ARTICLES: 493
CORRECTED COUNT: 245.19

China

China's investment in science is bearing fruit. In 2013, it published more articles in NPI journals than any other Asia–Pacific nation. Significantly, in January that year, the Chinese Academy of Sciences (CAS) knocked The University of Tokyo off the top of the NPI institutional rankings. China has ambitious projects underway that challenge not only Japanese but European and US institutions.

For China, 2013 was a year of scientific discoveries, technological feats and the construction of cutting-edge facilities.

In February a team from China and the US, led by Xiangdong Ji of Shanghai Jiao Tong University (SJTU) initiated the world's deepest particle-physics experiment, PandaX, aimed at detecting particles of dark matter in pools of liquid xenon deeper than 2.5 km underground.

In June, China sent its fifth crewed spacecraft, Shenzhou 10, to dock with China's space station, Tiangong 1. It is the first stage of a plan to construct a bigger modular station around 2020, four years before the planned end of the International Space Station programme. Also in June, the Tianhe-2 (or Milky Way-2) supercomputer became the world's fastest, with an operating speed of 33.9 petaflops per second – nearly twice as fast as the previous leader.

China's high-definition Earth observation satellite, Gaofen 1, started operating in December to survey and monitor environmental processes, particularly to collect data on natural disasters such as earthquakes.

Earlier in December, another arm of its space programme made news when China became the third country, after the US and Russia, to explore the moon. The Chang'e-3 lunar probe landed safely and delivered China's first robot rover, Yutu (or Jade Rabbit), which is equipped with ground-penetrating radar, spectrometers and cameras.

Chinese scientists are also exploring the oceans for knowledge. Under the country's 12th Five-Year Plan (2011-15) a National Deep Sea Center will be set up and its deep-diving submersible, Jiaolong, upgraded.

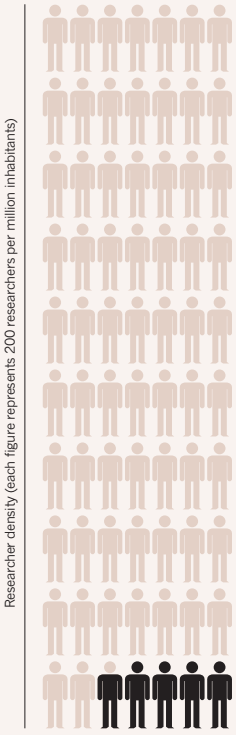
China can now also lay claim to the oldest-known primate skeleton, the earliest collection of fossilised dinosaur embryos — found in their crushed shells — and the earliest-known member of the bird family. These discoveries were published in *Nature* in 2013 by scientists from CAS and from other domestic and international institutions.

China is allocating an increasing proportion of its GDP to science and technology: 1.98% in 2012; expected to rise to 2.2% by 2015. President Xi Jinping, who took office in March 2013, is continuing his predecessor's

CHINA TOP TEN

China has 65 institutions in the Asia-Pacific top 200

ASIA-PACIFIC RANK 2013	INSTITUTION	2013 NATIONAL RANK	2013 CORRECTED COUNT	2013 ARTICLES	2012 NATIONAL RANK	2012 CORRECTED COUNT	2012 ARTICLES	2009–13 NATIONAL RANK	2009–13 CORRECTED COUNT	2009–13 ARTICLES
1	Chinese Academy of Sciences (CAS)	1	63.15	165	1	36.38	93	1	147.70	399
9	University of Science and Technology of China (USTC)	2	15.11	37	2	9.46	17	2	39.67	87
10	Tsinghua University	3	13.83	39	3	8.99	34	3	39.39	116
14	Peking University	4	11.16	48	4	8.72	35	4	33.15	131
17	BGI	5	10.50	32	5	6.62	30	5	23.86	73
21	Nanjing University	6	7.89	19	6	6.27	20	6	18.87	101
35	Fudan University	7	5.72	25	7	4.70	15	7	17.79	49
36	Zhejiang University	8	5.70	25				8	15.64	64
37	Shanghai Jiao Tong University (SJTU)	9	5.63	35	9	3.90	13	9	15.01	57
39	The University of Hong Kong (HKU)	10	4.99	18	10	2.92	14	10	14.67	68



CHINA 2013

POPULATION: 1.354 B
RESEARCHERS: 1.318 M

SOURCE: UNESCO

fiscal promotion of science and has emphasized that such investment should be a driving force for the country's economic development.

However, in 2013, Mu Rongping, director-general of the CAS Institute of Policy and Management, told the American Association for the Advancement of Science that China suffers from a lack of innovation. Critics blame a system that bases funding allocation on other considerations than merit.Only a small proportion of its science and technology budget is spent on basic research, academics are poorly paid and government agencies are not well coordinated.

Many Chinese enterprises depend on foreign innovation for core technologies. World Bank data show that in 2012 China earned US$1 billion in intellectual property fees while paying out US$17.7 billion. But, Chinese researchers are not without creativity: the Tianhe-2 supercomputer and China's space programme are both examples of how the country contributes significant home-grown improvements to existing technologies.

Chemistry is China's strength in the NPI. In that field, its top three institutions — CAS, University of Science and Technology of China (USTC) and Xiamen University — published 38 chemistry articles in Nature research journals in 2013. But 33 of these were in the online-only journal *Nature Communications*. The top two contributors to the more prestigious *Nature Chemistry* were Japan's Kyoto and Nagoya Universities (see Top Institutions by Journal, page 46). CAS earned about half of its CC from articles published in *Nature Communications*.

CAS LEADING THE WAY

CAS is the leading light among Asia-Pacific institutions. It comprises more than 100 research centres, of which the Institute of Physics (17%) and the Shanghai Institutes for Biological Sciences (13%) make the greatest contributions to CAS's NPI output. In 2013, CAS ranked 6th in the Global Top 100, up from 14th in 2012 and 23rd in 2011.

The notable riser in 2013 was Nanjing University, whose output in the physical sciences lifted it from 14th to 6th in China. Nanjing published more articles in *Nature Physics* than did any other Asia-Pacific institution in 2013 and was ranked third for papers in *Nature Materials*.

Of the top Chinese institutions, the highest proportional growth since 2009 has been shown by the global genomics company BGI, which is now China's fifth-ranked institution. Genome sequences published by BGI in *Nature, Nature Genetics* and *Nature Communications* help explain the evolution of predatory instinct in falcons and salt adaptation in the desert poplar, among other insights.

Almost 90% of the NPI articles from both BGI and SJTU came from international collaborations. For BGI this is to be expected as gene sequencing typically requires many collaborators. For instance, a typical genomics paper may have in excess of 200 authors affiliated with more than 150 institutions from across 20 countries.

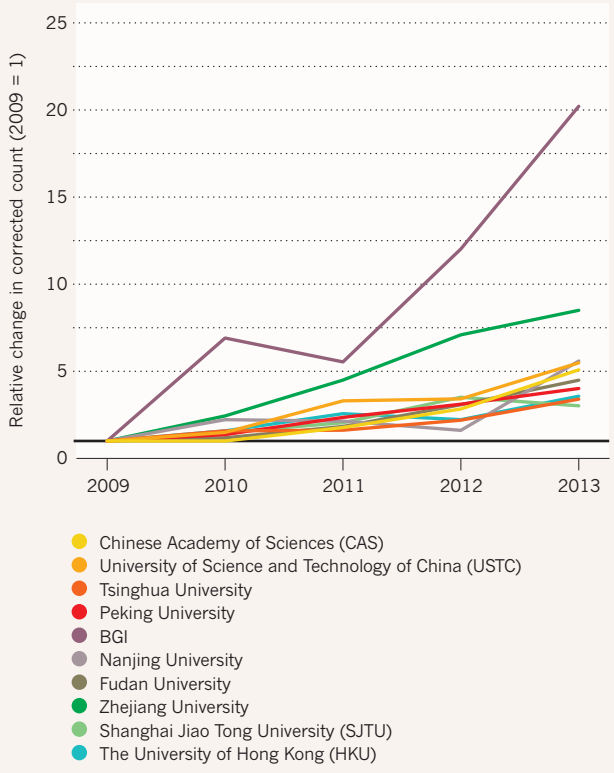
For SJTU, however, international cooperation is a strategy for improvement. It offers joint degrees with universities in the US, France and the UK, and a PhD exchange scheme with the University of Cambridge. It also has cooperation agreements with more than 100 universities and research institutions worldwide. SJTU claims to have the most returnees under the 1000 Talents scheme, a government-funded scheme that offers top Chinese researchers substantial incentives to return home. Despite recording an increased article count, SJTU was the only institution in the top ten whose corrected count decreased in 2013. This may be due in part to extensive international and domestic collaboration. SJTU published papers with 63 other Chinese institutions, compared with USTC's 24 and Tsinghua's 18.

China's range of international partners is changing: it increased collaboration with Denmark, Canada and Australia, at the expense of research with the US. Many collaborations have government support.

Since 2008 the National Natural Science Foundation of China (NSFC) has worked with the Danish National Research Foundation to establish ten research centres in cancer research, nanotechnology, renewable energy and communication technology. This link is starting to yield high-quality results. ■

INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top 10 institutions since 2009.



RESEARCH STRENGTHS

The subject areas in which China achieved its corrected count.