANGZHOU

Famed for its tea and silk production, its natural beauty and its historic architecture, Hangzhou is best known as a tourist destination. However, the city is also considered to be an important manufacturing base and logistics hub for coastal China. It is the capital and largest city of Zhejiang province, and has developed many new industries in recent years to expand its economic base beyond tea and textiles. It is home to car manufacturing (Geely), beverage production (Wahaha), pharmaceutical manufacturing (Mingsheng Pharma) and e-commerce (Alibaba).

Hangzhou has nearly half a million students enrolled at 38 higher education institutions. The best of them is Zhejiang University (ranked seventh in China), which contributed to 96% of the city's CC in 2012. None of the others are in the China Top 100.

Hangzhou spent nearly 20 billion yuan (US$3.2 billion) on science and technology in 2011. So far, 22 elite scientists have been recruited through the 1000 Talents programme as well as 91 through the Zhejiang 1000 Talents programme. The city also has its own talent recruitment programmes, which aim to attract applied scientists. Known as the 5050 and Qianjiang programmes, the initiatives brought in 39 teams and 41 experts respectively from abroad in 2012.

GUANGZHOU

Guangzhou is one of China's leading commercial and manufacturing regions. It is the third largest city by GDP in China, and in 2012 it overtook Beijing and Shanghai as the leading city in terms of GDP per capita. Located northwest of Hong Kong and northeast of Macau, the city is a key national transportation hub and trading port. Benefiting from its advantageous location, it was one of the first Chinese cities to undertake foreign trade — stretching back at least a couple of millennia. Its history of trading is one of the reasons for its relative wealth.

There are 72 colleges and universities in Guangzhou, with 11 in this year's NPI. There are none in the top ten, however: the highest ranked is Sun Yat-sen University at 15th in China. Two of the universities belong to Project 985 and five to Project 211. The city, which is the capital of Guangdong province, also has a branch of the CAS.

Guangzhou spent 23.8 billion yuan (US$3.8 billion) on science and technology in 2011. Its R&D/GDP ratio is 2.2%, which is low among China's major cities, but is expected to reach 2.5% by 2015. Next year, Guangzhou's R&D expenditure is forecast to account for 3% of the total annual public finance budget for science and research.

TIANJIN

Tianjin is in northern China, on the coast of Bohai Sea. Its role was highlighted in 2010 when the Ministry of Housing and Urban-Rural Development designated it as one of the five national central cities in China, alongside Beijing, Shanghai, Guangzhou and Chongqing. Tianjin's major industries include petrochemicals, textiles, car manufacturing, mechanical industries and metalworking.

In 2012 it moved up five places in NPI China with a doubling of its CC. There are almost half a million undergraduates and 48,000 graduate students at Tianjin's 55 colleges and universities (none of which are in China's top 20). Tianjin is also home to the National Supercomputing Centre in Tianjin and the Tianhe-I supercomputer, one of the world's few petascale supercomputers — capable of one quadrillion (10^{15}) floating point operations per second.

Tianjin spent 29.8 billion yuan (US$4.8 billion) on R&D in 2011, and had an above-average R&D/GDP ratio of 2.6% (increased to 2.7% in 2012). The city has attracted 312 scientists through the national 1000 Talents programme and its own Tianjin 1000 Talents programme.

About one-third of the scientists recruited through the two programmes settle in Binhai New Area (BNA). Tianjin is dedicated to growing the BNA, which is being developed as a base for China's new advanced industrial and financial industries, along the same lines as the Pudong area in Shanghai. BNA city planners are currently focusing on attracting high-tech medical and energy companies to set up and invest in the area. ■

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University of Science and Technology of China

A PRISTINE ENVIRONMENT FOR ACADEMIC RESEARCH

Established in 1958 as an affiliated university of the Chinese Academy of Sciences, the University of Science and Technology of China (USTC) in Hefei has grown to become one of China's leading universities in academic research. With talents spanning the entire breadth of the physical sciences, the USTC is set to gain world-class recognition through the pursuit of original and innovative research.

In October 2011, USTC researchers broke an important record in the world of quantum physics. They successfully sent entangled photons between two points across the Qinghai Lake by using a laser system that could enable quantum teleportation over a distance of 100 km. The achievement was impressive because it demonstrated the feasibility of using satellites to provide secure communications around the world. The results of this study, published in *Nature* in August 2012, have garnered wide attention from the scientific community and the general public.

The story of quantum teleportation is a mirror of the USTC's strengths and uniqueness in many ways. When the founding president Moruo Guo laid the first stone on 15 September, 1958, he had a vision of a university that is dedicated to basic research and original innovation. He set himself the mission to cultivate world-class talent for advancing China's development in science and technology. To that end, Guo wrote the university's motto, "Become politically sound and professionally competent; integrate theory with practice."

Now, 55 years later, the USTC has developed into a comprehensive institution that remains faithful to its founding principles. It continues to cultivate national talent, break traditional boundaries and seize new opportunities in emerging fields of science. Its impressive accomplishments in academic research, particularly in the fields of quantum information, nanomaterials and space sciences, have played and will continue to play an important role in China's growth as an international leader.

A humble beginning

"It was not all plain sailing for the USTC. In the early years, the USTC did mostly theoretical research because of economic limitations," says Chengzhi Peng of the Hefei National Laboratory for Physical Sciences at the Microscale and the Department of Modern Physics, who was one of the co-authors of the *Nature* paper on long-distance quantum teleportation. "In 2001, my supervisor Jianwei Pan returned from Austria and brought back the concept of quantum communication. He joined hands with Guangcan Guo, Yongde Zhang and other senior members to start quantum physics research at the USTC, and the university has been very supportive of our project ever since."

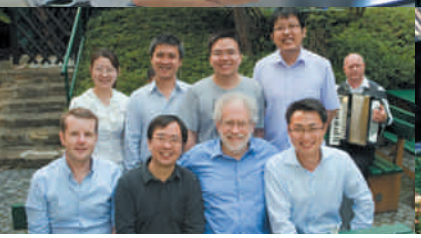
Peng's main area of interest is quantum key distribution, a cryptographic protocol for securely communicating information from one party to another. As the laws of quantum mechanics forbid people without permission to retrieve the information, the technology makes it harder for people to intercept the communication.

Peng was one of the many people who helped the USTC realize free-space quantum teleportation and entanglement distribution over long distances. He first demonstrated entanglement distribution over 13 km in 2005, then quantum teleportation over 16 km in 2010, and then both quantum teleportation and entanglement distribution over 100 km in 2012. Peng believes that a quantum network is going to be the method of choice for communication in the future.

A quantum leap

The applications of quantum mechanics do not stop at just quantum communication. Jiangfeng Du of the Hefei National Laboratory for Physical Sciences at the Microscale and the Department of





Modern Physics, for example, is devoting his energy to the study of quantum computation — one of the hottest research areas in physics at the moment.

Magnetic resonance, a technology that is vital to the success of quantum computation, is Du's primary area of interest. Quantum computers use electron or nuclear spins in solids as bits for storing information. These spins can become incoherent with time due to their coupling with the noisy environment and may lose information as a result. Magnetic resonance provides a precise way to manipulate spins and prolong their coherence time.

Du was one of the first people to use electron paramagnetic resonance for preserving spin coherence in malonic acid crystals. By firing a seven-pulse sequence into the crystal, he managed to prolong the coherence time of spins from 0.04 microseconds to 30 microseconds. The results of this study, published in *Nature* in October 2009, represent a significant step towards the realization of quantum computers.

Meeting national needs

The USTC often invests its time and money into a particular area because of national needs. China showcased its first human spaceflight mission in 2003 and its first unmanned lunar exploration in 2007. The next goal for the country is to send humans into deep space. However, the safety of spacecrafts and their onboard instruments can easily be jeopardized by energetic particles.

Yuming Wang of the Department of Geophysics and Planetary Sciences is a principal investigator studying coronal mass ejection (CME), an explosive event in the Sun's atmosphere that sends out a shockwave of energetic particles. A single coronal mass ejection event typically releases particles that amount to 10^{25} joules of energy. If these particles are directed towards Earth, they can disrupt sensitive instruments and pose serious health threats to humans onboard the spacecraft.

Wang's main focus is on the initiation, propagation and dynamic processes behind CME. The ultimate aim is to set up a warning system that could accurately predict space weather and prevent a national space disaster from happening. Recently, he studied the dynamics of a collision event between two CMEs. The results of his study made the cover story of the December 2012 issue of *Nature Physics*.

"Our project relies on interdisciplinary expertise from science and engineering. The USTC is one of only a few universities in China that can provide such expertise," says Wang, who is currently developing a particle-detection instrument to measure plasma parameters, including velocity, temperature and density. "We are waiting for the approval from the Chinese government to use the instrument in future space missions."

A nursery for talent

The USTC actively ventures into intersections of physical and life sciences. Longping Wen of the School of Life Sciences, for example, is currently investigating the biological effects of inorganic nanomaterials. "There are two interesting aspects in my research," says Wen. "On one hand, we try to understand the adverse effects of nanomaterials in cells and to find ways to minimize these adverse effects. On the other hand, we try to use toxic nanomaterials to target and kill cancer cells."

Wen recently found that rare-earth-based nanocrystals could induce autophagy, a process by which cells degrade themselves. He demonstrated that by attaching a biological peptide coating onto the nanocrystal, he could form a composite with controllable activity in cells. The results of this study were published in the September 2012 issue of *Nature Materials*.

So far, Wen has used his nanocomposites to kill human cervical cancer cells, breast cancer cells and liver cancer cells. More importantly, he showed that his nanocomposites could enhance the toxicity of chemotherapeutic drugs in killing chemoresistant cancer cells.

"The USTC is situated in the small city of Hefei," says Wen. "I chose to settle in the USTC because I believe the soil here (metaphorically speaking) is virgin and pure. There are fewer distractions here, so researchers can focus on their work. I was sure I could do something constructive at the USTC, and I was correct." ■

A guide to the NPI

A complete guide to understanding the compilation, structure and definitions used in the Nature Publishing Index. For more information see nature.asia/publishing-index.

The Nature Publishing Index (NPI) is maintained by Nature Publishing Group (NPG), a division of Macmillan Publishers that publishes *Nature*, the international science weekly, and more than 30 Nature-branded primary research and review journals covering a broad spectrum of the life sciences, physical and chemical sciences, and clinical medicine. NPG journals are among the most cited in scientific literature and are renowned for their publication of high-quality, high-impact research.

The NPI ranks institutions and countries/territories according to the number of primary research articles they publish in the Nature family of journals in a one-year period. It presents both raw numbers of published articles with author affiliations to a given country or institution, and a corrected count (CC) that is adjusted according to the relative contribution of each author to each article based on the percentage of authors from that institution or country in the paper's affiliations. This CC is tallied over a period of one year and is used to measure contribution to Nature journals. Only articles printed during the ranking period are included — advance online publications are not included until assigned an issue number and sent to press. The *Nature Publishing Index 2012 China* covers the period from 1 January 2012 to 31 December 2012.

The index, online at nature.asia/publishing-index, is updated every week to give a moving window of one year of data. The index website provides links to the abstracts of all articles used to calculate corrected counts, including the details of individual papers and authors contributing to an institution or country's rank in the index. This ensures that the index is fully transparent. It also provides data for review articles published in Nature journals. Review articles are not included in the annual rankings, however, because reviews are commissioned by journal editors and not submitted by researchers.

NATURE PUBLISHING INDEX ASIA-PACIFIC

The Asia-Pacific index is updated weekly and includes articles published in the latest issues of the Nature journals. Users of the index website can subscribe for email alerts to keep up to date with the latest results from the region. A print publication presenting the frozen data for each calendar year is published each year.

NATURE PUBLISHING INDEX GLOBAL TOP 100

The Global Top 100 is a ranked list of the top 100 institutions based on publications in *Nature* and the Nature research journals. The index is updated annually in March.

CORRECTED COUNT

The NPI is based on an article's corrected count (CC) — a calculation that takes into account the number of affiliated institutions per author and the percentage of authors per institution. All authors are considered to have contributed equally to each article. The maximum CC for any article is 1.0. The overall CC for a country/territory reflects the sum of the corrected counts of all institutions in that region. The rules governing the calculation of CC with respect to the way affiliations are presented are adjusted regularly to account for new scenarios.

The NPI is based on affiliation data drawn from Nature journal articles published on nature.com. There is great variability in the way authors present their affiliations and every effort is made to count affiliations consistently, making reasonable assumptions (outlined on the index website) to determine the corrected counts, which are approximations based on these assumptions and no counts are definitive.

RANKINGS, GRAPHS AND LISTS

Country rankings

Countries and territories are ranked according to CC and can also be filtered by article type using the selector at the top of the page. Clicking on a country name will display a list of institutions within that country/territory.

Institutional rankings

The institutional rankings track institutions in the Asia-Pacific region (including India and Australasia) according to their CC. Data for primary research articles (Articles, Letters and Brief Communications), reviews, or a combination of both, can be viewed by selecting the appropriate tab in the article filter at the top of the page. By default, the top 25 institutions are listed; clicking on 'Show all' at the bottom of the list will display all of the institutions. Clicking on the number in the 'Articles' column displays a list of all the articles from that particular institution.

Global institutional rankings are also available under the Global Top 100 page. The global page shows the list of institutions ranked by CC. Clicking on the number in the 'Articles' column lists the Nature articles contributing to the corrected count.

Rankings by Nature journal

The journal ranking groups all articles from the Asia-Pacific region according to Nature research journal, and can be filtered by article type. By default, the top five institutions are listed for each journal. Clicking on 'Show All' lists all of the institutions from the Asia-Pacific that have affiliations listed in that journal, and clicking on the number of articles displays a list of the articles from that journal with affiliations from that institution.

Rankings by subject area

The rankings by subject area track institutions in the Asia-Pacific region in four subject areas: chemistry, earth & environment, life sciences and physical sciences.

Historical rankings

The historical rankings track data by Asia-Pacific country for primary research articles (reviews are not included) for past years. Clicking on the year at the top of the table displays the rankings for that year based on the corrected count.

Historical graphs

These graphs provide a visual representation of the historical data based on primary research articles (only). Users can select up to five institutions or countries and the graph redrawn to represent the selection.

Latest research

The latest research section provides a breakdown of the latest publications in Nature journals from the Asia-Pacific region by country/territory, including journal name and article title. ■

THE NPI ONLINE: HOW IT WORKS

Research published in Nature journals from China can be tracked online through a comprehensive service that is updated weekly. nature.asia/publishing-index-china offers a 12-month rolling view of how institutions are ranking and the journal in which to find particular Articles, Letters and Brief Communications.

Article filter
An article filter at the top of most ranking lists allows users to track research articles and gives an option to access data on reviews

Research Articles
This is the default display reflecting the index's focus on primary research articles

To view a list of articles click on the number in the right hand column. Rankings by country, by journal and historical data from the last five years are also available

Research Articles | Reviews | All

Institution	Corrected Count[2]	Articles[3]
1. The University of Tokyo, Japan	39.4	116
2. ⊞Chinese Academy of Sciences (CAS), China	37.88	91
3. Kyoto University, Japan	22.47	55
4. ⊞RIKEN, Japan	18.96	78
5. Osaka University, Japan	18.18	54

Reviews
This displays data for review articles

Research Articles | Reviews | All

Institution	Corrected Count[2]	Articles[3]
1. The University of Auckland, New Zealand	3.25	4
2. The University of Sydney, Australia	2.7	4
3. The University of Tokyo, Japan	2.46	4
4. Monash University, Australia	2.4	5
5. The University of Melbourne, Australia	2.09	5

All
This displays both primary research articles and reviews

Research Articles | Reviews | All

Institution	Corrected Count[3]	Articles[4]
1. The University of Tokyo, Japan	41.86	120
2. ⊞Chinese Academy of Sciences (CAS), China	38.94	94
3. Kyoto University, Japan	22.47	55
4. ⊞RIKEN, Japan	20.85	82
5. Osaka University, Japan	18.59	56

Expanded Affiliations
Many organizations, such as the Chinese Academy of Sciences and Singapore's Agency for Science, Technology and Research (A*STAR), are umbrella agencies for many affiliated institutions. Such organizations are indicated by a plus mark ('+') in the index lists and can be expanded to show the contribution from each constituent institution

Research Articles | Reviews | All

Institution	Corrected Count[3]	Articles[4]
1. The University of Tokyo, Japan	41.86	120
2. ⊟Chinese Academy of Sciences (CAS), China	38.94	94
Shanghai Institutes for Biological Sciences (SIBS), CAS	6.42	15
Institute of Biophysics (IBP), CAS	4.67	15
Institute of Physics (IOP), CAS	3.6	9

Clicking on a plus mark (+) will show any affiliated institutions of an organization, listed in order of their corrected count

Clicking on an article count brings up a chronological list of the research articles and reviews published by that institution in the last 12 months

Articles
The number of articles encompasses the total contributions of a particular institution or country and each body is credited once per article. Clicking on the number of articles in any of the index ranking lists presents a complete list of the articles published by an institution or country/territory in the past year. Among these are the articles counted in the index along with the Nature journal in which it was published and the corrected count the article achieved. Hovering over the article title reveals its DOI and clicking on the title opens the article abstract on nature.com

Research Articles | Reviews | All

Journal	Title	CC[2]
Nature	An integrated encyclopedia of DNA elements in the human genome	0.02
Nature Biotechnology	Genome mapping on nanochannel arrays for structural variation analysis and sequence assembly	0.09
Nature Cell Biology	c-Abl promotes osteoblast expansion by differentially regulating canonical and non-canonical BMP pathways and p16 expression	0.22
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Clicking on the title of the article leads to its full text on the journal website

These rankings are updated weekly and are based upon papers published as research Articles, Letters and Brief Communications in *Nature* and Nature monthly research journals (excluding journals from scientific societies)

China Top 100

		2012			2011			5YR	
RANK	INSTITUTION	CC	AC	RANK	CC	AC	RANK	CC	AC
1	Chinese Academy of Sciences (CAS)	37.88	91	1	22.52	62	1	103.92	265
2	University of Science and Technology of China (USTC)	9.46	17	2	8.58	17	2	26.53	56
3	Tsinghua University	8.26	31	4	6.36	16	3	25.39	77
4	Peking University (PKU)	8.10	29	3	7.24	21	4	23.17	83
5	Shanghai Jiao Tong University (SJTU)	6.62	30	7	3.74	21	6	13.33	68
6	BGI	6.27	20	10	2.97	11	5	14.04	42
7	Zhejiang University	4.70	15	11	2.96	8	11	9.98	40
8	Huazhong University of Science and Technology (HUST)	4.41	14	25	1.00	6	15	5.76	22
9	Fudan University	3.90	13	13	2.34	14	12	9.19	47
10	The University of Hong Kong (HKU)	2.92	14	8	3.58	12	9	10.26	42
11	Hong Kong University of Science and Technology (HKUST)	2.51	5	5	3.86	5	13	8.54	16
12	Xiamen University	2.38	6	6	3.77	6	7	10.89	18
13	Chinese Academy of Agricultural Sciences (CAAS)	2.36	10	32	0.62	4	20	4.08	21
14	Nanjing University	2.35	6	9	3.01	11	8	10.86	35
15	Chinese Academy of Medical Sciences & Peking Union Medical College	2.34	15	16	1.47	14	16	4.56	37
16	Sun Yat-sen University	2.24	12	35	0.55	7	21	4.02	28
17	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	2.18	4	12	2.91	7	10	10.00	19
18	Shandong University	1.76	7	29	0.67	6	23	3.30	19
19	East China Normal University	1.72	4	56	0.21	1	28	2.43	9
20	Nanjing Medical University	1.67	11	22	1.18	5	22	3.97	20
21	Nankai University	1.54	7	24	1.03	2	17	4.31	17
22	The Chinese University of Hong Kong	1.53	10	18	1.25	2	19	4.22	22
23	Tsinghua-Peking Center for Life Sciences	1.44	6	122	0.04	1	39	1.48	7
24	Tianjin University	1.21	3	107	0.05	1	40	1.31	5
25	Second Military Medical University	1.21	8	15	1.65	6	14	6.67	21
26	China Agricultural University	1.19	7	—	—	—	24	3.10	16
27	East China University of Science and Technology (ECUST)	1.19	2	40	0.43	2	37	1.62	4
28	Wuhan University	1.18	6	64	0.18	2	36	1.70	12
29	China University of Geosciences	1.12	5	39	0.43	4	35	1.73	12
30	Xi'an Jiaotong University (XJTU)	1.11	7	23	1.12	4	26	3.02	13
31	South China University of Technology	1.05	3	50	0.25	2	38	1.48	11
32	Anhui Medical University	1.03	7	27	0.73	4	18	4.26	17
33	Tongji University	0.83	8	77	0.12	2	46	1.21	14
34	Fuzhou University	0.83	1	—	—	—	53	0.90	2
35	Yunnan University	0.69	3	98	0.06	1	59	0.77	5
36	Chinese Center for Disease Control and Prevention (China CDC)	0.67	2	—	—	—	58	0.78	4
37	The General Hospital of Chinese People's Liberation Army	0.67	4	92	0.08	2	61	0.75	6
38	Jilin University	0.63	6	19	1.24	3	29	2.40	16
39	Lanzhou University	0.56	3	70	0.15	3	60	0.75	7
40	Ocean University of China	0.56	4	30	0.67	2	44	1.23	6
41	The Hong Kong Polytechnic University	0.56	2	—	—	—	34	1.81	4
42	Beihang University (BUAA)	0.52	2	37	0.50	1	43	1.27	4
43	Sichuan Agriculture University	0.48	2	142	0.02	1	73	0.50	3
44	Nanjing Agricultural University	0.48	3	66	0.17	1	66	0.67	5
45	Soochow University	0.47	4	44	0.35	5	47	1.18	12
46	Beijing Forestry University	0.47	1	—	—	—	78	0.47	1
47	Chinese National Human Genome Center at Shanghai (CHGC)	0.46	1	65	0.17	3	45	1.21	8
48=	South China Agricultural University	0.38	1	—	—	—	79	0.45	2
48=	Linyi University	0.38	1	75	0.13	1	74	0.50	2

2012				2011			5YR		
RANK	INSTITUTION	CC	AC	RANK	CC	AC	RANK	CC	AC
50	China Medical University (PRC)	0.37	6	48	0.27	5	55	0.88	14
51	Beijing Normal University	0.34	2	46	0.29	4	51	1.01	9
52	Inner Mongolia Agricultural University	0.33	1	—	—	—	83	0.33	1
53	Sichuan University	0.26	7	101	0.05	1	42	1.27	18
54	Hunan Normal University	0.23	1	—	—	—	98	0.23	1
55=	National Center of Biomedical Analysis	0.22	1	14	1.82	2	25	3.04	4
55=	Zhucheng Dinosaur Museum	0.22	1	—	—	—	100	0.22	1
57	Southeast University	0.21	3	63	0.19	2	27	2.45	8
58	National Institutes for Food and Drug Control	0.21	1	—	—	—	104	0.21	1
59	E-Institutes of Shanghai Universities (EISU)	0.21	1	—	—	—	96	0.24	2
60=	Ministry of Agriculture	0.20	1	—	—	—	108	0.20	1
60=	National Center for Nanoscience and Technology (NCNST)	0.20	1	43	0.37	2	64	0.69	4
62	Fourth Military Medical University	0.19	5	82	0.11	2	81	0.40	9
63=	Hainan University	0.19	1	—	—	—	111	0.19	1
63=	ChangChun University of Science and Technology (CUST)	0.19	1	—	—	—	110	0.19	1
65=	United Christian Hospital	0.18	1	—	—	—	113	0.18	1
65=	Shanghai Research Center for Model Organisms	0.18	1	—	—	—	95	0.24	2
65=	Pamela Youde Nethersole Eastern Hospital	0.18	1	—	—	—	112	0.18	1
68	Northeast Normal University	0.17	2	—	—	—	115	0.17	2
69	Central South University (CSU)	0.17	5	42	0.37	4	67	0.66	11
70	Dalian University of Technology (DUT)	0.17	2	49	0.26	2	68	0.59	6
71=	Northwest University	0.17	1	31	0.64	2	56	0.81	3
71=	Shenyang Normal University	0.17	1	45	0.33	1	49	1.13	3
73	Shanghai Food and Drug Administration	0.15	1	—	—	—	119	0.15	1
74	National Engineering Center for Biochip at Shanghai	0.15	2	—	—	—	114	0.17	3
75	Northeast Agricultural University	0.15	1	—	—	—	124	0.15	1
76	Fujian Normal University	0.14	1	—	—	—	125	0.14	1
77	Ministry of Health, Guangzhou	0.14	1	—	—	—	126	0.14	1
78	Dalian National Laboratory for Clean Energy (DNL)	0.14	1	—	—	—	129	0.14	1
79	Shenzhen University	0.13	3	113	0.05	1	86	0.28	8
80	Capital Medical University (CMU)	0.13	3	54	0.23	3	72	0.51	9
81=	Nantong University	0.13	1	—	—	—	133	0.13	1
81=	Beijing University of Technology	0.13	1	—	—	—	76	0.49	2
81=	Shandong Tianyu Natural History Museum	0.13	1	—	—	—	63	0.71	3
81=	F. Hoffmann-La Roche Ltd	0.13	1	—	—	—	139	0.13	1
85	Wenzhou Medical College	0.12	3	130	0.03	1	121	0.15	4
86	City University of Hong Kong	0.12	2	38	0.46	2	69	0.58	4
87	Fujian Medical University	0.12	2	34	0.58	2	62	0.71	5
88=	Princess Margaret Hospital	0.12	1	—	—	—	141	0.12	1
88=	Ruttonjee & Tang Shiu Kin Hospitals	0.12	1	—	—	—	142	0.12	1
90	Zhengzhou University	0.11	3	58	0.21	2	54	0.89	8
91=	Chinese Academy of Geological Sciences (CAGS)	0.10	1	20	1.20	3	32	2.05	7
91=	China Three Gorges Museum	0.10	1	—	—	—	154	0.10	1
91=	Taishan University	0.10	1	—	—	—	163	0.10	1
91=	South University of Science and Technology of China (SUSTC)	0.10	1	—	—	—	160	0.10	1
91=	Hong Kong Baptist University	0.10	1	—	—	—	157	0.10	1
96	Shihezi University	0.09	1	—	—	—	77	0.48	4
97	Guangxi Medical University	0.09	3	—	—	—	150	0.11	4
98	Guangdong Medical College	0.09	2	—	—	—	168	0.09	2
99	Southern Medical University	0.09	2	112	0.05	2	70	0.57	7
100	Chongqing Medical University	0.09	1	—	—	—	169	0.09	1

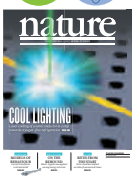
- Corrected counts (CC) for each institution are shown to two decimal places only. When two or more institutions have achieved the same CC, their positions in the NPI are determined by the third decimal place (or beyond).
- Rankings are based upon 2012 primary research papers published in the Articles, Letters and Brief Communications sections of Nature and Nature monthly research journals (excluding reviews and journals from scientific societies).
- These rankings are based on the most recent data available as of April 9, 2013. Owing to continual refinements of the data the figures in the database are liable to change and might differ from those printed in the supplements.

Top institutions by journal

Aggregated contributions to Nature journals from 2008 to 2012.

The Nature Publishing Index is comprised of 18 journals. The flagship journal is *Nature*, founded in 1869, and there are many subsidiary publications, including one online-only journal: *Nature Communications*. *Nature* and *Nature Communications* are multidisciplinary, whereas most others fall into one of our four subject categories: life sciences, chemistry, physical sciences and earth & environmental sciences. The exception is *Nature Chemical Biology*, which falls into the first two categories.

Below are the aggregated five-year data showing the top five institutions for each journal. (Journals that have been published for fewer than five years, specifically *Nature Communications, Nature Climate Change* and *Nature Chemistry*, show the most complete data.) ■



NATURE

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	25.80	87
2	Tsinghua University	11.49	23
3	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	5.80	9
4	University of Science and Technology of China	5.17	12
5	BGI	4.03	15

NATURE CHEMISTRY

RANK	INSTITUTION	CC	ARTICLES
1	Nankai University	2.00	2
2	Peking University	1.77	3
3	Chinese Academy of Sciences (CAS)	1.44	2
4	Xiamen University	1.33	2
5	East China Normal University	1.00	1

NATURE BIOTECHNOLOGY

RANK	INSTITUTION	CC	ARTICLES
1	BGI	3.25	7
2	Southwest University	1.02	2
3	The University of Hong Kong (HKU)	0.94	1
4	Chinese Academy of Sciences (CAS)	0.62	5
5	Tsinghua University	0.51	4

NATURE CLIMATE CHANGE

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	1.85	5
2	Xiamen University	0.77	1
3	Zhejiang University	0.75	1
4	Ocean University of China	0.33	2
5	Northwest A & F University	0.25	2

NATURE CELL BIOLOGY

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	4.24	10
2	Shanghai Jiao Tong University (SJTU)	2.45	4
3	Peking University	2.28	4
4	Xiamen University	1.64	3
5	Hong Kong University of Science and Technology (HKUST)	1.55	2

NATURE COMMUNICATIONS

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	21.83	43
2	University of Science and Technology of China	8.05	13
3	Peking University	6.33	12
4	Nanjing University	4.61	10
5	Tsinghua University	3.49	13

NATURE CHEMICAL BIOLOGY

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	1.89	6
2	Xiamen University	1.87	2
3	Peking University	0.85	1
4	Shanghai Jiao Tong University (SJTU)	0.67	2
5	Sichuan University	0.46	1

NATURE GENETICS

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	6.26	21
2	BGI	5.68	16
3	Anhui Medical University	3.84	26
4	Shanghai Jiao Tong University (SJTU)	2.68	15
5	Nanjing Medical University	2.61	7

NATURE GEOSCIENCE

RANK	INSTITUTION	CC	ARTICLES
1	China Earthquake Administration	1.85	5
2	Chinese Academy of Sciences (CAS)	1.81	7
3	University of Science and Technology of China	1.02	3
4	Ocean University of China	0.67	2
5	Chinese Academy of Geological Sciences (CAGS)	0.62	2

NATURE NANOTECHNOLOGY

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	2.77	8
2	Nanjing University	2.19	4
3	The Chinese University of Hong Kong	1.09	2
4	Fudan University	1.05	4
5	Xiamen University	1.00	1

NATURE IMMUNOLOGY

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	6.46	13
2	Second Military Medical University	5.85	9
3	Zhejiang University	1.68	5
4	National Center of Biomedical Analysis	1.22	2
5	Peking University	1.00	1

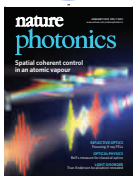
NATURE NEUROSCIENCE

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	7.99	12
2	Hong Kong University of Science and Technology (HKUST)	3.27	4
3	Zhejiang University	1.00	1
4	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	0.88	2
5	Peking University	0.81	4

NATURE MATERIALS

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	4.28	9
2	Hong Kong University of Science and Technology (HKUST)	1.65	2
3	Fudan University	1.58	3
4	University of Science and Technology of China	1.29	5
5	Nanjing University	1.24	3

NATURE PHOTONICS



RANK	INSTITUTION	CC	ARTICLES
1	University of Science and Technology of China	5.65	8
2	Peking University	2.25	3
3	South China University of Technology	1.00	1
4	Chinese Academy of Sciences (CAS)	0.96	1
5	University of Shanghai for Science and Technology	0.68	1

NATURE MEDICINE

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	1.18	3
2	Nanjing Medical University	1.17	2
3	GlaxoSmithKline plc	0.94	1
4	Shanghai Jiao Tong University (SJTU)	0.90	4
5	National Center of Biomedical Analysis	0.82	1

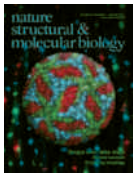
NATURE PHYSICS

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	5.00	17
2	University of Science and Technology of China	4.36	9
3	Tsinghua University	1.79	7
4	Fudan University	1.00	1
5	Peking University	0.32	3

NATURE METHODS

RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	1.07	2
2	East China University of Science and Technology (ECUST)	1.00	1
3	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	0.47	1
4	BGI	0.29	1
5	Peking University	0.18	2

NATURE STRUCTURAL & MOLECULAR BIOLOGY



RANK	INSTITUTION	CC	ARTICLES
1	Chinese Academy of Sciences (CAS)	8.47	14
2	Tsinghua University	3.07	7
3	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	2.13	4
4	Shandong University	1.39	3
5	Zhejiang University	1.25	2

Shanghai Jiao Tong University

SPEARHEADING THE SCIENCE AND TECHNOLOGY REVOLUTION IN CHINA

Shanghai Jiao Tong University (SJTU), established in 1896, is one of the oldest universities in China and has nurtured many great scientists and engineers over its 117-year history. In recent years, the academic programmes at the SJTU have been considerably expanded and the university is now universally acknowledged as one of the top Chinese research universities. It has the potential to make a leading contribution to science and technology in China, which is widely regarded as being necessary to maintain the economic growth of the nation.

Basic science is the foundation for advanced technology and engineering. Under the leadership of its president, Jie Zhang, a prominent scientist as well as a strong advocator for and outstanding practitioner of higher education, the SJTU is committed to redeveloping its research activities to create a first-rate science programme. The SJTU will realize its vision through several steps. As part of the first phase, many world-class scientists have been hired and given the freedom to develop research groups to address critical science problems. These scientists have recruited first-rate junior faculty members from the international arena, and their groups are supported initially by generous start-up funds from the university. After a few years of development, the groups will become competitive in attracting research funding from Chinese government agencies, and will begin producing first-rate science and establishing their reputations in the international communities.

In addition to expanding its scientific research and education programmes, the SJTU has also placed strong emphasis on cross-disciplinary scientific and engineering research. For this purpose, the Institute of Natural Sciences (INS) was established to nurture collaborations between science, engineering and other disciplines in order to bring forth new interdisciplinary scientific breakthroughs.

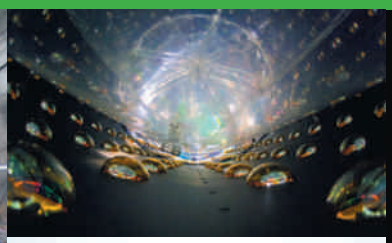
Since 2009, the Department of Physics and Astronomy at the SJTU has hired more than 15 senior professors and over 20 tenure-track faculty, largely from top institutions in the US and Europe. New academic programmes such as laser plasma physics, quantum information and communication, nuclear and particle physics, and astrophysics and astronomy have been developed. Research funding has increased by tenfold in the last four years. The department has already published papers in *Nature* and *Science*, and publishes about a dozen papers in *Physical Review Letters* each year.

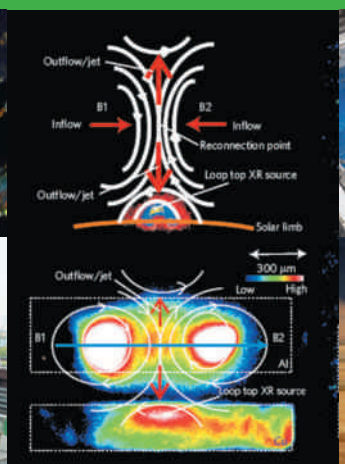
Jie Zhang, president of Shanghai Jiao Tong University

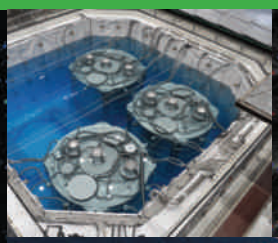
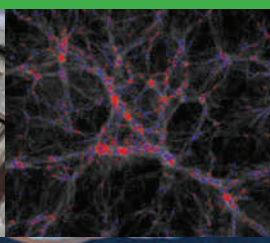
The SJTU's Department of Mathematics has also seen rapid growth in productivity and reputation. It has hired 6 senior and 18 tenure-track faculty from top institutions in the US and Europe. The department now boasts strong representation in many areas of modern applied mathematics, including partial differential equations, scientific computing, mathematical biology, image processing, data science, mathematical finance and statistics. The department is determined to become a top mathematical science department with an international reputation and global impact.

上海交通大學 SHANGHAI JIAO TONG UNIVERSITY

http://en.sjtu.edu.cn/




上海交通大學 SHANGHAI JIAO TONG UNIVERSITY

Exploring the deepest secrets of nature

The SJTU's new institute is studying the physics of the smallest and biggest objects in the Universe.

Particle physics and cosmology are concerned with phenomena occurring at the two extreme scales of the physical world. They capture the popular imagination and are well recognized as some of the most important research frontiers in science. The SJTU established the Institute of Nuclear and Particle Physics, Astronomy and Cosmology (INPAC) in 2009 to study fundamental physics. Its founding director, Xiangdong Ji, is a nuclear and particle physicist. His goal is to attract talented fundamental physics researchers to the SJTU, and the university is already seeing this goal partially acheived. INPAC now boasts a strong experimental particle physics group, a centre for astrophysics and astronomy, a centre for nuclear astrophysics, and a number of well-known theoretical particle physicists.

The experimental particle physics group at INPAC has a wide range of interests, including Large Hadron Collider (LHC) physics, neutrino physics and dark matter detection. Since 2003, Haijun Yang has been developing and applying an advanced data-mining technique for particle identification and event pattern recognition. This technique had been selected as one of the standard tools in the CERN TMVA software package and has been in used in a wide range of particle physics experiments, including the discoveries of the Higgs boson (rated in *Science* as one of the ten most important discoveries in 2012) at CERN and the single top quark at Fermilab. INPAC's Jianglai Liu is one of the main Chinese researchers on the Daya Bay Reactor Neutrino Experiment. Liu is one of the analysis coordination committee members, and has been comanaging the calibration system. The experiment has been hugely successful, determining for the first time non-zero neutrino oscillating parameter $\sin^2 2\theta_{13}$ at a 5.2 σ level. The institute participates in various other frontier experiments including neutrinoless double-beta-decay experiments and a next-generation muon g-2 experiment.

The central focus of the experimental particle physics group at INPAC is the dark matter detection experiment, PandaX, led by Ji and conducted at the world's deepest underground laboratory in Sichuan, China. Group members Karl Giboni and Kaixuan Ni have made important contributions to the largest running dark-matter experiment in the world, XENON100, in Italy, which has improved the limits already by over an order of magnitude. The PandaX experiment aims to improve on this by another order of magnitude and to conduct the first ton-scale dark matter experiment in the world. It uses liquid-xenon technology to observe scattering events between dark matter particles and ordinary atoms. The project has attracted many collaborators in China and overseas, including a group from the University of Michigan.

Research in astrophysics has recently been expanding rapidly. The Center for Astrophysics and Astronomy was established at INPAC in 2012 and is led by Yipeng Jing, a world expert on numerical and observational studies of large-scale structures in the Universe. In addition to the radio-astronomy project 12CMA, the centre is now involved with the BigBOSS dark energy experiment, the Antarctic Dome-A telescope project and the Square Kilometer Array (SKA) project. Its main goals are to understand the properties of dark energy, structure formation in the Universe, and galaxy structure and formation. The centre's theorists are also interested in black hole thermodynamics and the interaction between dark matter and dark energy. ■

Institute for Nuclear and Particle Physics, Astrophysics and Cosmology
http://inpac.physics.sjtu.edu.cn/en/
http://caa.physics.sjtu.edu.cn/

上海交通大学 SHANGHAI JIAO TONG UNIVERSITY

Bridging physics and engineering research

The Institute of Condensed Matter Physics (ICMP) is enthusiastically committed to reviving a great scientific tradition.

As one of the oldest and most prestigious universities in China, the SJTU has a long tradition of pursuing excellence in physics research and education. The focus shifted for several decades when the SJTU became primarily a higher education institution for engineering, but its strong history was revived in 2001 with the relaunch of the Department of Physics. Fueled by the dramatic expansion of the Chinese economy, the SJTU's condensed matter physics research group has been at the centre of the university's quiet revolution, combining fundamental science and engineering research.

The traditional strengths of the Institute of Condensed Matter Physics (ICMP) at the SJTU are engineering and applied physics research, including solar energy, electro-optics, conventional superconductivity and magnetism. In recent years, these have been extended to the more contemporary areas of nanomaterials and nanodevices, high-T_c superconductivity (including the growth of ultralarge single crystals and the preparation of industrialscale tapes for power transmission), first principles calculations for investigating novel mechanical and electronic properties of materials, terahertz physics, topological quantum materials and devices, and chiral p-wave superconductivity and topological quantum computation.

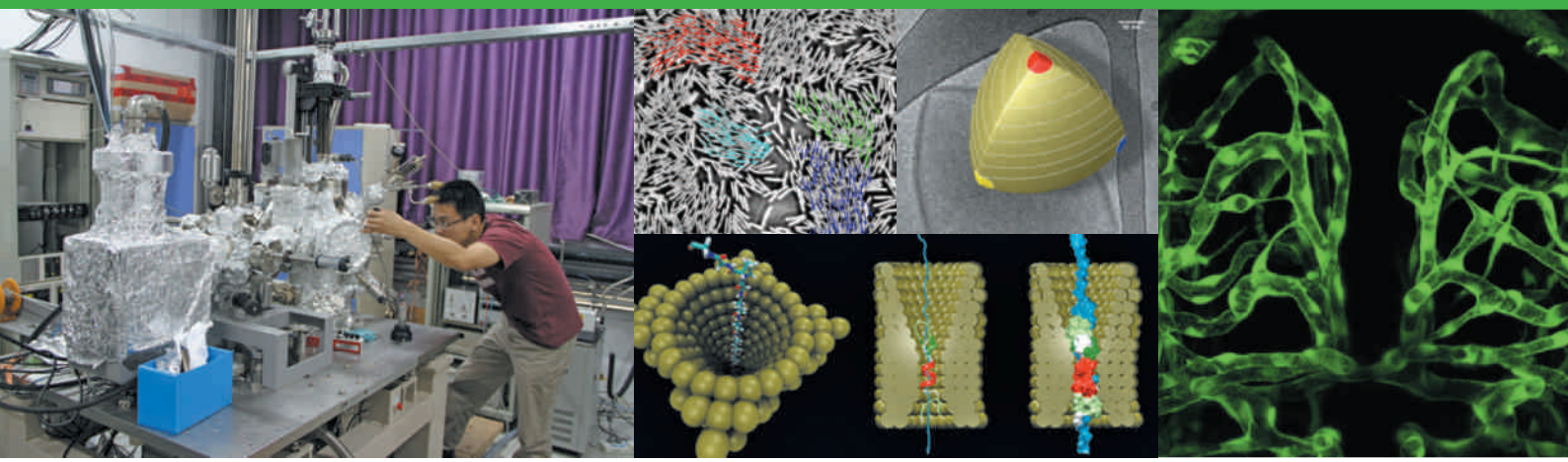
A particularly exciting success story of the ICMP is the recent work on topological quantum materials. The ICMP team is led by a senior experimentalist, Jinfeng Jia, and includes three junior faculty members, Dong Qian, Chunlei Gao, and Canhua Liu, as well as several graduate students and postdoctoral research associates. They have investigated the growth of novel quantum materials by modern molecular beam epitaxy. The laboratory is equipped with world-class facilities that include ultrahigh vacuum systems and advanced *in situ* spectroscopies, such as low-temperature, high-magnetic-field scanning tunneling microscopy and spectroscopy (as well as their spin-polarized varieties) and angle-resolved photoemission spectroscopy.

These instruments allow the team to grow, image and characterize novel materials. The group's most recent findings have been reported in several top journals, including *Physical Review Letters* and *Science*. Their studies have revealed new physics in hybrid systems involving topological insulators and superconducting or magnetic materials, and have implications for topological quantum computing and other advanced technologies being pursued in other SJTU centres.

Accounting for roughly half of the total research expenditure for physics at the SJTU, the ICMP strives to fulfill its established roles in the university while seeking to expand into new areas of research, including unconventional superconductivity, novel quantum devices and contemporary condensed matter theories.

As a part of these efforts, the ICMP is launching a new institute, the Shanghai Center for Complex Physics (SCCP), which will explore new physics at the interface between traditional condensed matter physics and newly developed quantum information. This high standard is being set by the first director of the SCCP, Tony Leggett, a 2003 Nobel Laureate in Physics. Founding members of the centre also include the chair of the organizing committee of the SCCP, Ying Liu, as well as Hang Zheng, Ping Ao, Chunlai Gao and others. Moving forward, the ICMP is striving to elevate its research to a new level while carrying out its core mission of producing high-quality scientists and engineers that are increasingly required by China and the world. ■

Institute of Condensed Matter Physics
Department of Physics
http://klasqc.physics.sjtu.edu.cn/en/



上海交通大學 SHANGHAI JIAO TONG UNIVERSITY

A cross-disciplinary centre for creative research

An institute with a new type of research environment is spawning breakthroughs through interdisciplinary collaboration.

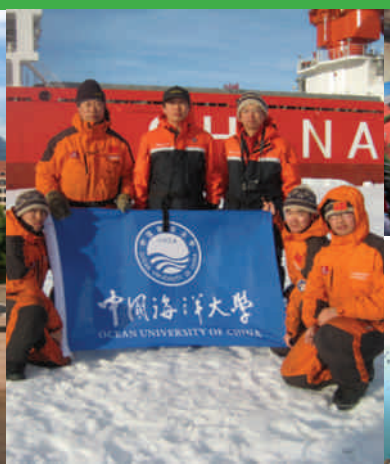
In response to the unique challenges of scientific research in the twenty-first century, David Cai, a computational neuroscientist and applied mathematician, envisions a new kind of a research environment. Specifically, as the director of the SJTU's Institute of Natural Sciences (INS), he aims to break down the traditional confines of individual disciplines so that the institute can become an intellectual centre for world-class interdisciplinary studies. The INS has established ambitious goals and exceptionally high-quality criteria for its innovative investigations, thus setting an unprecedented standard for creating a first-rate research environment and administrative structure that is highly conducive to creative scientific research in China. Since the inception of the INS in 2010, this vibrant environment and streamlined structure have amazed hundreds of international visitors, and earned their high praise.

The INS faculty consists of internationally established scientists as well as distinguished young research fellows recruited from top universities in the West, and with specialties in fields that include applied mathematics, statistics, physics, computer science, engineering, biology and life sciences. Ever expanding the scope of its interdisciplinary research, the INS currently includes six research cores: physical processes in biological systems, theoretical and computational neuroscience, soft condensed-matter physics, materials science, modern statistics and data science, and efficient scientific and engineering computation.

One unique feature of the INS is that research frequently involves close collaboration between experimentalists, theoreticians and computational scientists from various disciplines, inspiring unexpected ideas and new research directions. These collaborations have already sparked breakthroughs in a wide range of topics. Dan Hu and David Cai have studied the adaptation processes of blood vessel systems and their collaboration with experimentalists has revealed that vessel pruning of the brain vasculature is guided by an optimal efficiency principle. In partnership with experimentalists, Jakob Ulmschneider has used molecular dynamics to reveal new complex features of ion transport through the open conformation of a bacterial voltage-gated sodium channel. Hepeng Zhang has studied experimentally the propulsion efficiency of a swimming bacterium and a biomimetic nanobot with a rotating helical flagellum, revealing new insights for realizing a comprehensive theoretical characterization of microorganism swimming. Xiangjun Xing has demonstrated the fascinating morphology of nematic and smectic vesicles. An experimental physicist, Jie Zhang, has investigated jammed states, which can occur in disordered systems such as glassy molecular systems, colloids and granular materials; Zhang has discovered surprising new features of jamming transitions that cannot be explained by traditional theories. These diverse research results have been published — often as cover stories — in leading scientific journals including *Nature*, *PLOS Biology*, *PNAS* and *Physics Review Letters*, and have been featured as Research Highlights in *Nature*.

Through its exciting scientific work and active research atmosphere, the INS has established itself within a short time as a world-class research centre for exchanging innovative scientific ideas, conducting original interdisciplinary research and providing rigorous training of versatile cross-disciplinary scientists. With its high-quality studies, faculty and influx of outstanding visitors, the INS is well positioned to become one of the world's leading scientific institutes. ■

Institute of Natural Sciences
http://ins.sjtu.edu.cn/



Ocean University of China

DISCOVERING, UTILIZING AND PROTECTING THE OCEANS: NINETY YEARS OF STRIVING FOR EXCELLENCE

The Ocean University of China (OUC) has developed a broad academic programme with strengths in oceanography and fisheries since its founding in 1924. Equipped with advanced teaching and research facilities, the university has nurtured many leaders in the global marine science research community, Chinese national science policy makers and senior Chinese officials, including ten members of the Chinese Academies of Sciences and Engineering. The OUC has long been nationally acknowledged as a leader in oceanography and fisheries and is increasingly recognized as a top-ranked institution in China in a number of academic disciplines.

Physical oceanography and atmospheric science

The OUC is renowned for excellence in physical oceanography and atmospheric science. Its researchers have conducted many studies in multiscale ocean and atmosphere dynamics and air–sea interactions and their findings have been published in *Nature* journals. OUC work has revealed the importance of ocean dynamic processes in regional climate responses to global climate change and has clarified the influence of mesoscale and submesoscale ocean dynamics on large-scale climate change. Moreover, OUC research has led to advances in understanding thermohaline circulation dynamics, interactions between high and low latitudes, interactions between deep ocean and coastal seas, internal waves and mixing, changes in polar oceans and climate, and small-scale air–sea exchange.

Marine chemistry and engineering technology

The OUC's marine chemistry programme emphasizes synergetic basic and applied research on marine biogeochemical processes and their effects on the ecological environment and climate change, and on multipurpose utilization of seawater. Research and development efforts of environment-friendly marine materials and protection technologies are ongoing. Active OUC research projects also include studies on the organic carbon cycle of shelf seas, dimethyl sulphide and other reactive gases, biogeochemical tracers of land–ocean interactions, and antifouling functional membranes and coverings with novel copolymers containing capsaicin.

Marine drugs

The OUC is well known for its expertise in marine drugs — therapeutic agents developed from marine resources. The university is researching ways to discover and develop innovative marine drugs through the investigation of living marine resources; screening, optimization and synthesis of marine lead compounds; preclinical evaluation of potential drugs; and commercialization of new drugs. Since 1985, the OUC has developed and commercialized four marine drugs and it is currently performing clinical trials on another four drug candidates. Additionally, the OUC has produced the world's first biologically active marine oligo/polysaccharide database, chaired and published China's first comprehensive text on marine drugs, *Marine Materia Medica*, and been in charge of China's first marine drug journal.

Dexing Wu, president of the Ocean University of China

Marine biology and ecology

Marine biology and ecology programmes at the OUC study the interactions between marine life processes and the marine environment. Areas of particular focus include the genetic, developmental and metabolic

responses of marine organisms to global environmental changes; evolutionary trends of principal marine ecosystems; and the population dynamics of major marine species and their exploration, utilization and protection. Ongoing genetic and genomic studies of diverse marine organisms have paved the way for the OUC to determine the molecular bases and regulatory mechanisms that underpin key economic traits of marine organisms. Research at the university has also advanced knowledge of the development and evolution of amphioxus, phylogenesis of marine ciliates, marine microbiology, interactions between specific populations and environmental factors, effects of global changes on marine organisms, ecological management of marine life resources, and biomaterials derived from marine organisms.

Fisheries

Theoretical and applied research is critical for maintaining sustainable development in marine fisheries. The OUC leads in this field, focussing on interdisciplinary and comprehensive studies in healthy mariculture theory and technology, fisheries biology and resource protection, aquaculture ecology, and fisheries engineering, with the aim of solving fishery problems and meeting the food and economic needs of China. The OUC's development of a programme for the comprehensive control of and protection against the white spot syndrome virus has greatly assisted the shrimp industry. Concurrently, the university's nutritional physiology studies on important aquatic animals have provided a scientific basis for developing aquaculture fish feed.

Marine geology

Basic submarine geoscience and exploration techniques form the core of the OUC's activities in marine geology. The fields of marine geodynamics, submarine exploration technology, modern marine sedimentary processes, and resources and mineralization on the ocean floor have all seen advances from OUC research: breakthroughs have been made in the understanding of the tectonic evolution of typical orogenic belts and basins in eastern China and its seas, source-to-sink effects in high-turbidity waters, and the sedimentary record in eastern China continental shelves. The OUC specializes in research on the geodynamics of continental margins, modern ocean-floor hydrothermal activity and mineralization, modern marine sedimentary source-to-sink effects and land–sea interactions. OUC detection technology development has resulted in widely used research tools such as high resolution seismic systems, TV grabs, sensors for special environments and geophysical processing software.

Marine technology

Committed research teams at the OUC are developing key ocean acoustics, optics and remote sensing technologies, as well as underwater vehicle platforms and *in situ* sampling techniques. Furthermore, the university is researching information technologies for marine environments, including underwater navigation and locating techniques, ocean sensor networks, real-time communication and geographic information system technologies, and digital and transparent ocean engineering. Recent technical breakthroughs have been made in a system for remotely sensing the coupling between wind, waves and precipitation; a deep-ocean Raman *in situ* spectrometer system; underwater imaging techniques based on concentrated illumination and a frequency-difference laser scanning system; an airborne multichannel lidar system for monitoring oil pollution; an autonomous underwater vehicle in the deep sea with a navigation system based on sonar and underwater vision; and reliable data transmission and information security systems for underwater constraint networks.

Future development

The twenty-first century promises to be an ocean-focussed century in which China is committed to developing its maritime power. As a cradle for China's talented professionals in marine-related fields and a critical link in implementing national ocean policies, the university attracts ongoing support and competitive funding from the national government and produces significant research achievements recognized by the global scientific community. The OUC aims to continue on this path, growing as a world-renowned, research-oriented university that excels in oceanography and fisheries by its 100th anniversary in 2025. ■

Ocean University of China
www.ouc.edu.cn

Faculty Positions

Ocean University of China

A comprehensive university with strengths in oceanography and fisheries





The Ocean University of China invites leading scientists and talented professionals with specialties in disciplines listed in this issue of the *NPI China*.

A number of programs are available for experts of all nationalities.

Scholar Programs at the State/Provincial Level

1. National 1000 Plan: Recruitment Program for Global Experts
Applicants should hold positions of full professorship (or equivalent) senior engineer/technology expert roles in high-level overseas universities/institutions.
Full-time positions, Annual salary: 600K–800K, Housing subsidy: 2–2.5 mil.
Short-term positions, Annual allowance: 200K

2. National 1000 Plan: Recruitment Program for Young Overseas Experts
Applicants should have a PhD degree with overseas research experience of over 3 years and demonstrate the potential to make future achievements.
Annual salary: 200K–300K, Housing subsidy: 1.3–1.5 mil.

3. National 1000 Plan: Recruitment Program for Overseas Experts
Applicants should be non-ethnic Chinese internationally recognized experts who hold professorships (or equivalent) senior engineer/technology positions in overseas universities/institutions.
Annual salary: 600K–800K, Housing subsidy: 2–2.5 mil.

4. Chang Jiang Scholars Program of the State Ministry of Education
Distinguished Professor (full-time)
Applicants should be under the age of 45 and hold positions of associate professor or above in overseas universities/institutions.
Annual salary: 400K–500K, Housing subsidy: 1–1.3 mil.
Visiting Professor (short-term)
Applicants should hold positions of full professorship in high-level overseas universities and work at the OUC for a minimum of 2 months per year.
Annual allowance: 150K

5. Taishan Scholars Program for Overseas Experts, Shandong Province
Applicants should hold positions of associate professor or above in overseas universities/institutions and be under the age of 50. Applicants for short-term positions should work at the OUC for a minimum of 3 months per year.
Full-time positions, Annual salary: 250K–350K, Housing subsidy: 1–1.3 mil.
Short-term positions: Annual allowance of 100K

OUC Recruitment Programs

1. Zhufeng Scholars Program
Candidates for state/provincial programs may first apply for full-time positions of Zhufeng Scholars Program and will be eligible to work at the OUC after peer review. Successful applicants will take priority for recommendations for state/provincial programs.
Distinguished Professors to have:
Level I, Annual salary: 300K–500K, Housing subsidy: 800K
Level II: Annual salary: 200K–280K, Housing subsidy: 600K
Level III: Annual salary: 120K–180K, Housing subsidy: 400K

2. Green Card Scholars Program (short-term)
Candidates for state/provincial programs may first apply for Green Card Scholars Program and will be eligible to work at the OUC after peer review. Successful applicants should work at the OUC for a minimum of 2 months per year and will take priority for recommendations for state/provincial programs.
Guest Professor, Annual allowance: 100K
Visiting Professor, Annual allowance: 80K

3. Recruitment Program for Young Talented Professionals
Applicants should i) demonstrate potential for future development; ii) show remarkable achievements to-date; and iii) have a PhD degree from/post-doc experience of over 2 years at overseas universities/institutions.
Level I, Annual salary: 120K–150K, Housing subsidy: 300K
Level II, Annual salary: 100K, Housing subsidy: 150K
More Details: http://222.195.158.131/rsc/more15.htm

Faculty Positions for Young Talented Scientists

Applicants should i) have a PhD degree from/postdoctoral experience of over 2 years at high-level overseas universities or institutions; ii) demonstrate expertise in research and potential for future achievements; and iii) be under the age of 30. Applicants can be appointed associate professors for a term employment of 3 years.

Contact Information

Chinese Applicants: LI Zhaobin
Tel.: 86-532-66782519/E-mail: lzb@ouc.edu.cn

International Applicants: LI Shuang
Tel.: 86-532-66782290/E-mail: sinogerman@ouc.edu.cn

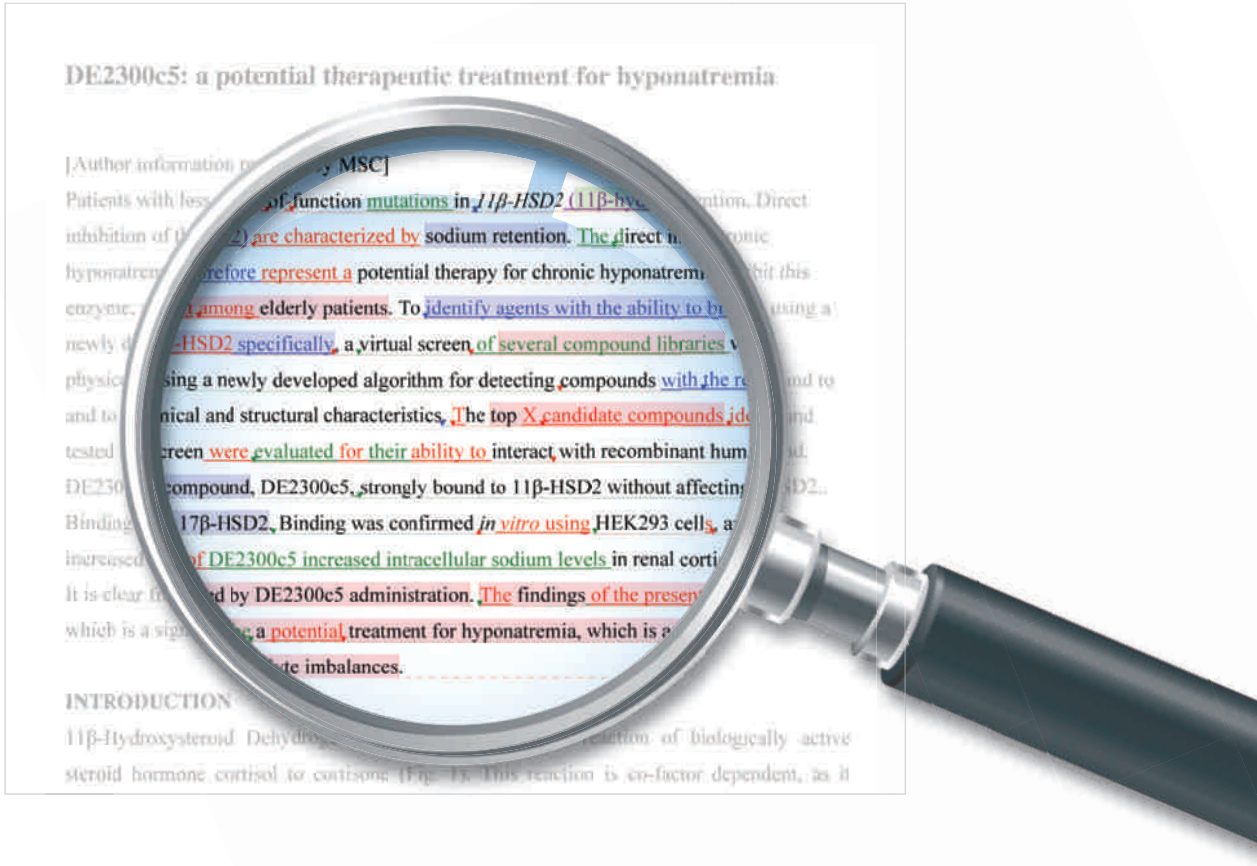
For more details on OUC programs, positions and recruitment procedures, please visit

http://222.195.158.131/rsc/025417.htm.

Notes:
1. Salaries, allowances and subsidies are paid in RMB (pre-tax) and above-mentioned amounts include financial support from state/provincial/municipal governments.
2. Benefits include start-up packages for research, rental apartments (not applicable to Level II of the Young Talented Professionals program), and spousal employment (for full-positions, not applicable to the Young Talented Professionals program).

MACMILLAN
SCIENCE COMMUNICATION

Scientific *Editing*



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SCIENCE COMMUNICATION

Asia-Pacific Top 200

The 2012 Nature Publishing Index contains 738 institutions and universities from the Asia-Pacific region. Below we present the top 200, which includes 51 institutions from China — up from 47 the previous year. In a change in criteria from past years, the NPI now includes international institutions that have labs outside their home country, as long as they are in the Asia-Pacific region. The index compilers have also disambiguated funding agencies (for example, the Australian Research Council). Each institution supported by a funding agency is treated independently. When there is a host institution managing the research, that institution gets the credit for the article published. ■

2012			CORRECTED COUNT		2011			2008–2012		
RANK	INSTITUTION	COUNTRY	(CC)	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
1	The University of Tokyo	Japan	39.72	116	1	42.83	109	1	178.14	453
2	Chinese Academy of Sciences (CAS)	China	37.88	91	3	22.52	62	2	103.92	265
3	Kyoto University	Japan	22.47	55	2	23.98	56	3	92.29	218
4	RIKEN	Japan	19.14	79	4	19.96	70	4	92.10	300
5	Osaka University	Japan	18.22	54	5	17.43	48	5	77.52	208
6	The University of Melbourne	Australia	10.78	48	8	9.83	46	8	32.08	157
7	Nagoya University	Japan	10.50	30	9	9.67	26	7	36.40	100
8	University of Science & Technology of China	China	9.46	17	11	8.58	17	13	26.53	56
9	National University of Singapore (NUS)	Singapore	9.37	47	16	6.25	32	15	24.79	124
10	Tohoku University	Japan	8.55	27	7	10.99	29	6	40.78	117
11	Tsinghua University	China	8.26	31	15	6.36	16	14	25.39	77
12	Peking University	China	8.10	29	13	7.24	21	17	23.17	83
13	Australian National University (ANU)	Australia	8.10	21	14	7.18	13	11	29.58	79
14	National Institute of Advanced Industrial Science & Technology (AIST)	Japan	7.30	23	10	8.82	22	12	27.79	88
15	The University of Queensland	Australia	7.07	41	12	7.71	34	10	30.19	128
16	Agency for Science, Technology & Research (A*STAR)	Singapore	6.63	36	33	3.24	21	16	24.68	111
17	Shanghai Jiao Tong University (SJTU)	China	6.62	30	28	3.74	21	26	13.33	68
18	BGI	China	6.27	20	37	2.97	11	25	14.04	42
19	Kyushu University	Japan	5.81	20	19	4.58	19	19	18.32	68
20	Hokkaido University	Japan	5.47	17	21	4.26	16	22	17.14	54
21	Yonsei University	South Korea	5.46	14	71	1.20	6	46	8.73	31
22	Zhejiang University	China	4.70	15	38	2.96	8	38	9.98	40
23	Tokyo Institute of Technology	Japan	4.60	16	32	3.39	14	24	15.62	65
24	Seoul National University	South Korea	4.60	26	6	11.27	32	9	30.35	96
25	Huazhong University of Science & Technology (HUST)	China	4.41	14	83	1.00	6	58	5.76	22
26	The University of Sydney	Australia	4.41	24	18	5.00	30	18	19.04	100
27	Korea Advanced Institute of Science & Technology (KAIST)	South Korea	4.03	15	27	3.74	13	20	17.32	48
28	Keio University	Japan	3.96	19	41	2.71	9	21	17.25	56
29	Fudan University	China	3.90	13	45	2.34	14	41	9.19	47
30	James Cook University	Australia	3.89	12	65	1.26	7	63	5.40	24
31	Monash University	Australia	3.88	21	17	5.24	17	23	15.68	61
32	The University of New South Wales	Australia	3.82	22	35	3.02	16	31	11.62	60
33	Sungkyunkwan University	South Korea	3.67	10	63	1.36	4	39	9.68	30
34	Nanyang Technological University (NTU)	Singapore	3.57	14	34	3.06	13	34	10.69	38
35	The Commonwealth Scientific & Industrial Research Organisation (CSIRO)	Australia	3.44	16	25	3.81	13	30	11.64	48
36	National Institute for Materials Science (NIMS)	Japan	3.25	15	20	4.52	12	29	12.34	41
37	Academia Sinica	Taiwan	3.21	20	31	3.52	10	35	10.56	41
38	NTT Group	Japan	3.16	5	43	2.61	7	28	12.66	24
39	University of Tsukuba	Japan	3.04	12	55	1.57	9	50	8.18	34
40	Japan Agency for Marine-Earth Science & Technology (JAMSTEC)	Japan	2.93	11	79	1.04	5	43	9.02	28
41	The University of Hong Kong (HKU)	China	2.92	14	30	3.58	12	36	10.26	42
42	Hiroshima University	Japan	2.77	11	57	1.46	7	42	9.11	39
43	Hanyang University	South Korea	2.62	11	59	1.44	6	60	5.59	22
44	Hong Kong University of Science & Technology (HKUST)	China	2.51	5	24	3.86	5	47	8.54	16
45	Korea University	South Korea	2.43	6	42	2.71	12	40	9.28	34

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
46	Xiamen University	China	2.38	6	26	3.77	6	32	10.89	18
47	Chinese Academy of Agricultural Sciences (CAAS)	China	2.36	10	122	0.62	4	78	4.08	21
48	Nanjing University	China	2.35	6	36	3.01	11	33	10.86	35
49	Chinese Academy of Medical Sciences & Peking Union Medical College	China	2.34	15	56	1.47	14	72	4.56	37
50	Sun Yat-sen University	China	2.24	12	130	0.55	7	79	4.02	28
51	Kumamoto University	Japan	2.19	12	209	0.25	1	89	3.31	20
52	National Institute of Biological Sciences, Beijing (NIBS, Beijing)	China	2.18	4	39	2.91	7	37	10.00	19
53	Gwangju Institute of Science & Technology (GIST)	South Korea	2.12	5	137	0.50	2	65	5.20	13
54	Council of Scientific and Industrial Research (CSIR)	India	2.11	3	–	–	–	124	2.25	4
55	Tokyo University of Science	Japan	2.08	6	62	1.38	5	83	3.65	14
56	National Cancer Center	Japan	2.01	8	119	0.63	2	70	4.98	18
57	The University of Western Australia	Australia	2.00	26	23	4.08	22	44	8.99	80
58	Pohang University of Science & Technology (POSTECH)	South Korea	1.95	5	29	3.73	8	27	13.88	35
59	Queensland Institute of Medical Research (QIMR)	Australia	1.94	17	51	1.79	15	49	8.29	69
60	National Taiwan University	Taiwan	1.87	14	78	1.10	7	73	4.41	32
61	Samsung	South Korea	1.85	6	40	2.86	5	52	7.79	19
62	Kobe University	Japan	1.84	6	58	1.45	5	54	7.04	32
63	Japan Synchrotron Radiation Research Institute (JASRI)	Japan	1.81	8	67	1.24	5	67	5.09	24
64	Tokyo Medical & Dental University	Japan	1.79	10	52	1.77	10	45	8.84	47
65	Shandong University	China	1.76	7	113	0.67	6	90	3.30	19
66	East China Normal University	China	1.72	4	229	0.21	1	106	2.43	9
67	The Walter & Eliza Hall Institute of Medical Research (WEHI)	Australia	1.70	8	98	0.78	7	48	8.32	39
68	Ulsan National Institute of Science & Technology (UNIST)	South Korea	1.67	4	–	–	–	150	1.67	4
69	Nanjing Medical University	China	1.67	11	73	1.18	5	80	3.97	20
70	Osaka Prefecture University	Japan	1.66	5	344	0.10	1	120	2.32	11
71	National Tsing Hua University	Taiwan	1.65	6	172	0.31	2	127	2.17	11
72	University of Tasmania	Australia	1.61	12	88	0.95	7	77	4.16	31
73	National Chiao Tung University (NCTU)	Taiwan	1.61	4	97	0.83	5	105	2.65	13
74	Nankai University	China	1.54	7	80	1.03	2	74	4.31	17
75	Ewha Womans University	South Korea	1.53	8	53	1.75	8	69	5.06	21
76	The Chinese University of Hong Kong	China	1.53	10	66	1.25	2	76	4.22	22
77	Nara Institute of Science & Technology (NAIST)	Japan	1.49	4	61	1.42	4	59	5.70	18
78	Tata Institute of Fundamental Research (TIFR)	India	1.46	3	44	2.50	4	53	7.68	15
79	Tsinghua-Peking Center for Life Sciences (CLS)	China	1.44	6	492	0.04	1	161	1.48	7
80	Juntendo University	Japan	1.44	8	334	0.11	1	91	3.22	23
81	Jawaharlal Nehru University	India	1.38	2	85	1.00	1	117	2.38	3
82	Chiba University	Japan	1.37	9	60	1.42	6	62	5.44	26
83	Kyung Hee University	Korea	1.36	6	191	0.28	4	110	2.44	14
84	Korea Institute of Science and Technology (KIST)	Korea	1.33	6	168	0.32	3	87	3.53	14
85	Griffith University	Australia	1.31	5	101	0.76	4	68	5.08	21
86	National Institutes of Natural Sciences (NINS)	Japan	1.30	7	22	4.21	13	51	8.12	37
87	Okayama University	Japan	1.24	5	124	0.61	3	61	5.46	16
88	The University of Otago	New Zealand	1.21	5	131	0.54	7	57	5.88	30
89	Tianjin University	China	1.21	3	444	0.05	1	171	1.31	5
90	Second Military Medical University	China	1.21	8	54	1.65	6	55	6.67	21
91	NEC Corporation	Japan	1.19	4	93	0.88	4	130	2.14	10
92	China Agricultural University	China	1.19	7	–	–	–	93	3.10	16
93	Japan Atomic Energy Agency (JAEA)	Japan	1.19	7	76	1.12	6	97	2.96	16
94	East China University of Science & Technology (ECUST)	China	1.19	2	148	0.43	2	153	1.62	4
95	Wuhan University	China	1.18	6	250	0.18	2	149	1.70	12
96	Macquarie University	Australia	1.17	8	74	1.17	9	64	5.28	27
97	China University of Geosciences	China	1.12	5	147	0.43	4	147	1.73	12
98	Xi'an Jiaotong University	China	1.11	7	77	1.12	4	95	3.02	13
99	The University of Tokushima	Japan	1.10	4	253	0.18	3	102	2.76	15
100	Swinburne University of Technology	Australia	1.08	4	142	0.47	3	100	2.91	11
101	F. Hoffmann-La Roche Ltd	Switzerland	1.07	2	–	–	–	131	2.07	3

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
102	University of Toyama	Japan	1.06	5	473	0.04	1	192	1.15	7
103	Tokyo Metropolitan Institute of Medical Science	Japan	1.05	3	92	0.94	3	88	3.38	15
104	South China University of Technology	China	1.05	3	202	0.25	2	159	1.48	11
105	Anhui Medical University	China	1.03	7	104	0.73	4	75	4.26	17
106	Teikyo University	Japan	1.01	3	–	–	–	181	1.23	5
107	Waseda University	Japan	1.00	6	47	2.18	6	71	4.70	20
108	National Institute of Infectious Diseases (NIID)	Japan	1.00	1	217	0.24	3	115	2.40	8
109	University of Waikato	New Zealand	0.92	3	263	0.17	1	200	1.09	4
110	The Graduate University for Advanced Studies (Sokendai)	Japan	0.91	5	49	1.88	9	86	3.58	23
111	Kansai Medical University	Japan	0.89	1	–	–	–	205	1.05	3
112	National Institute of Genetics (NIG)	Japan	0.87	3	277	0.14	2	99	2.91	17
113	The University of Wollongong	Australia	0.85	5	300	0.13	1	121	2.32	11
114	JEOL Ltd.	Japan	0.85	3	90	0.94	3	119	2.34	8
115	Japanese Foundation for Cancer Research	Japan	0.85	2	–	–	–	187	1.19	5
116	Tongji University	China	0.83	8	315	0.12	2	185	1.21	14
117	Fuzhou University	China	0.83	1	–	–	–	231	0.90	2
118	High Energy Accelerator Research Organization (KEK)	Japan	0.83	3	108	0.70	6	132	2.04	12
119	The University of Canterbury	New Zealand	0.81	5	198	0.27	3	126	2.17	12
120=	Ritsumeikan University	Japan	0.80	1	590	0.00	1	204	1.05	3
120=	Raman Research Institute (RRI)	India	0.80	1	–	–	–	253	0.80	1
122	Nagasaki University	Japan	0.79	3	112	0.68	2	134	2.04	9
123	Centre for Australian Weather & Climate Research (CAWCR)	Australia	0.79	4	199	0.27	2	124	2.23	11
124	Queensland University of Technology	Australia	0.78	3	360	0.09	3	229	0.91	7
125	The University of Adelaide	Australia	0.78	8	96	0.85	12	87	3.55	36
126	National Institute of Informatics (NII)	Japan	0.77	2	117	0.64	5	104	2.66	13
127	Kanazawa University	Japan	0.76	2	223	0.23	3	82	3.79	12
128	National Institute for Environmental Studies (NIES)	Japan	0.75	3	87	0.98	4	109	2.46	11
129	National Center for Global Health & Medicine	Japan	0.75	6	356	0.09	2	234	0.88	9
130=	Suntory Institute for Bioorganic Research	Japan	0.70	1	–	–	–	270	0.71	2
130=	Victor Chang Cardiac Research Institute (VCCRI)	Australia	0.70	1	120	0.63	2	92	3.16	9
132	Yunnan University	China	0.69	3	427	0.06	1	260	0.77	5
133	Curtin University	Australia	0.68	3	109	0.70	4	81	3.85	15
134	China Medical University	Taiwan	0.68	9	106	0.72	5	138	1.95	20
135	The University of Auckland	New Zealand	0.68	5	46	2.25	12	66	5.10	26
136	Chinese Center for Disease Control & Prevention (China CDC)	China	0.67	2	–	–	–	259	0.78	4
137	Gakushuin University	Japan	0.67	2	–	–	–	118	2.36	6
138	The General Hospital of Chinese People's Liberation Army	China	0.67	4	395	0.08	2	265	0.75	6
139	Tokyo Gakugei University	Japan	0.67	1	177	0.30	1	222	0.97	2
140	Japan Aerospace Exploration Agency (JAXA)	Japan	0.67	3	259	0.17	1	168	1.31	8
141	Saitama Medical University	Japan	0.66	3	343	0.10	1	154	1.56	13
142	Kyoto Prefectural University	Japan	0.65	2	283	0.14	1	256	0.79	3
143	Iwate Biotechnology Research Center (IBRC)	Japan	0.64	1	–	–	–	250	0.81	2
144	Jilin University	China	0.63	6	69	1.24	3	114	2.40	16
145	Mater Medical Research Institute	Australia	0.63	1	–	–	–	298	0.63	1
146	National Cancer Centre Singapore	Singapore	0.62	4	340	0.10	2	266	0.74	7
147	National Yang-Ming University (NYMU)	Taiwan	0.62	3	179	0.29	3	108	2.51	13
148	Japan Biological Informatics Consortium (JBIC)	Japan	0.62	3	173	0.30	1	212	1.02	5
149	University of the Ryukyus	Japan	0.61	6	–	–	–	300	0.61	6
150	National Institute of Polar Research (NIPR)	Japan	0.61	3	–	–	–	302	0.61	3
151	International Rice Research Institute (IRRI)	Philippines	0.60	1	–	–	–	305	0.60	1
152	University of Electro-Communications	Japan	0.60	3	374	0.08	1	306	0.60	3
153	The National Institute of Radiological Sciences (NIRS)	Japan	0.59	1	–	–	–	307	0.59	1

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
154	Peter MacCallum Cancer Center	Australia	0.59	6	364	0.08	3	113	2.43	24
155	Akita University	Japan	0.59	6	255	0.18	2	141	1.95	11
156	Garvan Institute	Australia	0.57	4	292	0.14	2	101	2.85	16
157	Tokyo University of Pharmacy and Life Sciences	Japan	0.57	2	252	0.18	2	223	0.97	6
158	University of Ulsan	Korea	0.57	7	354	0.09	2	245	0.84	11
159	Lanzhou University	China	0.56	3	276	0.15	3	262	0.75	7
160	Ocean University of China	China	0.56	4	114	0.67	2	182	1.23	6
161	Fukui Prefectural University	Japan	0.56	1	–	–	–	173	1.31	2
162	The Hong Kong Polytechnic University	China	0.56	2	–	–	–	144	1.81	4
163	Yokohama City University	Japan	0.55	4	48	1.90	8	56	5.92	25
164	National Institute of Health Sciences (NIHS)	Japan	0.54	2	180	0.29	2	227	0.92	5
165	National Institute of Agrobiological Sciences (NIAS)	Japan	0.53	3	197	0.27	1	103	2.71	11
166	National Defense Medical College	Japan	0.53	2	–	–	–	329	0.53	2
167	Beihang University (BUAA)	China	0.52	2	136	0.50	1	177	1.27	4
168	Aichi Cancer Center	Japan	0.50	5	–	–	–	289	0.66	8
169=	Matsumoto Dental University	Japan	0.50	1	–	–	–	322	0.55	2
169=	RMIT University	Australia	0.50	1	388	0.08	1	254	0.80	3
169=	National Hospital Organization Nagoya Medical Center	Japan	0.50	1	–	–	–	344	0.50	1
169=	Koito Manufacturing Co., Ltd.	Japan	0.50	1	–	–	–	343	0.50	1
169=	Melbourne Centre for Nanofabrication (MCN)	Australia	0.50	1	–	–	–	340	0.50	1
174	Sichuan Agriculture University	China	0.48	2	533	0.02	1	337	0.50	3
175	Nanjing Agricultural University	China	0.48	3	261	0.17	1	286	0.67	5
176	Soochow University	China	0.47	4	158	0.35	5	189	1.18	12
177	Beijing Forestry University	China	0.47	1	–	–	–	357	0.47	1
178	Tokai University	Japan	0.47	1	–	–	–	237	0.86	7
179	Chinese National Human Genome Center at Shanghai (CHGC)	China	0.46	1	258	0.17	3	184	1.21	8
180	National Institute of Information & Communications Technology	Japan	0.45	2	349	0.10	1	133	2.04	7
181	Gunma University	Japan	0.45	4	466	0.04	1	201	1.06	12
182	Visva-Bharati University	India	0.44	1	–	–	–	367	0.44	1
183	Gachon Medical School	South Korea	0.44	2	–	–	–	333	0.51	3
184	Kyoto Sangyo University	Japan	0.43	3	290	0.14	2	313	0.57	5
185	Taipei Veterans General Hospital	Taiwan	0.42	3	561	0.01	1	167	1.33	7
186	Iwate University	Japan	0.41	3	–	–	–	275	0.71	5
187=	Korea Electronics Technology Institute (KETI)	South Korea	0.40	1	–	–	–	353	0.48	2
187=	Korea Institute for Advanced Study (KIAS)	South Korea	0.40	1	–	–	–	387	0.40	1
187=	Ono Pharmaceutical	Japan	0.40	1	–	–	–	243	0.84	2
190	Chung-Ang University (CAU)	South Korea	0.40	3	125	0.61	2	180	1.23	6
191	Korea Research Institute of Standards & Science (KRISS)	South Korea	0.39	2	190	0.28	2	268	0.73	5
192	National Institute of Health	South Korea	0.38	5	110	0.69	3	151	1.67	11
193	Nagoya City University	Japan	0.38	4	–	–	–	203	1.05	10
194=	South China Agricultural University	China	0.38	1	–	–	–	364	0.45	2
194=	Linyi University	China	0.38	1	305	0.13	1	341	0.50	2
196	China Medical University (PRC)	China	0.37	6	200	0.27	5	235	0.88	14
197	Tokyo Women's Medical University	Japan	0.36	4	353	0.10	1	125	2.19	17
198	Deakin University	Australia	0.35	2	–	–	–	352	0.48	4
199	Kyungpook National University	South Korea	0.35	4	152	0.42	2	230	0.90	9
200	Beijing Normal University	China	0.34	2	183	0.29	4	213	1.01	9

- Corrected counts (CC) for each institution are shown to two decimal places only. When two or more institutions have achieved the same CC, their positions in the NPI are determined by the third decimal place (or beyond).
- Rankings are based upon 2012 primary research papers published in the Articles, Letters and Brief Communications sections of Nature and Nature monthly research journals (excluding reviews and journals from scientific societies).
- These rankings are based on the most recent data available as of April 9, 2013. Owing to continual refinements of the data the figures in the database are liable to change and might differ from those printed in the supplements.

Global Top 100

The Global Top 100 list counts the primary research published in all Nature journals by any institution worldwide. International institutions get credit for their labs outside of their home country. Funding agencies such as the Medical Research Council in the UK or the US Department of Energy get credit only if they directly manage institutions. Otherwise it is the host institution that is credited.

The table below shows the world's top 100 scientific institutions for 2012 and is dominated by the United States and Europe. China is still well represented, with four institutions from the country making the list, up from three in 2011. ■

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	Harvard University	United States	150.25	369
2	Stanford University	United States	76.34	161
3	Max Planck Society	Germany	64.31	186
4	Massachusetts Institute of Technology (MIT)	United States	60.39	199
5	French National Centre for Scientific Research (CNRS)	France	45.91	246
6	National Institutes of Health (NIH)	United States	43.82	143
7	University of Washington	United States	40.97	102
8	University of Cambridge	UK	39.80	137
9	The University of Tokyo	Japan	39.72	116
10	Swiss Federal Institute of Technology (ETH, Zurich)	Switzerland	39.28	72
11	University of California, Berkeley	United States	38.23	98
12	Chinese Academy of Sciences (CAS)	China	37.88	91
13	University of California, San Diego (UCSD)	United States	37.44	95
14	University of Oxford	UK	36.97	131
15	Columbia University in the City of New York	United States	34.76	89
16	Yale University	United States	34.46	82
17	University of California, San Francisco (UCSF)	United States	33.24	95
18	Johns Hopkins University	United States	32.82	94
19	University of California Los Angeles (UCLA)	United States	26.97	82
20	University of Michigan	United States	25.89	76
21	Helmholtz Association of German Research Centres	Germany	25.75	122
22	Northwestern University	United States	25.34	54
23	University of Chicago	United States	24.88	54
24	University of Illinois, USA	United States	24.49	55
25	California Institute of Technology	United States	24.28	63
26	Kyoto University	Japan	22.47	55
27	The Scripps Research Institute	United States	22.20	44
28	University of Pennsylvania	United States	21.24	58
29	Washington University in St Louis	United States	20.85	72
30	Weizmann Institute of Science	Israel	20.54	34
31	Princeton University	United States	20.39	44
32	Duke University	United States	20.03	67
33	RIKEN	Japan	19.57	80
34	Cornell University	United States	19.54	67
35	New York University	United States	18.53	47
36	Osaka University	Japan	18.22	54
37	University of Toronto	Canada	17.15	63
38	Memorial Sloan-Kettering Cancer Center	United States	16.17	44
39	Medical Research Council (MRC)	UK	16.12	38
40	University College London	UK	15.62	79
41	University of North Carolina at Chapel Hill	United States	15.24	52
42	Swiss Federal Institute of Technology (EPFL)	Switzerland	15.17	43
43	The University of Texas at Austin	United States	14.91	43
44	The University of Texas Southwestern Medical Center at Dallas	United States	14.61	32
45	University of Geneva	Switzerland	14.10	43
46	University of Pittsburgh	United States	14.01	44

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
47	University of Minnesota	United States	13.89	47
48	Lawrence Berkeley National Laboratory	United States	12.97	73
49	F. Hoffmann-La Roche Ltd	Switzerland	12.85	25
50	The University of Texas MD Anderson Cancer Center, USA	United States	12.48	33
51	University of Maryland	United States	12.35	52
52	University of Bristol	UK	12.30	41
53	Utrecht University	Netherlands	12.08	45
54	The University of Edinburgh	UK	11.95	52
55	University of Colorado Boulder	United States	11.89	37
56	Salk Institute for Biological Studies	United States	11.84	24
57	University of Massachusetts Worcester	United States	11.68	28
58	University of Zurich (UZH)	Switzerland	11.49	41
59	The Rockefeller University	United States	11.35	31
60	Spanish National Research Council (CSIC)	Spain	11.03	47
61	University of Wisconsin-Madison	United States	10.80	31
62	The University of Melbourne	Australia	10.78	48
63	National Institute for Health and Medical Research (INSERM)	France	10.68	92
64	University of Copenhagen	Denmark	10.59	54
65	Nagoya University	Japan	10.50	30
66	University of Freiburg	Germany	10.30	33
67	Baylor College of Medicine	United States	10.26	38
68	European Molecular Biology Laboratory (EMBL)	Germany	9.98	38
69	Imperial College London	UK	9.96	64
70	Ludwig Maximilian University of Munich (LMU)	Germany	9.75	52
71	Mount Sinai School of Medicine	United States	9.63	35
72	University of Tennessee	United States	9.50	29
73	University of Science and Technology of China	China	9.46	17
74	The University of British Columbia	Canada	9.42	36
75	Howard Hughes Medical Institute (HHMI)	United States	9.41	16
76	National University of Singapore (NUS)	Singapore	9.37	47
77	Heidelberg University	Germany	9.28	46
78	Vanderbilt University	United States	9.24	41
79	Pennsylvania State University	United States	9.22	35
80	Los Alamos National Laboratory (LANL)	United States	9.21	23
81	Purdue University	United States	9.12	22
82	University of Southern California (USC)	United States	9.00	47
83	University of California Irvine (UCI)	United States	8.67	36
84	Ohio State University	United States	8.61	30
85	Tohoku University	Japan	8.55	27
86	Leibniz Association of German Research Institutes	Germany	8.49	28
87	University of Utah	United States	8.36	29
88	Technical University Munich (TUM)	Germany	8.32	29
89	Tsinghua University	China	8.26	31
90	Rutgers, The State University of New Jersey	United States	8.22	25
91	Argonne National Laboratory	United States	8.21	24
92	University of California, Davis	United States	8.20	41
93	Peking University	China	8.10	29
94	Australian National University (ANU)	Australia	8.10	21
95	National Research Council (CNR)	Italy	8.09	49
96	University of Groningen	Netherlands	8.02	37
97	Cold Spring Harbor Laboratory	United States	7.80	27
98	McGill University	Canada	7.78	43
99	The University of Manchester	UK	7.76	34
100	Georgia Institute of Technology	United States	7.64	17

- Corrected counts (CC) for each institution are shown to two decimal places only. When two or more institutions have achieved the same CC, their positions in the NPI are determined by the third decimal place (or beyond).
- Rankings are based upon 2012 primary research papers published in the Articles, Letters and Brief Communications sections of Nature and Nature monthly research journals (excluding reviews and journals from scientific societies).
- These rankings are based on the most recent data available as of April 9, 2013. Owing to continual refinements of the data the figures in the database are liable to change and might differ from those printed in the supplements.

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