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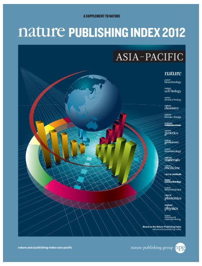

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Most people would agree that the Asia-Pacific is where it's happening. The definition of "it" varies — but from manufacturing to finance, fashion, art, pop music and, increasingly, science, the eyes of the world are focused on the region.

Here we present a picture of high-quality research output from the region through the unique lens of the 2012 Nature Publishing Index, which ranks institutions and countries in the Asia-Pacific.

Over the past few years, the NPI has charted the rise and rise of science in the Asia-Pacific region. The 2012 body of papers in Nature journals continues this trend: there have never been more papers with authors from Asia-Pacific research organizations, either in absolute terms or as a proportion of the total produced (see 'A year of growth', page 6).

Asia-Pacific science is a significant presence on the global stage, with 13 institutions from the region making the top 100 (see page 48). China, in particular, had a strong year and now boasts four institutions on this list, up from three in 2011. Singapore is a new entrant (see page 25), while Japan is down to six institutions (see page 12) and South Korea has dropped out entirely (see page 24).

So what are the major drivers of these trends? External factors have certainly played a role: Japan and, indeed, New Zealand, (see page 28) has been dealing with the aftermath of devastating earthquakes and the consequent diversion of funds and resources.

For China, improved output has been in part the result of increased governmental scientific investment over the past 20 years (see page 18). The country's arrival as a contender to Japan's research dominance was made clear in 2012, and a tipping point may have been reached. The grande dame of Asia-Pacific research — the University of Tokyo — has company at the head of the table: the Chinese Academy of Sciences (CAS) is now neck-and-neck with Todai (as the university is known). Moreover, if we look at a 12-month rolling window (nature.asia/publishing-index-asia-pacific), CAS actually edged ahead in January 2013. Can CAS hold this position throughout the year? Such dynamic competition for supremacy gives the scientific world yet another reason to keep its eyes on the ascendant Asia-Pacific.

Nick Campbell
Head of Nature Publishing Group, Greater China

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NATURE PUBLISHING INDEX 2012 ASIA-PACIFIC
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Tohoku University

RESTORATION AND GROWTH IN THE FACE OF CHALLENGE

With its strong reputation for providing high-quality education and research, Japan's Tohoku University found itself playing a leading role in the reconstruction of disaster-stricken areas and the regeneration of Japan following the 2011 Great East Japan Earthquake.

Tohoku University is located in Sendai, the capital city of Miyagi prefecture, which lies in the Tohoku region of northeastern Japan. Founded in 1907 as the third university in the former imperial university system, Tohoku University is proud to have always adopted an 'open-door' policy. In 1913 Tohoku University became the first university in Japan to admit female students, the 100th anniversary of which it celebrated in 2013. In its early days, Tohoku University attracted young, talented researchers with global knowledge and exceptional skills. Since its foundation, Tohoku University has been leading the world in materials science research and is the location of the renowned Advanced Institute for Materials Research, a World Premier International (WPI) Research Center. The university has also contributed to cutting-edge technology through its innovations in magnetic recordings, optical communication and semiconductors. Additionally, in the life sciences the university has made advances in the development of medical treatments through its research on multilineage-differentiating stress-enduring (Muse) cells.

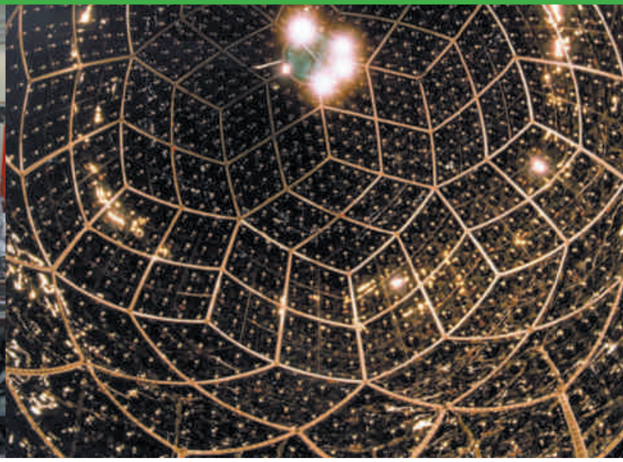
On 11 March 2011, the Great East Japan Earthquake, with a magnitude of 9.0 on the Richter scale, struck the Tohoku region, causing some 19,000 fatalities and widespread destruction. Tohoku University, whose own facilities suffered damage, enthusiastically embraced the mission of restoring the area. Dedicated efforts of the university staff and heartfelt support from around the world have contributed to the ongoing reconstruction of Tohoku. Two years after the earthquake hit, Tohoku University's own facilities and buildings are in use, research is conducted as before and radioactivity levels in Sendai have been normal. The university continues to engage in research and contribute to society with the aim of restoring Tohoku.

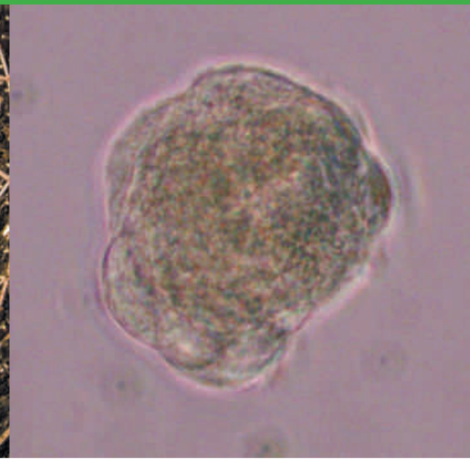
In confronting the new challenges arising from the catastrophic events, Tohoku University set itself two goals: to lead in the reconstruction and regeneration efforts in the Tohoku region, and to achieve world-class status. To attain the first goal, detailed action plans were conceived with tasks carefully delegated to ensure competency and efficiency. All of the university staff realized the importance of accepting them with a positive and determined mindset. "United by a common goal, every member of Tohoku University is committed to developing solutions that will benefit both industry and the local people," says Susumu Satomi, president of Tohoku University.

Susumu Satomi, president of Tohoku University

In pursuit of world-class status, Tohoku University understands that protocols and goals for education and research have to be clearly and independently defined. "The university will equip students with the leadership qualities and communication skills necessary to meet the challenges posed by evolving societal demands. In research, we will promote cutting-edge and interdisciplinary approaches, as well as expanding basic research programmes," explains Satomi.

The journey of Tohoku University has been one of innovation, growth and response to change. By pursuing the road to restoration, the university is poised to rebound to even greater heights and to become more resilient.





TOHOKU UNIVERSITY

Comprehensive action plan for rebuilding northeastern Japan

After the earthquake, Tohoku University launched eight projects and Reconstruction Action 100+ with the aims of rebuilding Tohoku and revitalizing Japan.

As a leading university in the region, Tohoku University has played a key role in initiating and implementing disaster recovery and rebuilding efforts. The university has launched eight core projects, which were designed to bring together national and international universities, research institutes, governments, industries and local communities to form a collaborative framework for reconstructing the Tohoku region.

Disaster science

One of the eight projects was headed by the International Research Institute of Disaster Science (IRIDeS), which focuses on the management and mitigation of natural disasters. The IRIDeS aims to build sustainable and resilient societies that will respond promptly, sensibly and effectively to emergencies.

Reconstruction of community healthcare and new biobank

Following the earthquake, the situation of many injured people was compounded by the destruction of numerous medical facilities. Many healthcare professionals found themselves unable to work. To address this growing crisis, the Project for Reconstruction of Community Healthcare was set up to retrain and retain healthcare professionals.

At the same time, a large-scale biobank was established as a global research centre for genomic medicine, preventive medicine, drug development and translational research.

Smart energy and ICT

Due to severe damage to power lines, power supply systems and communications were crippled throughout Japan. Aiming to prevent such disruptions from recurring, the Project for Environment Energy and the Information Communication Technology (ICT) Reconstruction Project were created. These two projects brought together a team of researchers to develop power systems and communication infrastructures capable of withstanding disasters.

Environment protection

The leakage of radioactive isotopes from the nuclear power station in Fukushima seriously impacted the area around the power station and generated an urgent need to decontaminate the environment. To realize this, the Radioactive Decontamination Project was inaugurated to detect and remove radioactive substances. In addition, measures to restore marine life and the environment were implemented under the Tohoku Marine Science Project.

Local economy challenges

Finally, to revive the local economy, the Regional Industries Restoration Support Project was created to assist in rebuilding affected industries and communities, and the Regional Innovation Producer School was established to train leaders to achieve continual innovation and productivity. In addition, the Industry–University Collaboration Development Project for Reconstruction was formed to enhance cooperation between academia and industry and to promote commercialization of intellectual property owned by Tohoku University.

Since the disasters, Tohoku University faculty members from various disciplines have also been volunteering their time and services to rebuild the Tohoku region and revitalize Japan's economy as part of the Reconstruction Action 100+.

Image: Bousai Consultant Co., Ltd./IRIDeS, Tohoku Univ.

TOHOKU UNIVERSITY

Striving towards a disaster-resilient society

Tohoku University spearheaded recovery efforts after the 2011 Great East Japan Earthquake with the inauguration of the International Research Institute of Disaster Science (IRIDeS).

In 2007, Tohoku University formed the Research Group on Disaster Prevention and Management, a team of researchers from 19 different faculties and schools. Its main aim was to develop novel technologies for earthquake and tsunami prediction and crisis management. While the team achieved considerable success with their models being implemented in over 30 countries, the destructive force of the Great East Japan Earthquake surpassed the limits of existing knowledge and technology. Tohoku University responded by establishing the International Research Institute of Disaster Science (IRIDeS) in April 2012 to take a leading role in recovery and reconstruction efforts. Furthermore, the IRIDeS aims to introduce cutting-edge technology and robust disaster-management protocols to the world.

While it is disconcerting to consider the occurrence of another catastrophic event of similar magnitude, the possibility cannot be ruled out. The IRIDeS recognizes that it is essential to learn from experiences to develop sustainable and disaster-resilient communities. To achieve this goal, the Hazard and Risk Evaluation Research Division of the IRIDeS aims to combine earthquake and tsunami engineering with geoinformatics based on historical and recent disasters to improve disaster prediction. "The reliability of long-term evaluation of hazards has been improved by combining the data from the 2011 earthquake with that obtained from the earthquakes of 869 and 1611," explains Arata Hirakawa, director of the IRIDeS. In addition, cooperation with local municipalities and governments will be strengthened to establish robust protocols for swift evacuation and recovery.

The Human and Social Response Research Division of the IRIDeS conducts research into disaster-related cognitive science and socio-economic sciences to better understand the social processes underlying human perception and behaviour in complex natural and social environments. The results will be applied to develop disaster prevention and mitigation systems responding promptly, sensibly and effectively to natural disasters.

The IRIDeS Regional and Urban Reconstruction Research Division has established several initiatives to reduce the need for human resources in recovery operations and to preserve Japan's rich history. Innovative disaster robotics have been created to reduce human participation in search and rescue operations. "Many robotic systems were used to gather information such as structural damage and environmental parameters in response to the Fukushima Daiichi Nuclear Power Plant incident. As far as we know, it was the first time in human history that robots were used so extensively," explains Hirakawa. Concurrent with active efforts to decontaminate the environment, novel technologies and protocols are being developed for locating and preserving historical artifacts and documents.

On the road to recovery, the IRIDeS is deeply committed to learning from past experiences to realize a better tomorrow. This aspiration is expressed by the IRIDeS logo, which signifies the transformation of misfortune into positive outcomes. "By combining the lessons learned from the Great East Japan Earthquake with the excellent work conducted at the various faculties of Tohoku University, I am convinced that the IRIDeS will become a world-leading institute in advancing earthquake and tsunami observation and prediction," states Hirakawa with admirable determination. ■

災害科学国際研究所 IRIDeS International Research Institute of Disaster Science

International Research Institute of Disaster Science (IRIDeS)
http://irides.tohoku.ac.jp/eng/

TOHOKU UNIVERSITY

Advancing medical research and services

To address critical medical problems after the earthquake in March 2011, Tohoku University created the Project for Reconstruction of Community Health Care to regenerate the local medical community and establish personalized preventive medicine.

The Great East Japan Earthquake and resulting tsunami caused widespread devastation and an unprecedented demand for medical services in the Tohoku region. Local healthcare professionals strived to cope with the mounting crisis, but their efforts were greatly hindered by the extensive destruction of medical institutions in coastal areas. Compounding the problem was the loss of many medical documents and patient records.

As a part of this Tohoku University initiative, the Comprehensive Training Center for Community Medicine was formed by uniting the Tohoku University Hospital, the Graduate School of Medicine, the Graduate School of Dentistry and the Institute of Development, Aging and Cancer. The new centre was established to devise comprehensive solutions to the complex set of problems and to create an expansive biobank for genome studies.

Designed to be a self-sufficient institution equipped with sophisticated facilities and equipment, the Comprehensive Training Center for Community Medicine is responsible for retraining and deploying healthcare professionals. Its loop-like mechanism provides a framework for upgrading medical skills and knowledge while retaining human resources locally. To cultivate a new generation of healthcare professionals to engage in community and disaster medicine, the centre invited medical experts in the field to impart their knowledge and skills to Tohoku University students.

The second goal of the project was the inception of the Tohoku Medical Megabank Organization (ToMMo) which is responsible for reconstructing medical institutions in the Tohoku region. The ToMMo Clinical Fellowship programme was created for healthcare professionals who are motivated to be part of the Tohoku reconstruction efforts as well as having a passion for genome research.

"To date, we have appointed more than 15 ToMMo Clinical Fellows. Five of them have already been engaged in regional medical services," relates Masayuki Yamamoto, executive director of ToMMo.

To support and maintain a group of healthcare professionals in Tohoku, ToMMo is committed to expanding its role as an important medical institution serving both the local and international community. To fulfil this goal, the ToMMo Biobank was established to conduct long-term health studies of residents in disaster-stricken communities in the Tohoku region. Already the biggest population-based biobank in Japan, the ToMMo Biobank aims to recruit researchers globally and to collaborate with commercial companies that share the vision of revitalizing the Tohoku region. Through its Tohoku Genome Reference Panel Project, standard sets of human genomes will be generated to provide invaluable data for innovating personalized preventive medicine.

"This project is unique as it focuses on the genomic profiles of Tohoku residents, whereas other biobanks mainly analyse populations in the Western world. I hope we can soon achieve a genetic reference panel that can serve as a standard for Japan — I believe it will be the first such panel of an Asian population," explains Yamamoto.

The ToMMo Biobank hopes to share its findings with the world, culminating in the initiation of translational research and drug development.

東北メディカル・メガバンク機構
TOHOKU MEDICAL MEGABANK ORGANIZATION

Tohoku Medical Megabank Organization (ToMMo)
www.megabank.tohoku.ac.jp/english/

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A year of growth

In 2012, the countries of the Asia–Pacific region continued to increase their high–quality scientific output and improve their standing in the Nature Publishing Index. And, despite the ongoing global economic doldrums, national spending on research and development was also raised by governments in most of the top countries.

In 2012, researchers at 738 institutions from 16 Asia-Pacific countries contributed to 1,009 primary research articles published in Nature journals, representing just over 28% of the world total of 3,560. All these figures have grown year on year — including the region's proportion of the total — since 2008 (see 'Growth in the NPI').

However, there is an uneven spread of scores across the journals that make up the Nature Publishing Index (NPI). For instance, Asia-Pacific authors contribute to 40% of the articles and earn 28% of the corrected count (CC) for *Nature Communications*, whereas for *Nature* the figures are 22% of articles and 8.6% of the CC. *Nature Communications* records important advances within the same disciplines as *Nature* and the other research journals, but papers it features don't need to have such strong scientific impact. These figures suggest that Asia-Pacific institutions generally have some way to go with their contribution to basic science of the highest calibre. The challenge is to replicate the growth in the region's contribution to global research output in the impact of its work.

Moreover, because Nature journals publish mainly basic research rather than applied science, the Asia-Pacific region's strengths in engineering and high-tech manufacturing are not represented in the NPI. In fact, both South Korea and Taiwan have acknowledged that their lack of focus on basic research is a problem. In 2012, South Korea established a new Institute for Basic Science in an effort to rebalance its research and development (R&D) effort (see 'South Korea', page 24).

FIVE-YEAR STORY

The NPI is a useful record of the publishing activity of countries and institutions across the Nature journals. There will soon be data available dating back to 2000, making it possible to look at long-term trends in publication performance.

In the 2012 Asia-Pacific NPI, which presents data from the past five years, the order of the top five countries has not changed over that period. But there is jostling in the ranks. Japan, which still dominates, has seen only a modest increase in output in the past five years; China is edging closer, with a four-fold increase in CC over this time. South Korea and Singapore are also rising fast (see 'Output growth', page 9).

China is the big story of 2012. It has increased its CC from 2011 by 36%, compared to Japan's 9% and Australia's 5.6%. Further down the ranks, three countries/territories were vying for sixth place in 2011, but Taiwan forged ahead last year with a CC increase of more than 20%. Meanwhile, the CC of the other two — India and New Zealand — fell.

Although Japan is still leading the pack, it did not have a stellar year (see 'Japan', page 12). The country has had a double setback: the diversion of resources into rebuilding after the 2011 Tohoku earthquake and tsunami, and — like the rest of the world — coping with the economic downturn. The number of Japanese institutions in the Global Top 100 decreased from seven to six, and five of the remaining institutions — including the region's premier research institution, the University of Tokyo — fell in the rankings (see 'Global Top 100', page 48).

It is not all bad news for Japanese science however. The country holds regional first place in three of the NPI's four subject categories — chemistry, life sciences and physical sciences — and ranks third in earth & environmental sciences (see 'Research areas', page 9).

The top three countries dominate the subject categories: China is second across the board, while Australia leads in the area of earth sciences, is third in life sciences, and fourth in chemistry and physical sciences. The only intrusions into the top ranks by other countries are South Korea, which is third in physics, and New Zealand, taking fourth place in earth sciences.

CHINESE ASCENT

Within China, the star performer is Chinese Academy of Sciences (CAS). The research behemoth, with 60,000 employees, is seriously challenging the University of Tokyo as the region's top science institution (see 'China', page 18). China now has four representatives in the Global Top 100, with the elevation of Tsinghua University above Peking University. But the rapid rise in quantity of scientific output has raised questions about its quality, both internally and externally.

In 2008 and 2009, Australia was just about on a par with China. This is no longer the case. Although a steady increase in funding has seen Australia's R&D output grow and allowed its CC to nearly double over the past five years, the country has fallen behind the Chinese juggernaut and now sits unchallenged in third place in the region. Australia's top-ranked institution is the University of Melbourne, which continues to rise in both regional and global rankings. Other institutions have not kept up: the University of Melbourne and the Australian National University in Canberra, the country's capital, are its only representatives in the Global Top 100. But these two institutions are likely to have company soon. James Cook University, in the northern city of Townsville near the Great Barrier Reef, will break into the Global Top 100 next year if it continues its current trajectory (see 'Australia', page 22).

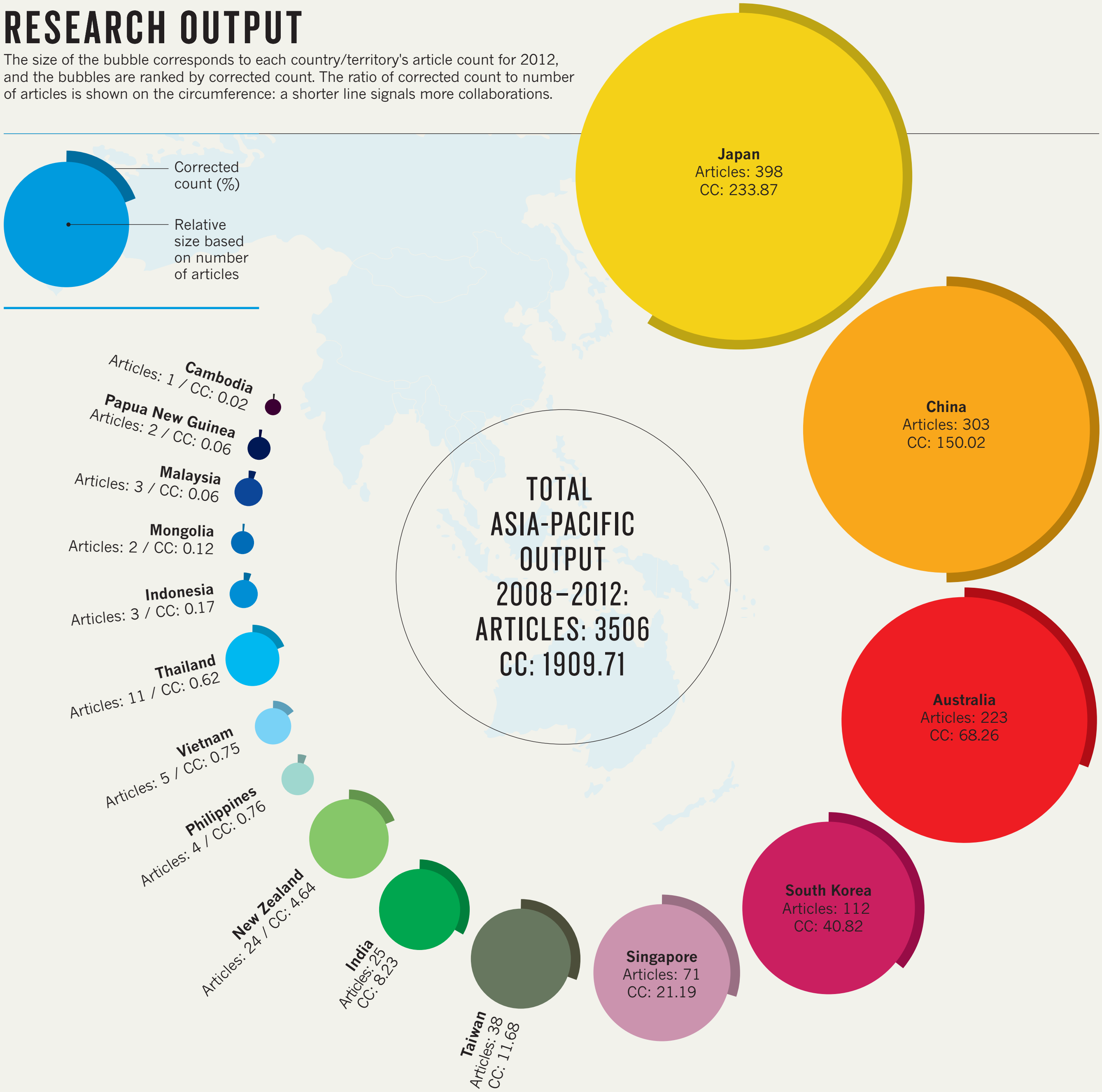
The rapid rise in quantity of China's scientific output has raised questions about its quality, both internally and externally.

Having achieved a few years of growth, South Korea paused in 2012 as its CC fell slightly, but this could be a lull before a storm of activity. The country has enjoyed increased funding, the initiation of an extensive basic research programme, and is now under the leadership of a president with an engineering background determined to apply a scientific slant to many policy areas (see 'South Korea', page 24). The country appears poised for an R&D spurt in 2013 similar to the one Singapore experienced in 2012. That nation improved its CC in 2012 by nearly 60% and its best-known institution, the National University of Singapore, marched into the Global Top 100 for the first time.

China's large population and economy are supporting the growth in Chinese science. But, as a percentage of its population, China has fewer researchers than other Asia-Pacific countries. Its researchers also have the lowest efficiency rating in terms of CC per researcher (see 'Researcher efficiency', page 9). South Korean researchers publish at a similarly low rate, whereas Australia and Singapore, which both have smaller populations, maintain their regional rankings with a high level of researcher efficiency. As noted, publication in Nature journals is a reflection on both the quality and the type of science being produced. ■

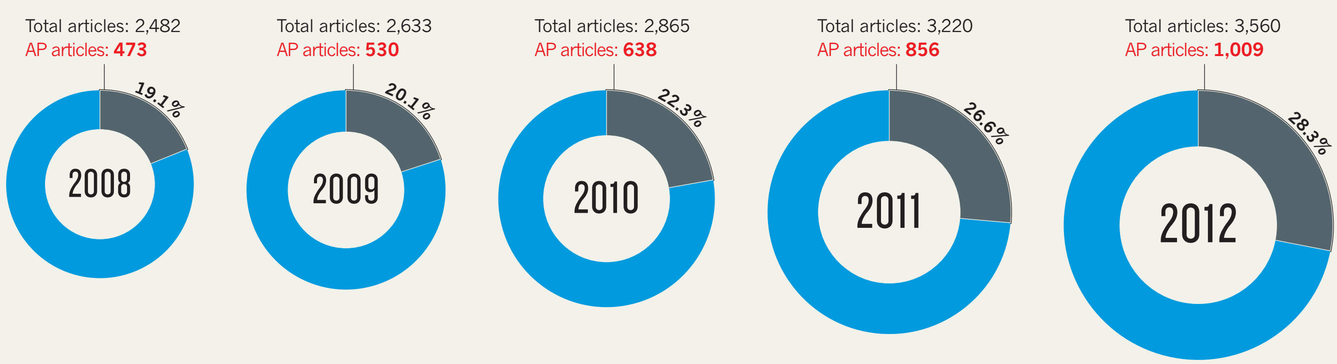
RESEARCH OUTPUT

The size of the bubble corresponds to each country/territory's article count for 2012, and the bubbles are ranked by corrected count. The ratio of corrected count to number of articles is shown on the circumference: a shorter line signals more collaborations.



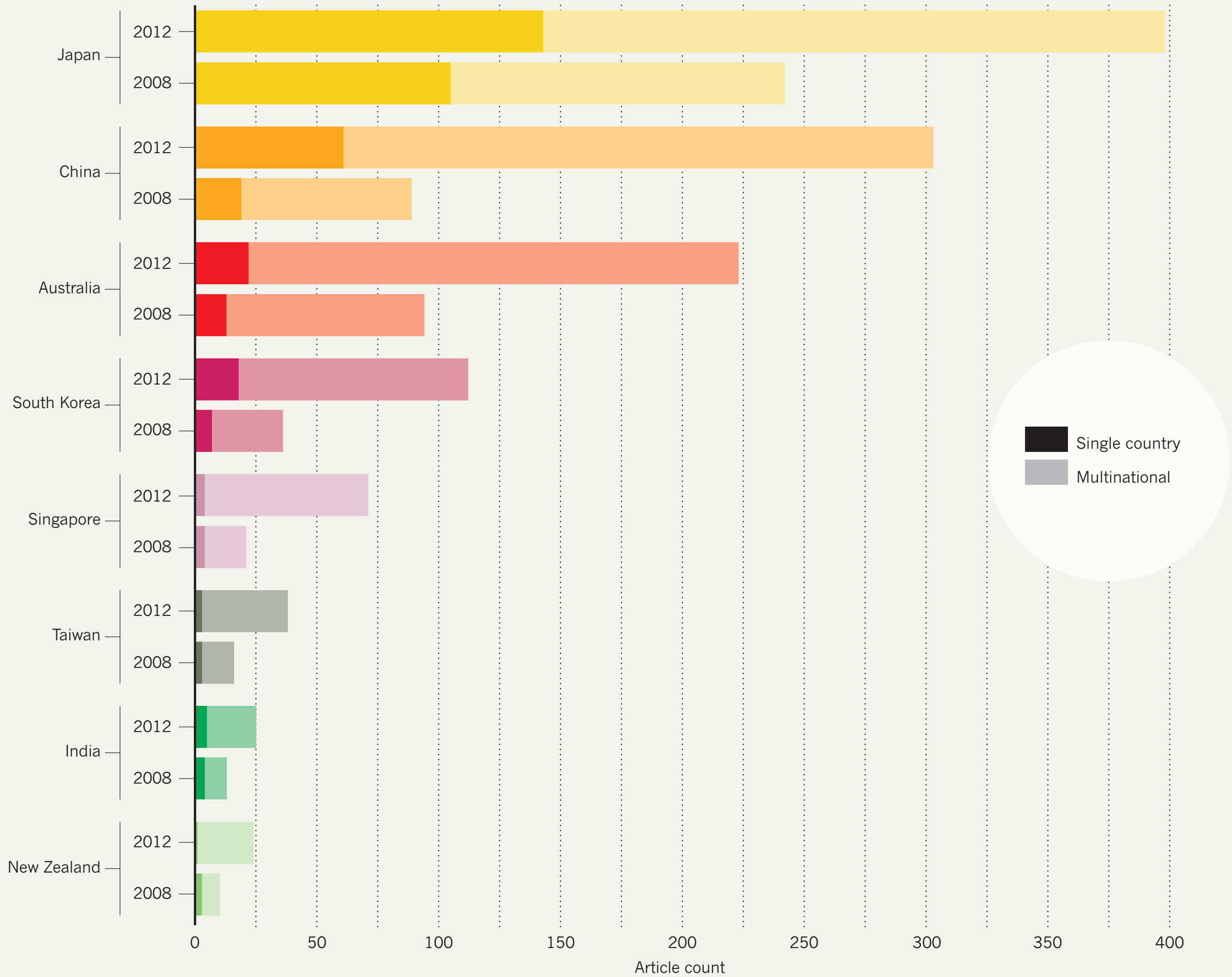
GROWTH IN THE NPI

Along with growth in the number of articles in the NPI, the share attributable to Asia-Pacific researchers has also increased.



COLLABORATION TRENDS

Over the past five years, article counts have grown for all the top eight countries/territories in the year's NPI. However, this growth is unevenly split between articles wholly authored by scientists within one country/territory and articles that represent international collaborations.



COLLABORATIONS

The region's authors contributed to just over 28% of the total number of articles in the NPI in 2012. However, their share of CC, which apportions multi-author work equally (see 'A guide to the index', page 32), was only 15% of the total. This compares to 41% of CC for the United States and 31% from the 27 European Union nations.

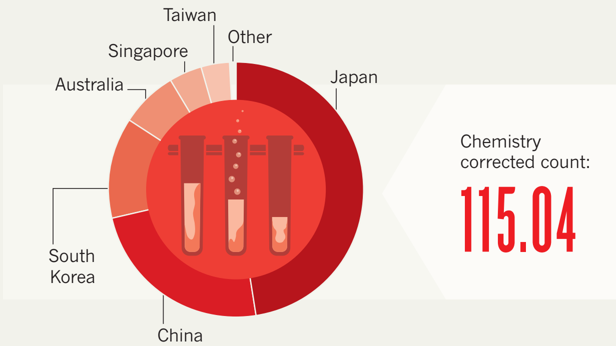
These figures suggest that Asia-Pacific researchers are more likely to collaborate with researchers from outside their region than are US and European scientists. Asia-Pacific authors receive slightly less per article (an average of 0.54 CC per article) than do authors from the US (0.73) and EU (0.65).

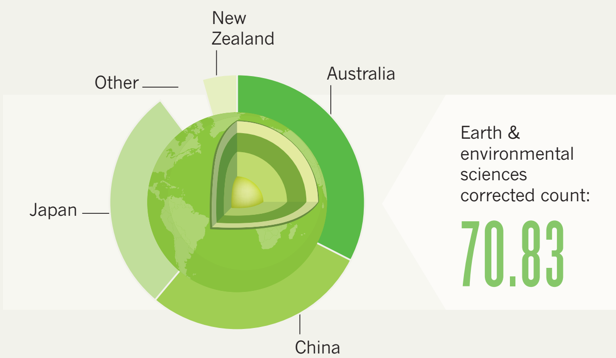
Comparing NPI data from 2012 with those from 2008 reveals an interesting trend in international collaborations, and a distinction between the countries of the Asia-Pacific. In these five years, all of the top 8 Asia-Pacific countries/territories have become more collaborative in their science, but have varied in the proportion. The bottom four in particular — Singapore, India, Taiwan and New Zealand — have increased their total number of articles almost entirely through more collaborations, with little or no growth in domestically authored articles. The most collaborative is Singapore, with only 4 out of 71 articles being wholly internal. This is not surprising, given the high number of multinational corporations setting up labs in the country, providing exposure to researchers at many institutions around the world.

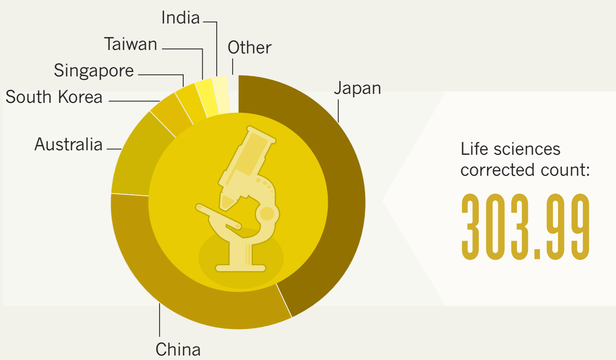
In contrast, what appears to mark out the top four countries is their ability to grow their internal science output. Although, proportionally, the rise in article count for Japan, China, Australia and South Korea comes mainly from more international collaborations, these countries have also pushed up their within-country papers. Indeed, China and South Korea have both more than doubled their output. Japan's growth is modest, but domestic papers still account for more than a third of its article count (and 61% of its CC). A solid output in home-grown papers could therefore be a useful indicator of the strength of a country's internal science capabilities.

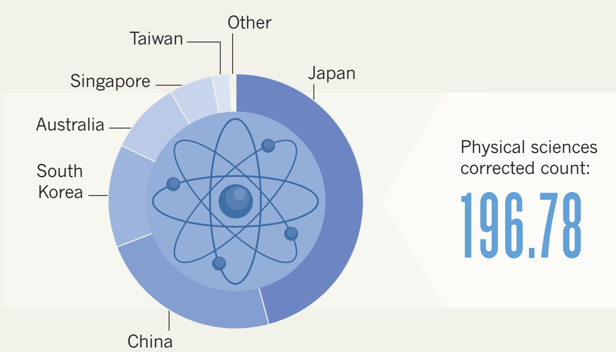
RESEARCH AREAS

Each country/territory's share of the corrected count by subject area: chemistry, Earth & environmental sciences, life sciences and physical sciences.



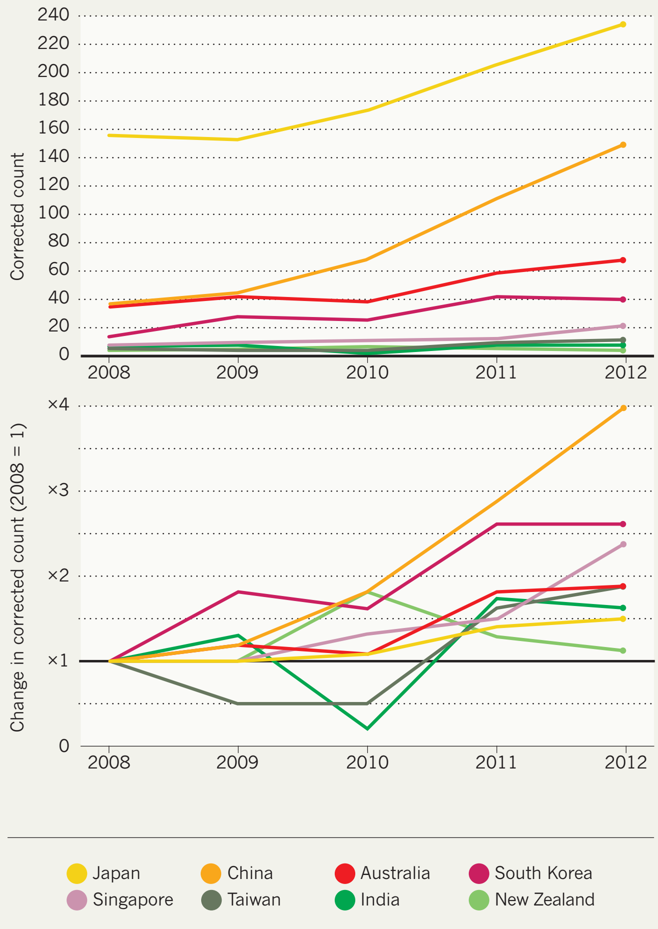






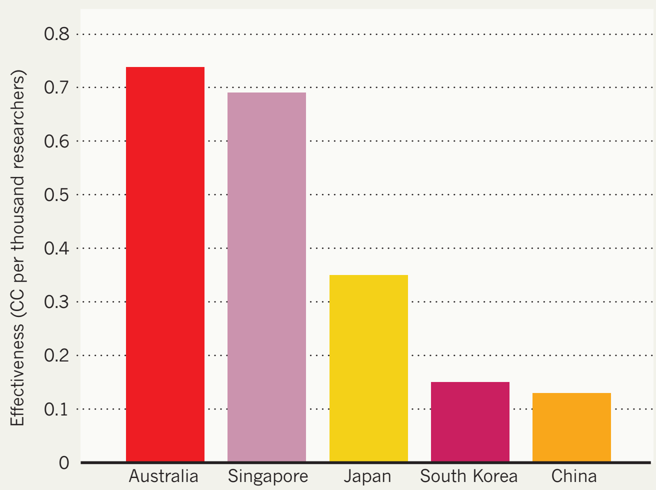
OUTPUT GROWTH

Charting the corrected count in absolute numbers shows the margin by which Japan leads other countries/territories (top). However, seen as a relative change (bottom) the figures show improvement for China, Singapore and South Korea.



RESEARCHER EFFICIENCY

Dividing the corrected count by the number of researchers gives a measure of the effectiveness of a country's researchers.



SOURCE: UNESCO





RIKEN

A LEADER OPENING UP TO THE WORLD

RIKEN is Japan's most comprehensive research organization for basic and applied science. With institutes and facility sites across Japan and collaborations with research institutions worldwide, RIKEN is at the forefront of research in fields spanning the entire range of the natural sciences, from developmental biology and neuroscience to quantum physics and computer science. In 2012, RIKEN added the identification of element 113 and its contribution to the international Encyclopedia of DNA Elements (ENCODE) project to its long list of scientific achievements. Two new large-scale facilities, the RIKEN X-ray free-electron laser, known as SACLA, and the K computer, opened for shared use by Japanese and foreign researchers. RIKEN is also attracting an increasing number of foreign researchers, who are drawn by the institute's world-class research, state-of-the-art facilities and comfortable work conditions.

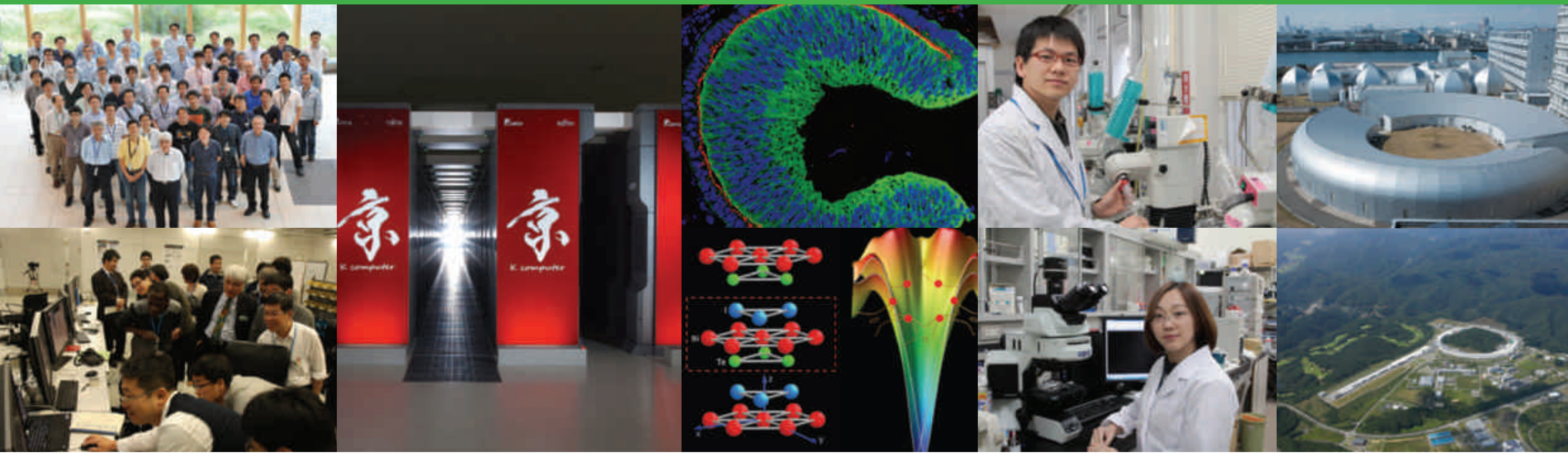
Lucky number 113

The RIKEN Wako campus, just outside Tokyo, is home to the RIKEN Nishina Center for Accelerator-Based Science where Kosuke Morita and his team created element 113. The team, from institutions across Japan and China, started the experiment in 2003 and since then has identified atoms of element 113 three times. The last and to date most unambiguous data was collected in experiments at the RIKEN Linear Accelerator and reported in September 2012. By firing zinc atoms at a bismuth film, the team produced a very heavy ion followed by a chain of six consecutive alpha decays identified as products of an isotope of element 113. "This has been a painstakingly long experiment," says Morita. "First, we had to create the 108th, 110th, 111th and 112th elements. This gave us confidence that we had the right experimental conditions to produce element 113. For our next challenge, we look to the uncharted territory of element 119 and beyond."

The ENCODE project

A group of researchers led by Piero Carninci, team leader of the RIKEN Omics Science Center in Yokohama, contributed to the ENCODE project, an international research project funded by the National Human Genome Research Institute (NHGRI). ENCODE aims to identify all functional elements encoded in the human genome. Carninci's team contributed to the project by mapping RNA-transcribed regions using data on transcription starting sites gathered by RIKEN's original Cap Analysis Gene Expression (CAGE) technique. "Scientists at the RIKEN Omics Science Center are particularly pleased with this work because the CAGE technology, which was developed earlier, was employed as one of the standard technologies for analysing the output of the genome," explains Carninci. "This international collaboration is in line with the centre's mission to understand the function of the genome."

The **RIKEN Nishina Center for Accelerator-Based Science** is a leading accelerator complex where theoretical and experimental scientists collaborate in their exploration of the mysteries of nuclei. The centre has two main divisions: an experimental division, for accelerator research, and a theoretical division, for fundamental research in nuclear physics. The accelerators can handle a wide variety of different nuclei, providing unique opportunities for researchers to study the structure and properties of nuclei in great detail.



First-class facilities available to all

Two celebrated additions to RIKEN's suite of state-of-the-art large-scale facilities opened in 2012. SACLA, RIKEN's new X-ray free-electron laser, and the K computer are now available for shared use.

Located in Harima next to the SPring-8 synchrotron radiation facility, SACLA generates a very special X-ray laser beam equipped with the shortest wavelength in the world and extremely fast pulses. The facility will enable researchers to shed light on the nanoworld in three dimensions. Filming chemical reactions and unravelling the structure of biomolecules and nanostructures are examples of what can be achieved thanks to SACLA's ultrafast beam.

RIKEN's K computer was developed in collaboration with Fujitsu and with the support of the Japanese government. The supercomputer twice took first place in rankings of the world's fastest supercomputers and has won numerous awards. In September 2012 it opened for shared use by researchers in industry and academia. This supercomputing resource will provide researchers with unprecedented computing power, opening up opportunities for simulations at scales and complexities never before attempted.

The **RIKEN Omics Science Center** aims to advance the field of Omics, the comprehensive study of molecules in living organisms, by developing a system called the "life science accelerator" (LSA). The LSA is a multi-purpose, large-scale analysis system that rapidly analyses molecular networks, combining unique biological resources, human resources, technologies, know-how and essential administrative ability.

Working at RIKEN

The proportion of foreign scientists working at RIKEN has increased steadily over the past 10 years. Thanks to programmes that create such positions as the Foreign Postdoctoral Researcher and the International Program Associate for PhD students, RIKEN is becoming increasingly attractive to young, non-Japanese researchers looking for an experience abroad. "RIKEN is a world-leading institution. I came here for an internship and liked it so much that I decided to stay for my PhD," explains Tong Bu, a PhD student from China. The quality of the research is the main reason young scientists choose RIKEN. "There are a lot of good scientists here, doing research that is cutting-edge," explains Philipp Gubler, a postdoctoral researcher coming from Switzerland. What appeals to Aron Beekman, who came from the Netherlands, is the fact that "everyone at RIKEN is really focused. It is a really stimulating and efficient work environment." Franco Nori, head of the digital materials team at the RIKEN Advanced Science Institute, adds: "Many research visitors describe RIKEN as among the best places in the world to do research. There are many outstanding groups, and the environment is conducive to excellence."

Foreign researchers joining RIKEN are supported in a number of ways. The staff at the dedicated Central Help Desk is fluent in English and offers support at every step of the relocation process, from finding accommodation to opening a bank account and organizing childcare. Helplines in English are available and dedicated web pages offer foreign staff all the information they need to settle down in Japan. "Everyone gets first-class treatment here, that's why you never feel alone or unsupported," concludes Piero Carninci from the RIKEN Omics Science Center.

The RIKEN Omics Science Center and the RIKEN Brain Science Center are two of the few institutions in Japan to use English as their official work language, a clear sign that RIKEN is committed to facilitating exchange with researchers from outside Japan. These new exchanges will provide a powerful stimulus for new research into unexplored areas of science and consolidate RIKEN's presence on the international stage. For more information about job opportunities at RIKEN, please visit www.riken.jp.

RIKEN
www.riken.jp
www.rikenresearch.riken.jp

ARTICLES:
398

CORRECTED COUNT:
233.87

Japan

The country's top institutions dominate science in the Asia–Pacific, accounting for 80 of the top 200 positions in the NPI. But scientific output increased only marginally in 2012 under challenging economic conditions and a national focus on reconstruction following the devastating earthquake and tsunami of 2011. The University of Tokyo retains the top spot in the region, followed closely by the Chinese Academy of Sciences.

In October 2012, Shinya Yamanaka was announced as joint winner of the Nobel Prize in Physiology or Medicine. Based at Japan's second-ranked university, Kyoto, and the Gladstone Institutes, San Francisco, California, Yamanaka was recognized for demonstrating a process by which to transform differentiated cells back to a stem cell-like state.

Within days of Yamanaka's triumph, the Japanese media were trumpeting another stem cell researcher, Hisachi Moriguchi, who claimed to have used Yamanaka-style cells — called induced pluripotent stem cells, or iPS cells — in successfully treating heart disease. Moriguchi's story, however, was found to be fraudulent.

This pattern of peaks and troughs typified Japan's year of research. The country maintains its scientific dominance of the region: the University of Tokyo alone publishes almost as much research in Nature journals as all institutions combined in the fourth-ranked country, South Korea. But there are signs of a challenge to Japan's dominance of scientific endeavour.

SLIPPING GLOBALLY

China, with its sheer size, continuing economic growth and significant investment in science, is snapping at Japan's heels. Although still a long way behind on total corrected count (CC), the increase in the number of articles published by Chinese researchers in Nature research journals in 2012 is about double that of Japanese scientists (see 'A year of growth', page 6).

What's more, in 2012, the CC for China's premier research body, the Chinese Academy of Sciences (CAS), came to within 2 points of the University of Tokyo's count; in 2011 CAS was more than 20 points behind. Early indications in 2013 are that the University of Tokyo will have a hard time maintaining the top spot for much longer (see 'China', page 18).

Globally, many Japanese institutions fell in their ranking over the past year. The University of Tokyo, for example, slid from sixth to ninth

JAPAN TOP TEN

Japan has 80 institutions in the Asia-Pacific top 200

Asia-Pacific rank 2012	Institution	National rank 2012	Corrected count 2012	Articles 2012	National rank 2011	Corrected count 2011	Articles 2011	National rank 2008–12	Corrected count 2008–12	Articles 2008–12
1	The University of Tokyo	1	39.72	116	1	42.83	109	1	178.14	453
3	Kyoto University	2	22.47	55	2	23.98	56	2	92.29	218
4	RIKEN	3	19.14	79	3	19.96	70	3	92.10	300
5	Osaka University	4	18.18	54	4	17.43	48	4	77.38	208
7	Nagoya University	5	10.50	30	6	9.67	26	6	36.40	100
10	Tohoku University	6	8.55	27	5	10.99	29	5	40.78	117
14	National Institute of Advanced Industrial Science & Technology	7	7.30	23	7	8.82	22	7	27.99	88
19	Kyushu University	8	5.81	20	8	4.58	19	8	18.32	68
20	Hokkaido University	9	5.47	17	10	4.26	16	10	17.14	54
23	Tokyo Institute of Technology	10	4.60	16	12	3.39	14	11	15.62	65

JAPAN 2012

POPULATION: 126.4 M

RESEARCHERS: 655,530

SOURCE: UNESCO

and Kyoto University from 20th to 25th (see 'Global Top 100', page 48). At both universities, the CC was lower in 2012 than in 2011. The number of Japanese institutions in the Global Top 100 was reduced from seven in 2011 to six in 2012: the National Institute of Advanced Industrial Science and Technology which ranked 71st in 2011, dropped off the list entirely in 2012.

Funding sources for Japanese science are under severe constraints. From 2008 to 2011, Japan's economy shrank by 10%. Gross domestic expenditure on research and development (GERD) as a proportion of GDP also fell — from 3.5% in 2008 to 3.3% in 2010 — further tightening science spending.

The impact on Japan's scientific community of the Tohoku earthquake and tsunami of March 2011 was deeply felt in 2012. As part of the government's effort to find the US$210 billion budgeted for reconstruction, it reduced public sector salaries by as much as 10% — affecting scientists working in universities and publicly funded research institutes, such as RIKEN, ranked third in the country. Research leaders are concerned that this austerity not only disadvantages government scientists compared with those in the private sector, but generally makes science a less attractive career. Another disincentive for young researchers is a lack of movement at the top of the industry, blighting opportunity for career advancement.

The institution most affected by the fallout of the tsunami was Tohoku University in Sendai, one of Japan's prestigious 'National Seven' universities. Tohoku is a bedrock of engineering, materials science and metallurgy research — indeed, physical sciences contributed to more than 80% of Tohoku's CC in 2012. Not surprisingly, Tohoku's CC dropped in 2012, and its national ranking fell from fifth to sixth. But the university has been promised significant funds for reconstruction, including about US$9 million a year for the next ten years, to develop an International Research Institute of Disaster Science. The university is also setting up the Tohoku Medical Megabank Organization to rebuild the area's medical system along a new model based on a genome biobank of the region's population.

With government money tight, Japanese universities have been examining other potential funding routes. Traditionally, laws on sources of university financing, and a lack of local philanthropy, had impeded institutions from seeking money from private sources. But in 2012, the University of Tokyo found a way around this barrier, raising a US$7.5-million endowment from Norwegian donor Fred Kavli. The philanthropist's largesse was acknowledged by the renaming of one of its top research institutes after him.

And there are many Japanese research areas into which foreigners might see value in investment. A group at the Yokohama City University, ranked 64 in Japan, used iPS cells to create liver-like tissue in a dish, coaxing them for the first time to self-organize into an organ. Simultaneously, researchers from RIKEN reported the laboratory growth of an optic cup — a precursor to the human eye. Overall, life science research such as this contributed to more than 56% of Japan's total CC in 2012.

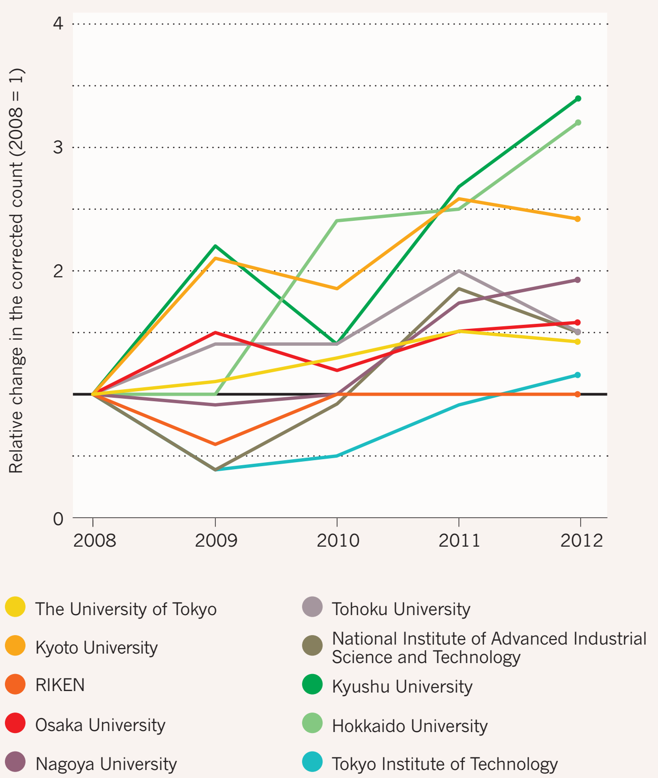
JAPANESE INSTITUTIONS SLIPPING

The relative position of Japanese research institutions in the NPI is stable. This year's top four institutions — the University of Tokyo, Kyoto University, RIKEN and Osaka University, respectively — are the same as last year, and in the same order. Earthquake-battered Tohoku University was replaced in fifth rank by Nagoya University, another of the 'National Seven'. Nagoya University was the top ranked institution in the Asia-Pacific publishing in *Nature Medicine*; the university boasts a particularly strong department of neurology with its researchers using microRNA regulation of gene expression to treat an inherited neurodegenerative disorder. The only newcomer to the top 10 is the Tokyo Institute of Technology, ousting the National Institute of Materials Science.

Noteworthy movement in the lower ranks include the rise of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) from 30th to 15th. It was the top Asia-Pacific institute publishing in *Nature Geoscience* in 2012. ■

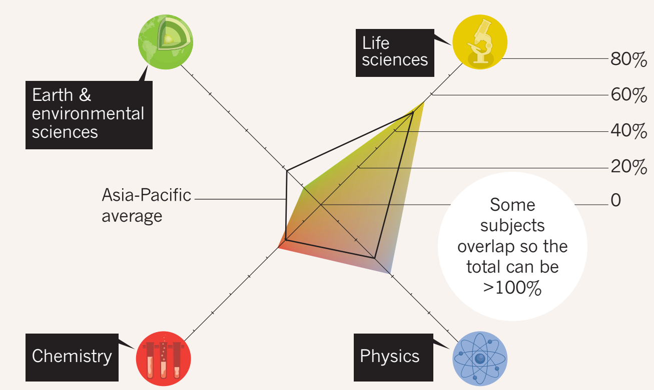
INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top 10 institutions since 2008.

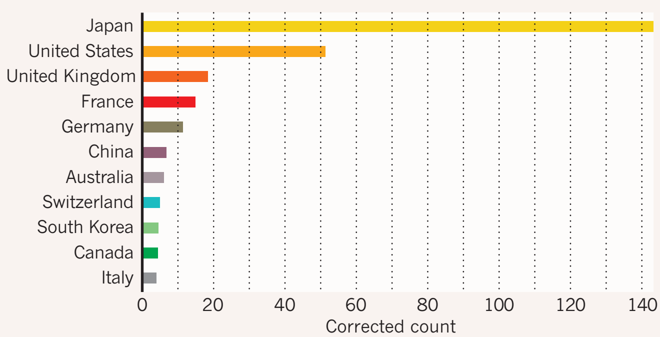


RESEARCH STRENGTHS

The subject areas in which Japan achieved its corrected count.



The countries with which Japan collaborates most. Its domestic corrected count is shown for comparison.






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

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 co-operation as well. For example, the co-operative 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.

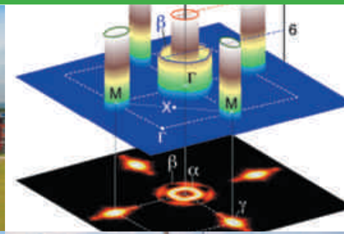
Research strength

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.

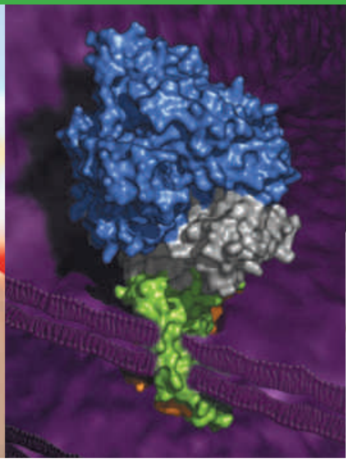
International collaboration

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


中国科学院 CHINESE ACADEMY OF SCIENCES

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. ■

ARTICLES: 303

CORRECTED COUNT: 150.03

China

Economic growth in recent years has been matched by a huge increase in scientific output. This trend continued through 2012 in contrast with many other countries hit by the global financial malaise. While Chinese research improves its international standing and recognition, at home there are concerns that cultural factors are impeding innovation.

Jun Wang, the head of genome-sequencing powerhouse BGI, was one of *Nature's* "Ten people who mattered" in 2012. Recognition of him as a "genome juggernaut" acknowledges one of many players making the most of China's increased investment in science and technology. The resultant surge in scientific output is laid bare in the country's continual rise up the NPI. Since 2008, China's output as measured in corrected count (CC) has increased four-fold compared to Japan's increase of only 50% (see 'A year of growth', page 6).

The Chinese government plans to increase R&D expenditure from its 2010 level of 1.75% of gross domestic product (GDP) to at least 2.5% by 2020 — a small proportion if considered globally. But the scale of the Chinese GDP means that the country's total R&D spending is second only to the United States.

While the quantity of Chinese science is growing, commentators say its quality needs to be improved. The impact of published research, as measured by the number of citations per article, is lower than those produced by Japan, the United States and other leading science nations. Bai Chunli, president of the Chinese Academy of Sciences (CAS), despite his institution narrowly missing the top spot in the Asia-Pacific, says scientific research in his country is "still weak".

Even so, China has steadily expanded its NPI presence. In 2011, China's CC amounted to 3.3% of the global publication count; in 2012 that grew to 4.2%. Almost all Chinese institutes have risen through the ranks and the country now has four in the Global Top 100, including Tsinghua University.

China's research behemoth CAS, which has 60,000 employees working in more than 100 institutes, dominates national output. It leads all other Asia-Pacific institutions for publications in *Nature* as well as *Nature Structural & Molecular Biology*, *Nature Cell Biology* and *Nature Methods*. CAS published 50% more papers in Nature journals in 2012 than it did in 2011, pushing it from 23rd to 12th in the global rankings.

In the Asia-Pacific region, CAS missed out on the top spot by less than

CHINA TOP TEN

China has 51 institutions in the Asia-Pacific top 200

Asia-Pacific rank 2012	Institution	2012 National rank	2012 Corrected count	2012 Articles	2011 National rank	2011 Corrected count	2011 Articles	2008–12 National rank	2008–12 Corrected count	2008–12 Articles
2	Chinese Academy of Sciences	1	37.88	91	1	22.52	62	1	103.92	265
8	University of Science & Technology of China	2	9.46	17	2	8.58	17	2	26.53	56
11	Tsinghua University	3	8.26	31	4	6.36	16	3	25.39	77
12	Peking University	4	8.10	29	3	7.24	21	4	23.17	83
17	Shanghai Jiao Tong University	5	6.62	30	7	3.74	21	6	13.33	68
18	BGI	6	6.27	20	10	2.97	11	5	14.04	42
22	Zhejiang University	7	4.70	15	11	2.96	8	11	9.98	40
25	Huazhong University of Science & Technology	8	4.41	14	20	1.00	6	15	5.76	22
29	Fudan University	9	3.90	13	13	2.34	14	21	9.19	47
41	The University of Hong Kong	10	2.92	14	8	3.58	12	9	10.26	42

CHINA 2012

POPULATION: 1.353 Bn

RESEARCHERS: 1.152 M

SOURCE: UNESCO

two points. First position was retained by the University of Tokyo. But in January 2013, CAS overtook the University of Tokyo in the 12-month rolling count for the Asia-Pacific (nature.asia/publishing-index-asia-pacific). This was the first change at the top of the rankings in the region since the NPI began. As we go to press CAS retains its spot at the top but given that these two heavyweight institutions remain relatively close their positions may conceivably fluctuate for a while yet. CAS is not the only Chinese institution experiencing such ascendancy. Among the country's top ten universities, all except one — the University of Hong Kong — ranked higher in 2012 than in 2011. The improvement in Chinese science is reflected at all levels, with the number of institutions publishing in Nature journals growing by 42% — from 153 in 2011 to 218 in 2012. In 2008 the number was less than 50.

LIFE SCIENCES STRENGTH

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. Merck's confidence is echoed by a growing number of companies setting up large R&D centres in China. Domestic companies are also joining forces with foreign organizations, including Merck and Pfizer, for drug and clinical development projects. Encouraged by government spending on healthcare, particularly policies allocating huge sums to drug development, China's life sciences institutions are growing globally.

Life sciences research contributed two-thirds of China's 2012 CC and CAS is top of the competitive life sciences institutional table, ahead of the University of Tokyo on CC. BGI has been particularly prolific, producing studies on the genomes of agriculturally important species such as cotton, maize and tomato, and studies of mutations associated with diseases such as renal cell carcinoma and liver cancer. It ranked higher than any other Asia-Pacific institution in both *Nature Genetics* and *Nature Biotechnology* in 2012 and was in fourth and first place, respectively over the past five years (see 'Top institutions by journal', page 46).

The country was also well represented in the physical sciences. CAS, along with the Chinese Academy of Engineering, published a list of the top 10 science events of 2012. It included a February 2012 *Nature* paper by Jian-Wei Pan, from the University of Science and Technology of China (ranked second in the country) which described a breakthrough in quantum information processing.

HONG KONG FALTERS

Buoyed by strong life sciences, Shanghai Jiao Tong University, BGI, Zhejiang University and the Huazhong University of Science and Technology (HUST) moved up the national ranking to take the 5th to 8th places respectively. HUST's rise from 25th in 2011 is impressive. A highlight was a study showing gene expression and physiological conditions in the nematode *Caenorhabditis elegans* can be regulated by another species: its food source, *Escherichia coli*. Fudan University rose to 9th place with strong contributions in life and physical sciences.

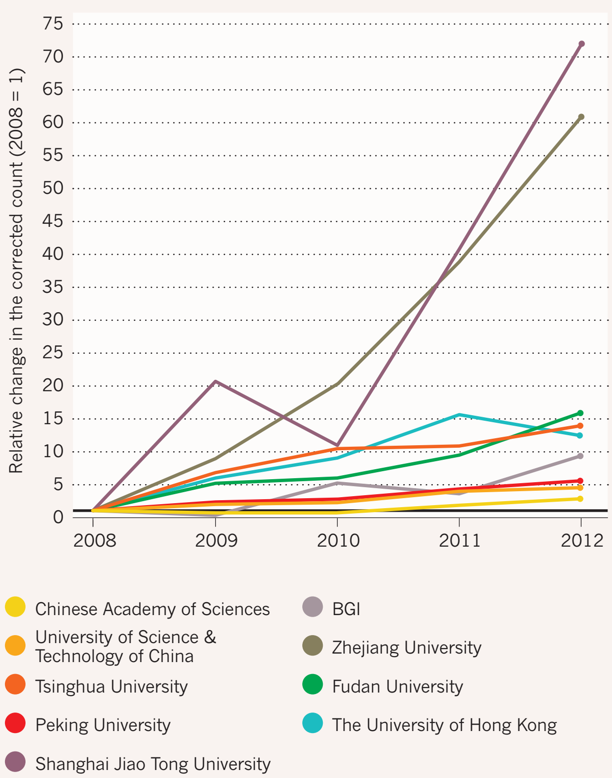
Two Hong Kong institutions fell in the ranking: the University of Hong Kong moved from 8th to 10th despite increasing its CC by one point, and Hong Kong University of Science and Technology fell from 5th to 11th spot. Hong Kong's leaders are not giving science the same priority as it receives in mainland China, allocating just 0.7% of GDP to R&D.

Despite a strong showing in the 2012 NPI, Chinese science has much room for improvement. "China still has an environment and atmosphere that is not conducive to big innovations, including a lack of investment in human resources, excessive competition, fighting over resources, sectoral interests, impatience and a longing for quick success," Bai Chunli said at the Communist Party's 18th national congress. Less than 5% of its R&D money is spent on basic research, much less than the United States' spend of 19%.

If its longing for success, 'quick' or otherwise, is to be realized, China will need to address these issues. ■

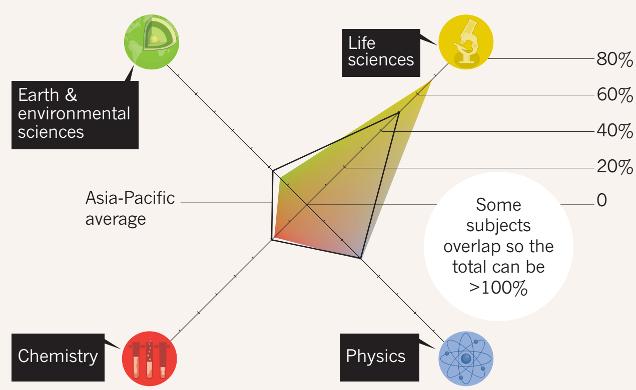
INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top nine institutions since 2008.

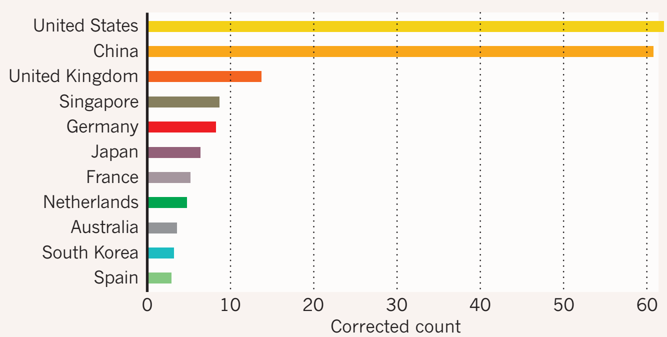


RESEARCH STRENGTHS

The subject areas in which China achieved its corrected count.



The countries with which China collaborated most. Its domestic corrected count is shown for comparison.







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."

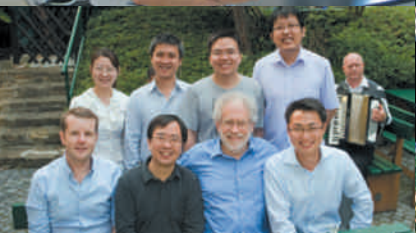
Peng's main area of interest is quantum key distribution, a cryptographic protocol for securely communicating information from one party to another. As the laws of quantum mechanics forbid people without permission to retrieve the information, the technology makes it harder for people to intercept the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

ARTICLES: 223

CORRECTED COUNT: 68.26

Australia

Funding for Australian science could not escape cuts in a tough economic year, but the country's research climate remains healthy, as reflected by its growing output in the Nature Publishing Index. The ranking of Australian institutions has been relatively stable in recent years with the University of Melbourne remaining in the top spot while James Cook University is bucking historical trends with a rapid rise through the ranks.

The year augured well after the 2011 Nobel Prize for Physics was awarded to Brian Schmidt of the Australian National University (ANU). The prize marked the beginning of a high-profile period for physics and astronomy in Australia. In May 2012, after much anticipation, it was announced that Australia and New Zealand would gain a significant share of the Square Kilometre Array (SKA), the world's largest radio telescope, to be built jointly with South Africa. Yet despite Australia's proven strengths in astrophysics and astronomy, the country ranks only 12th in the world for physical sciences. ANU is the top-ranked Australian institution publishing in the physical sciences in Nature journals, but its position was gained largely on the strength of research publications in quantum science rather than in astrophysics.

It is Australia's traditional strengths in life sciences and earth and environmental sciences that have cemented its third place in the Asia-Pacific region, behind Japan and China and ahead of South Korea. Although Australia's corrected count (CC) increased to 68.26, the gap between it and China (at 150.03) is widening — so too is its lead over South Korea (at 40.82; see 'A year of growth', page 6).

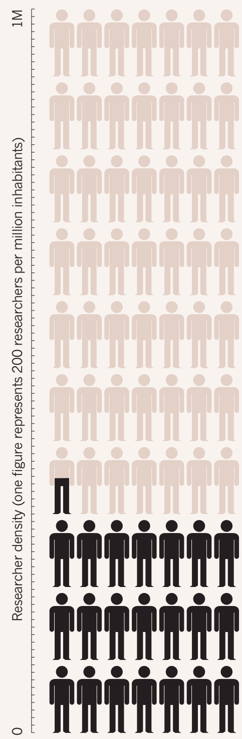
This steadily improving picture for Australia reflects recent government policy of solid support for science in the face of global and national economic jitters. According to the most recent OECD figures, Australia's spending on R&D is around 2.2% of its gross domestic product (GDP) — higher than that of China, Canada and the United Kingdom but lower than the United States, Japan, South Korea and Singapore.

In a stringent 2012–2013 Budget, the government allocated a record US$1.76 billion investment to support university research (up from US$1.64 billion the previous year), but overall expenditure on science, research and innovation dropped by 3.6 % to just less than US$9.2 billion. When the country's fiscal belt was further tightened in October, the government maintained research grant funding through the National Health and Medical Research Council and the Australian Research Council (ARC), but announced US$512 million in cuts to be

AUSTRALIA TOP TEN

Australia has 27 institutions in the Asia-Pacific top 200

Asia-Pacific rank 2012	Institution	2012 National rank	2012 Corrected count	2012 Articles	2011 National rank	2011 Corrected count	2011 Articles	2008–12 National rank	2008–12 Corrected count	2008–12 Articles
6	The University of Melbourne	1	10.78	48	1	9.83	46	1	32.08	157
13	Australian National University	2	8.10	21	3	7.18	13	3	29.58	79
15	The University of Queensland	3	7.07	41	2	7.71	34	2	30.19	128
26	The University of Sydney	4	4.41	24	5	5.00	30	4	19.04	100
30	James Cook University	5	3.89	12	10	1.26	7	11	5.40	24
31	Monash University	6	3.88	21	4	5.24	17	5	15.68	61
32	The University of New South Wales	7	3.82	22	8	3.02	16	7	11.62	60
35	The Commonwealth Scientific & Industrial Research Organisation	8	3.44	16	7	3.81	13	6	11.64	48
57	The University of Western Australia	9	2.00	26	6	4.08	22	8	8.99	80
59	Queensland Institute of Medical Research	10	1.94	17	9	1.79	15	10	8.29	69



AUSTRALIA 2012

POPULATION: 22.9 M

RESEARCHERS: 92,379

SOURCE: UNESCO

made over the next four years to spending on a programme that funds university equipment and infrastructure.

AUSTRALIA'S STRENGTHS

Australia's geographical isolation and unique land- and seascapes make it an ideal place for research in the earth and environmental sciences. Papers in these fields might only represent a third of Australia's CC, but this is a far higher proportion than for other countries in the region (see 'A year of growth', page 6). Australia ranks fifth globally in earth and environmental sciences, behind the United States, UK, France and Germany, and is dominant in the Asia-Pacific region. Of the top 14 institutions for earth and environmental research, 8 are Australian.

Australian researchers are making great strides in studying the country's astounding native environmental phenomena. A highlight of 2012 was an analysis by scientists from the Australian Institute of Marine Science and the University of Wollongong of a 27-year record of the Great Barrier Reef that demonstrated a loss of half the coral cover in that period. This threat has been recognized by the ARC which funds the collaborative Centre of Excellence for Coral Reef Studies, based at James Cook University, specifically to investigate the reef, including the impact of climate change.

THE TRADITIONAL UNIVERSITIES AND THE TROPICAL NEWCOMER

Although their rankings have been shuffled, the same institutions comprise the Australian top 10 as in 2011. Ensconced in the top position is the University of Melbourne, which also rose in regional and global rankings. Melbourne is now 6th in the Asia-Pacific region (up from 8th last year) and 61st in the world — three places higher than in 2011.

Melbourne University researchers published several notable papers in 2012, including in *Nature Genetics*, along with China's BGI and collaborators from around the world, the genome of the debilitating *Schistosoma* parasite. The large size of teams typically involved in genetic research often means a low CC attributed to any one institution. Yet, with 15 articles in *Nature Genetics* in 2012, along with articles yielding higher CCs in *Nature Immunology, Nature Medicine* and *Nature Methods*, the University of Melbourne earned approximately three-quarters of its total CC from papers in life sciences. This places it 6th among Asia-Pacific institutions in life sciences, up from 14th place in 2008.

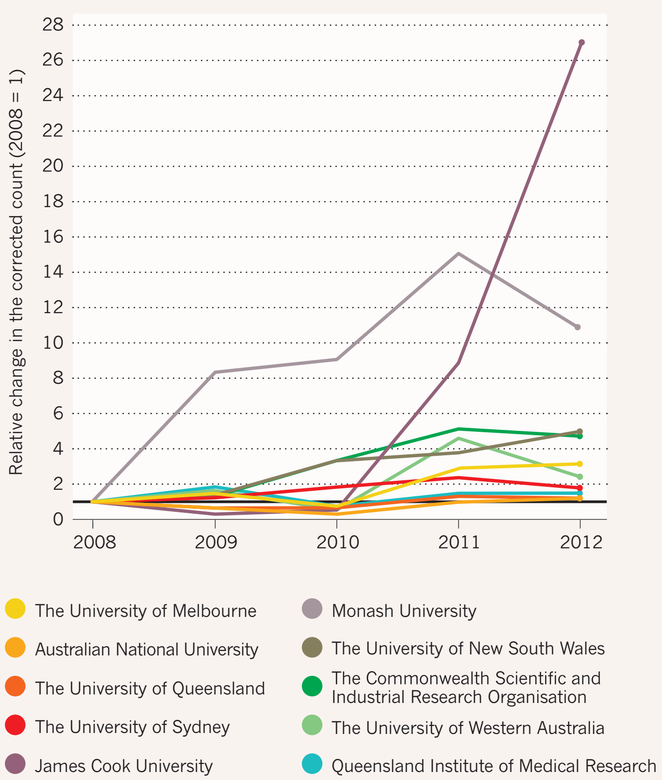
Austrialian National University, now second in the country having swapped places with the University of Queensland since last year, is the only other Australian institution in the Global Top 100, at 94 (see 'Global Top 100', page 48). The University of Queensland has dropped to 107 from 86.

Building on gains last year, the biggest mover has again been James Cook University in the northern city of Townsville, up from 10th to 5th, below the University of Sydney and just ahead of Monash University and the University of New South Wales. James Cook is now ranked 30th in the region, up from 66th in 2011 and 296th in 2010. James Cook's strengths lie in the earth and environmental sciences. It is the top-ranked Asia-Pacific institution in *Nature Climate Change*, and is also the biggest Australian contributor (just ahead of ANU) to the country's earth and environmental sciences count. Specifically, in the 2012 NPI, James Cook benefited from four high-scoring papers from scientists at the ARC Centre of Excellence for Coral Reef Studies on the impacts of increased temperatures and carbon dioxide on corals and coral-reef fish species.

The institutions making up the Australian top 10 are the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the University of Western Australia, which did not maintain the improvement seen in 2011, and the Queensland Institute of Medical Research. Of Australia's 'Group of Eight' of the oldest and most established universities, only the University of Adelaide is outside the top 10 (languishing in 19th position). The recent budget cuts to future university infrastructure funding, however, will hit the research-intensive Group of Eight the hardest — potentially weakening their grip on the upper rankings. ■

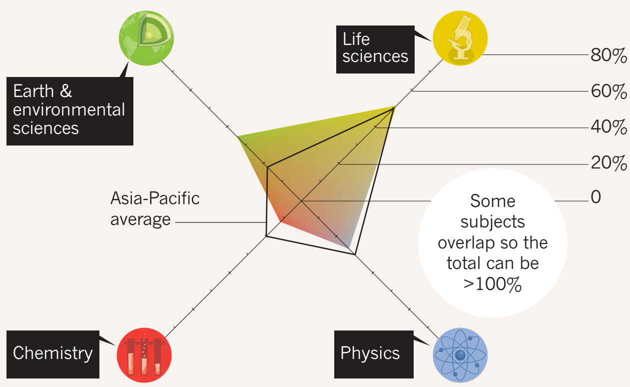
INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top ten institutions since 2008.

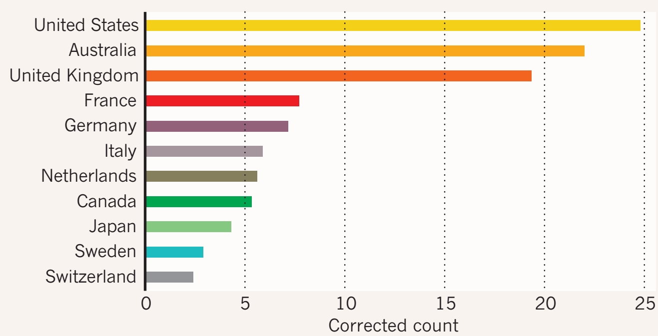


RESEARCH STRENGTHS

The subject areas in which Australia achieved its corrected count.



The countries with which Australia collaborates most. Its domestic corrected count is shown for comparison.



ARTICLES:
112

CORRECTED COUNT:
40.82

South Korea

The country seems determined to improve its scientific reputation. 2012 saw fresh investment in basic science and a new research-focused government.

Increased investment is yet to have a major effect. Although it retains fourth place in the NPI in the Asia-Pacific region, South Korea's corrected count (CC) has dropped while the output of its neighbours has continued to rise. Despite this fall, there are now 13 South Korean institutions in the Asia-Pacific top 100 — up from 10 in the two previous years.

Attempts to rejuvenate South Korean science are a priority for the country's newly-elected president, Park Geun-hye, who trained as an electronic engineer. Geun-hye says she will make science and technology policy a cornerstone of her government and plans to raise total R&D spending from 4% of gross domestic product (GDP) in 2011 to 5% in 2017, which would make it the highest proportion spent of all the Asia-Pacific countries. She also intends to establish an overarching 'ministry of future innovative science', separate from the current Ministry of Education, Science and Technology, to improve the prominence of science in areas such as agriculture, defence, medicine and even the arts.

Geun-hye will be building on the foundations of policies of her predecessor, Lee Myung-bak. In May 2012, he launched the Institute for Basic Science (IBS) to be headquartered in the central city of Daejong. The plan, which has funding until 2017, is that eventually the IBS will comprise about 50 research centres, each receiving more than US$9 million a year and headed by an internationally respected scientist.

The idea is that developing basic science and fundamental technologies will act as a springboard to more innovative applications and products. One of the first centres to be built will house a rare-isotope accelerator to further, among other things, cancer research, the exploration of new materials and the study of nuclear physics.

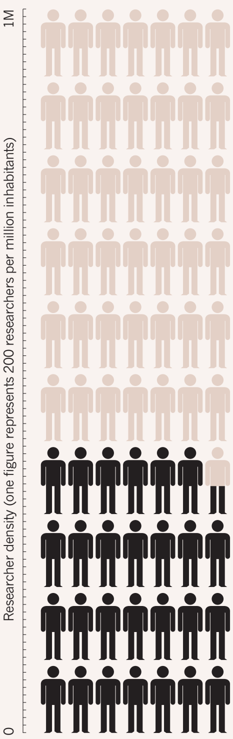
South Korea's greatest strengths lie in the physical sciences, particularly nanotechnology, materials sciences and photonics. But the price of its concentration on applied science is seen in the US$6 billion it pays out annually to use fundamental technologies developed elsewhere. Addressing this problem is a central concern of the Korean Graphene Research Hub, which will help Korean scientists become pioneers in understanding the one-atom-thick sheets of carbon that have potential technological application in electronic displays, solar cells and computer chips. The country's spend on graphene research is greater than that of the entire EU and it is home to seven of the eight researchers with the most graphene-based patents.

Sungkyunkwan University, which is heavily financed by the industrial

SOUTH KOREA TOP TEN

South Korea has 21 institutions in the Asia-Pacific top 200

Asia-Pacific rank 2012	Institution	2012 National rank	2012 Corrected count	2012 Articles	2011 National rank	2011 Corrected count	2011 Articles	2008–12 National rank	2008–12 Corrected count	2008–12 Articles
21	Yonsei University	1	5.46	14	9	1.20	6	6	8.73	31
24	Seoul National University	2	4.60	26	1	11.27	32	1	30.34	96
27	Korea Advanced Institute of Science & Technology (KAIST)	3	4.03	15	2	3.74	13	2	17.32	48
33	Sungkyunkwan University	4	3.67	10	8	1.36	4	4	9.68	30
43	Hanyang University	5	2.62	11	7	1.44	6	8	5.59	22
45	Korea University	6	2.43	6	5	2.71	12	5	9.28	34
53	Gwangju Institute of Science & Technology	7	2.12	5	13	0.50	2	9	5.20	13
58	Pohang University of Science & Technology	8	1.95	5	3	3.73	8	3	13.11	34
61	Samsung	9	1.85	6	4	2.86	5	7	7.79	19
68	Ulsan National Institute of Science & Technology	10	1.67	4	–	–	–	15	1.67	4



SOUTH KOREA 2012

POPULATION: 48.58 M
RESEARCHERS: 264,118

SOURCE: UNESCO

conglomerate Samsung, leads the world in graphene patent publications.

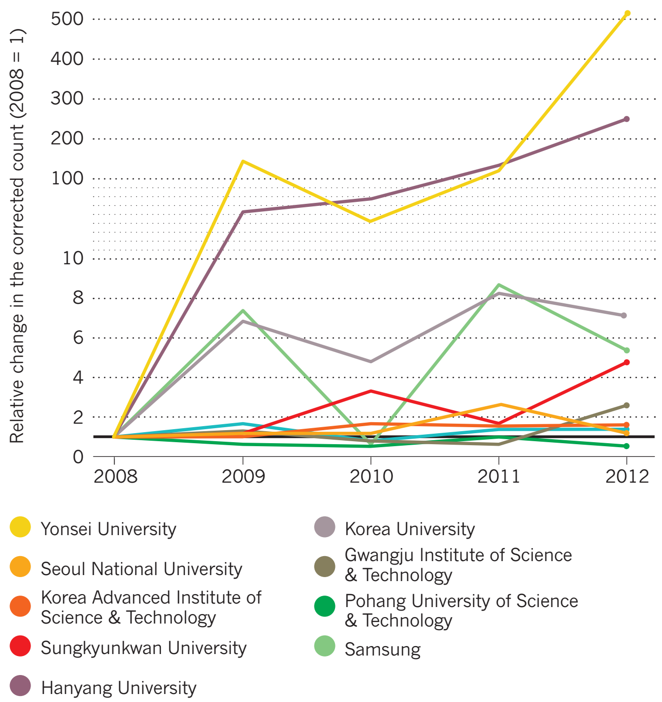
South Korea is also pushing its life sciences enterprises. In 2012, public spending on stem cell research rose by 45% to about US$94 million, with much of the increase going towards clinical research and trials. In the past year, the South Korean Food and Drug Administration has approved three stem cell treatments.

According to the NPI, South Korea's top research institution is now Yonsei University, a private Christian institution that is particularly strong in molecular biology and materials science. Yonsei is one of South Korea's three most established institutions: the SKY universities. The other two, Seoul National University and Korea University, rank two and six in the country.

After an outstanding year in 2011 when it topped the national table, the corrected count of Seoul National University fell by 50% in 2012. This decline resulted in South Korea disappearing altogether from the Global Top 100. The star performers in 2012 were the science and technology institutes, plus Samsung, which comprise half of the South Korean top 10. ■

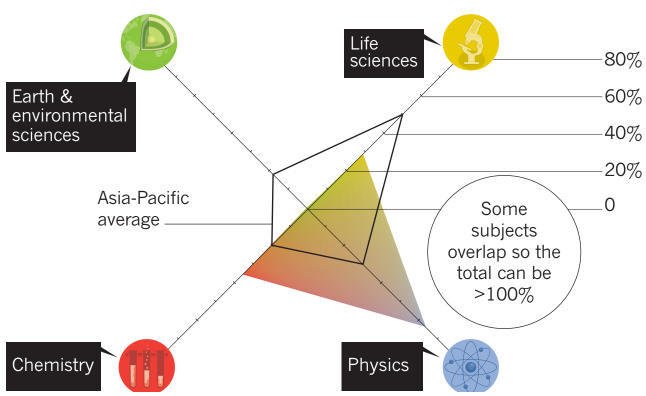
INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top nine since 2008.



RESEARCH STRENGTHS

The subject areas in which South Korea achieved its corrected count.



ARTICLES: 71

CORRECTED COUNT: 21.19

Singapore

Having recovered from a sluggish 2011 it shows the most improved performance of all the major science-producing countries in the region.

Fifth-ranked Singapore was never going to be caught languishing. In the 2011 NPI, the science endeavours of the island nation appeared to be flagging. It was adrift of the four countries above it and was being challenged by Taiwan. But in 2012 the CC of Singapore's publications in Nature journals surged, growing faster than not only Taiwan, but also South Korea, Australia, China and Japan (see 'A year of growth', page 6).

Singapore is deeply dependent on innovation to maintain its high standard of living. The government has had significant success in encouraging private investment in research: more than 60% of the country's approximate US$5.5 billion R&D spend comes from non-governmental sources. The 2011 blip in its research effort may be attributable to the loss of about US$1 billion in private funding in 2009 due to the worldwide financial crisis. This shortfall is well on the way to being recovered.

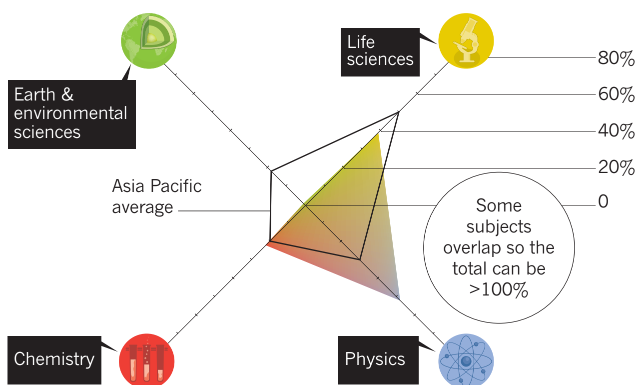
Singapore's NPI performance is belied by the country's size: its population of just over 5.3 million means that the country has far fewer research scientists than its regional competitors, although it has the highest concentration of researchers of any of the top five countries.

Singapore also tends to focus on patentable, marketable research, such as applications in engineering, information technology and healthcare — areas that do not feature strongly in research-focused Nature journals.

In addition, its government encourages collaborative research,

RESEARCH STRENGTHS

The subject areas in which Singapore achieved its corrected count.



particularly with multinational corporations, and has created specific hubs in biomedical science (Biopolis) and in physical sciences, information technology and engineering (Fusionopolis). These hubs harness the work of institutes of the government organization, the Agency for Science, Technology and Research (A*STAR), which is Singapore's second-ranked institution, as well as the R&D labs of giants such as GlaxoSmithKline, Novartis and Merck. This sort of research does not figure strongly in Nature journals, and collaborative work contributes less to CC than does stand-alone research.

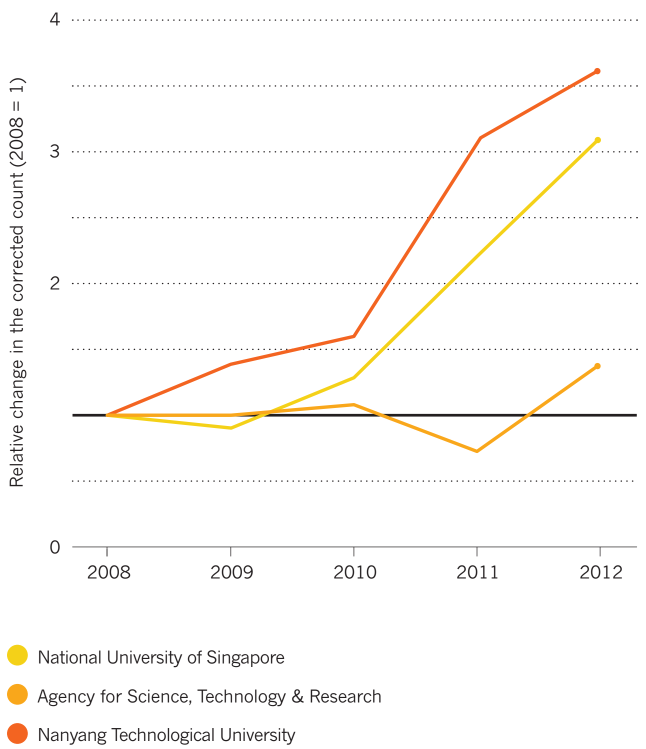
Three Singapore institutions have a significant presence — the National University of Singapore (NUS) ranked at 9 in the Asia-Pacific region, A*STAR at 16, and Nanyang Technological University (NTU) at 34. NUS is a rising star, particularly in the physical sciences, chemistry, IT and life science collaborations and has become the first Singapore institution to be included in the NPI Global Top 100 at 76, up from 110 in 2011 (see 'Global Top 100', page 48). NUS's regional ranking has increased from 16 to 9.

A*STAR, which bounced back after a lean 2011, is still lower in the regional rankings than it was in 2009 and 2010. NTU, however, is consistently increasing its CC and has maintained its ranking — a significant effort in the face of the ascent of Chinese research institutions. Both A*STAR and NTU have demonstrated expertise in nanotechnology and photonics. In August, for example, A*STAR researchers published a high-profile paper in *Nature Nanotechnology* describing a technique to increase the resolution of printed images by an order of magnitude, and potentially revolutionizing data storage. NTU scientists have shown how to synthesize large amounts of high-quality ultrathin metal sulphide nanocrystals, which can be used in a variety of applications.

Smaller institutes, such as the National Cancer Centre and the Singapore Eye Research Institute, in part dependent on the expertise of the big three, are steadily climbing the regional rankings. As in 2011, Singapore's top three institutions produced more than 93% of the CC for the country. ■

INSTITUTIONAL PUBLISHING TRENDS

Charting the changes in output from the top nine since 2008.



SINGAPORE TOP TEN

Singapore has 4 institutions in the Asia-Pacific top 200

ASIA-PACIFIC RANK 2012	INSTITUTION	2012 NATIONAL RANK	2012 CORRECTED COUNT	2012 ARTICLES	2011 NATIONAL RANK	2011 CORRECTED COUNT	2011 ARTICLES	2008–12 NATIONAL RANK	2008–12 CORRECTED COUNT	2008–12 ARTICLES
9	National University of Singapore	1	9.37	47	1	6.25	32	1	24.79	124
16	Agency for Science, Technology & Research	2	6.63	36	2	3.24	21	2	24.68	111
34	Nanyang Technological University	3	3.57	14	3	3.06	10	3	10.68	38
146	National Cancer Centre Singapore	4	0.62	4	7	0.10	2	4	0.74	7
213	Singapore Eye Research Institute	5	0.29	7	5	0.15	5	7	0.44	21
219	Singapore General Hospital	6	0.26	4	–	–	–	6	0.54	9
442	National University Health System	7	0.06	1	–	–	–	12	0.06	1
481	Solar Energy Research Institute of Singapore	8	0.04	1	–	–	–	13	0.04	1
537	National University Cancer Institute	9	0.03	1	–	–	–	14	0.03	1
551	Tan Tock Seng Hospital	10	0.03	1	–	–	–	15	0.03	1

SINGAPORE 2012

POPULATION: 5.18 M

RESEARCHERS: 30,530

SOURCE: UNESCO / WORLD BANK

Asahikawa Medical University Hospital Telemedicine Center

DISEASE PREVENTION AND HEALTH PROMOTION

Striving to reduce regional disparities in healthcare, in 1999 Asahikawa Medical University opened the first and only telemedicine centre in Japan.

This centre shares medical information with many hospitals in and outside of the country via a telemedicine network. The specialists at the university support diagnoses and operations performed at remote sites, basing their judgment on the clinical imagery and other data transmitted over a distance. The centre also provides ICT-based services for people in local communities in the areas of disease prevention, recurrence prevention and the improvement of general health and wellbeing.

Telemedicine for home care after surgery

In order to ensure dependable support to the patients who have undergone surgery at Asahikawa Medical University Hospital, the Telemedicine Center provides a service which allows the medical staff of the university and referring hospitals to check the condition of patients under home care.

In this service, the centre uses a home terminal rented to the patient and a hospital terminal operated by the medical staff. The home terminal can automatically collect data for blood pressure, body weight, blood sugar and other health indicators, and can be used easily without computer skills. The patient can also consult the medical staff using the videophone feature of the home terminal.

Akitoshi Yoshida, director of the Telemedicine Center and president of Asahikawa Medical University

'Wellnetlink' personal health record

Asahikawa Medical University developed and operates the personal health record system 'Wellnetlink', which supports the self-management of vital daily data (including body weight and blood pressure), health checkup results, diagnostic images, medical charts and other information.

By using Wellnetlink, patients can share their information with particular physicians, public health nurses and other medical professionals of their choosing, and seek advice specific to their condition. In an application of this system, ophthalmologists at Asahikawa Medical University review the fundus photographs of local inhabitants and inform them individually of the health condition of their eye. This service has detected abnormal conditions such as glaucoma and macular degeneration in more than half of the users, contributing to the prevention of progression to more severe conditions, and therefore a reduction in patient suffering as well as medical expenditure, through early treatment.

Offering the newest medical information to the local population

The Hokkaido Medical Museum provides various health and medical information to healthcare workers and the population in the region, and helps them work toward the prevention of diseases and the avoidance of progression to severer conditions.

A video conference system connects the Telemedicine Center and several audience sites at public facilities. The lectures given at the centre by specialists from the university are distributed live to all venues, where the attendees can ask questions directly to the speakers via the video conference system. For those unable to attend the live teleconferences, videos of the recorded lectures are offered on the website of Asahikawa Medical University.

Regional round-up

The top five countries of the Asia–Pacific, with corrected counts of more than 21, constitute the top tier of the Nature Publishing Index. A second tier comprises Taiwan, India and New Zealand. Then there is a significant gap before the rest: eight Asia–Pacific countries, all of which have corrected counts of less than one.

TAIWAN

Its increase in the NPI puts it in a firm position. From a low corrected count (CC) of around 3 in 2009 and 2010, Taiwan has risen rapidly to a 2012 CC of 11.68 from 38 articles. It has drawn comfortably ahead of India and is getting closer to Singapore.

In December, Taiwan President Ma Ying-jeuo announced that his country had achieved its goal of increasing spend on research and development (R&D) to 3% of gross domestic product (GDP). Furthermore, he said he supported increasing the proportion even further, to 5%. Because Taiwan has few natural resources, Ma said, it was important to continue to invest in R&D talent.

Taiwan's particular strengths lie in genetics, chemical biology and materials sciences. This year, for instance, its scientists published notable papers concerning genome-wide association studies, protein structures, graphene and transition metals in a range of Nature journals. In a culmination of these areas, researchers at the National Chiao Tung University in Hsinchu published a paper in *Nature Nanotechnology* concerning a protein-based transistor they had built using gold nanoparticles. But, as with South Korea, much of Taiwan's scientific effort is devoted to technological applications rather than fundamental research (it is one of the world's major computer chip manufacturers). This means it spends more than US$5 billion a year — more than 20% of its research outlay — on royalties for access to basic technologies.

Taiwan has seven institutions in the Asia-Pacific Top 200, including 4 in the top 100, led by Taipei's Academia Sinica at 37 followed by the National Taiwan University (also based in the capital city) at 60; then two institutions in the northern city of in Hsinchu: National Tsing Hua University at 71 and National Chiao Tung University at 73. The Academia Sinica has fallen in the regional ranking, down from 31 in 2011 but still well above the 175 it achieved in 2010. The National Taipei University of Technology, which was within the top 100 in 2011, has dropped out of the table altogether.

INDIA

The country's science effort has blown hot and cold over the past five years, in some way reflecting the relationship at home between its ambitious scientific plans and its struggle with poverty.

The country's CC is prone to fluctuation: in 2009, India had a CC of 6.84, well over double that of Taiwan. The next year this had plummeted to 1.22 — below that of Bangladesh — only to reach a new high in 2011 of 8.53. In 2012, however, the CC fell again, to 8.24.

This uneven research output reflects an inconsistency in government priority for science. The budget of March 2012 was disappointing, particularly as Prime Minister Manmohan Singh had previously raised expectations by suggesting that India should double the proportion of GDP spent on R&D. In the end, however, the budget only provided for a 5% increase, about half the rate of inflation, leaving research outlays at around 1% of GDP.

There were bright spots for India's science community, such as the announcement of a plan to launch a satellite to orbit Mars in late 2013. The government also outlined a five-year plan earmarking US$24 billion for R&D in six key scientific departments. This is more than 2.5 times what the country had spent on science over the previous five-year period.

India's economic boom is slowing — growing by 5.5% last year, the lowest rate since 2004. Science and technology, expressed through improved agriculture, increased energy efficiency, better infrastructure and higher levels of innovation, are expected to provide a boost. But the value of innovation is sometimes questioned. A former chair of the Indian Space Research Organisation, G. Madhavan Nair, described the Mars venture as "a half-baked mission being attempted in undue haste with misplaced objectives". Others consider it an unnecessary expense in a country where many children are malnourished and homes lack sanitation.

Last July, India suffered the world's biggest electricity blackout and, according to the OECD, a quarter of the population still has no access to power. Yet many oppose, on environmental grounds, the 300 proposed Himalayan dams, which would provide much-needed power. In agricultural science too there are mixed messages. In October, the science minister, S. Jaipal Reddy, cast doubt on the future of genetic engineering. "The science is not clear," he said, in response to the proposal set out by a panel of scientists which was appointed by India's Supreme Court. The panel recommended a 10-year moratorium on trials of GM crops after opposition to the method. The court is hearing a case to stop GM trials in which the government itself is a defendant.

Nevertheless, India is particularly strong in the life sciences. As in 2011, the country's top three institutions all rank within the top 100 regionally on the basis of publications in this field. They are the Institute of Genomics and Integrative Biology in Delhi at 56, the Tata Institute of Fundamental Research in Mumbai (78) and the Jawaharlal Nehru University in New Delhi (82).

NEW ZEALAND

According to the NPI, New Zealand R&D is in decline. From a high point of 7.31 in 2010 it has decreased to a CC of 4.64. But this could be set to improve: the country's budget in May signalled a rise in funding of nearly 7%, which was accompanied by a revamped government approach. Since July, under a new Ministry of Research, Business, Innovation and Employment, research funding is now linked explicitly with both business activity and jobs.

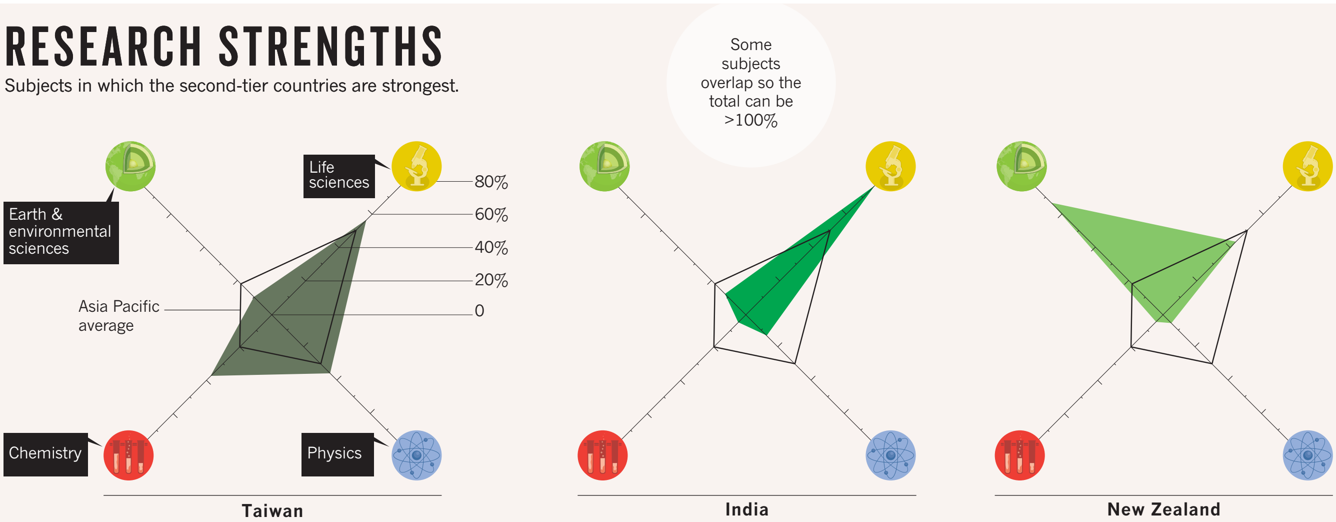
New Zealand science had a boost in 2012 with the announcement in May that, along with Australia, it will play an important role in the establishment and operation of the world's largest radio telescope, the Square Kilometre Array, to be built jointly with South Africa. New Zealand's research activity is heavily tilted towards the earth and environmental sciences, a field in which it ranks fourth in the Asia-Pacific, so this new telescope should help improve its output in the physical sciences.

New Zealand, like Japan, it is coming to grips with rebuilding, having suffered devastating earthquakes in the South Island in 2010 and 2011. The cost of restoring the three important tertiary institutions of Christchurch — the University of Canterbury, Lincoln University and the Christchurch Polytechnic Institute of Technology — is expected to be in the region of US$661 million. Canterbury was hardest hit, but despite a drop in student numbers it has risen to third place among national institutions and achieved an NPI regional ranking of 119.

There are only 24 papers in total in the NPI that feature a New Zealand

RESEARCH STRENGTHS

Subjects in which the second-tier countries are strongest.



REGIONAL RANKINGS

How the countries line up

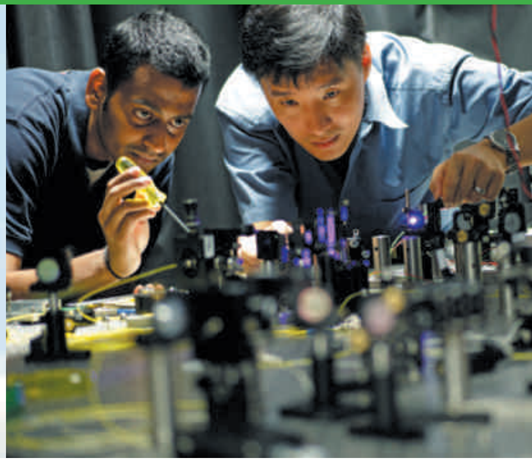
COUNTRY	2012 Asia-Pacific rank	2012 Corrected count	2012 Articles	2011 Asia-Pacific rank	2011 Corrected count	2011 Articles	2010 Asia-Pacific rank	2010 Corrected count	2010 Articles	2009 Asia-Pacific rank	2009 Corrected count	2009 Articles	2008 Asia-Pacific rank	2008 Corrected count	2008 Articles
Japan	1	234.28	398	1	216.6	362	1	173.01	266	1	153.83	248	1	156.59	242
China	2	150.03	303	2	110.04	225	2	68.08	152	2	44.47	103	2	37.38	89
Australia	3	68.26	223	3	64.63	172	3	39.63	129	3	42.56	106	3	35.72	94
South Korea	4	40.82	112	4	41.01	92	4	24.8	69	4	28.56	54	4	15.48	36
Singapore	5	21.19	71	5	13.49	53	5	11.26	44	5	9.17	29	5	8.82	21
Taiwan	6	11.68	38	6	9.68	26	6	7.31	27	6	6.84	19	6	6.01	16
India	7	8.24	25	7	8.53	30	7	2.93	17	7	4.03	14	7	5.10	13
New Zealand	8	4.64	24	8	5.30	28	8	1.38	3	8	3.00	16	8	4.14	10
Philippines	9	0.76	4	9	0.72	3	9	1.22	10	9	0.43	3	9	0.85	2
Vietnam	10	0.75	5	10	0.60	1	10	0.49	8	10	0.36	5	10	0.78	4
Thailand	11	0.62	11	11	0.50	5	11	0.29	1	11	0.04	1	11	0.25	1
Indonesia	12	0.17	3	12	0.31	5	12	0.13	1	12	0.04	1	12	0.20	1
Mongolia	13	0.12	2	13	0.31	3	13	0.11	1	13	0.03	1	13	0.12	1
Malaysia	14	0.06	3	14	0.31	2	14	0.02	2	–	–	–	14	0.08	1
Papua New Guinea	15	0.06	2	15	0.25	3	–	–	–	–	–	–	15	0.04	1
Cambodia	16	0.02	1	16	0.07	1	–	–	–	–	–	–	–	–	–
Bangladesh	–	–	–	17	0.07	1	–	–	–	–	–	–	–	–	–
Myanmar	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Tonga	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Solomon Islands	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

researcher; the most the country has ever contributed to is 28. Such small numbers create significant movement in the regional rankings from year to year among its institutions. For instance, in 2012, the University of Otago in Dunedin, the country's oldest university, which is renowned for medical and life science research, heads the list at 88 in the region (being the only New Zealand institution in the top 100); second is Waikato at 109, and fourth is Auckland (135). In contrast, in 2011, Auckland was the leading institution in 46th position, followed by the Victoria University of Wellington (91st regionally), which this year has slumped to 310.

OTHER COUNTRIES

There are 16 countries in the Asia-Pacific represented in the 2012 NPI, down from 17 in 2011. Bangladesh and Myanmar did not make a contribution, but Mongolia has joined the ranks with work on two papers: one each in *Nature Communications* and *Nature Geoscience*.

After New Zealand come the Philippines and Vietnam, with CCs of 0.76 and 0.75, followed by Thailand with 0.62. All these countries are involved in large, multi-country collaborations. The Philippines, for example, hosts the International Rice Research Institute, and Vietnam and Thailand contribute to international research into tropical diseases. In mid-2012 Vietnam and Japan launched a joint research centre in Hanoi that aims to improve extraction and processing of the rare-earth elements used in modern catalysts and batteries. Malaysia, Papua New Guinea and Cambodia all contributed to 3 papers or fewer. ■



National University of Singapore

A GLOBAL UNIVERSITY, LEADING RESEARCH IN ASIA AND BEYOND

From its founding in 1905 as a modest medical school, the National University of Singapore (NUS) has developed into a research-intensive institution that is consistently ranked among the world's leading universities.

With top researchers and state-of-the-art facilities, NUS aspires to create world-class research peaks on a broad base of research excellence. A total of 23 university-level research institutes and centres, along with 16 faculties and schools, form a dynamic network for education and research. NUS also hosts three of Singapore's five Research Centres of Excellence (RCEs) — specializing in quantum technologies, cancer and mechanobiology — and is a partner in a fourth RCE that draws on NUS' strengths in life sciences and sustainability research.

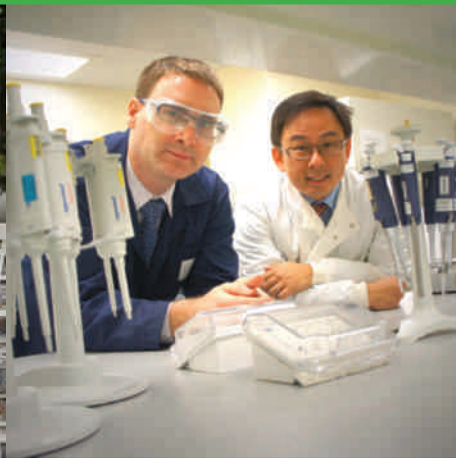
As a global university centred in Asia, NUS brings Asian perspectives and expertise to bear on issues relevant to the region and beyond. A rigorous academic culture and a spirit of enterprise drive high-impact research and innovation at Singapore's flagship university.

Peaks of research excellence

At NUS, researchers push the boundaries of discovery, with a focus on the development of practical research applications that benefit society. Recent highlights include the following:

- NUS researchers have found how a compound that is undergoing preclinical trials as a potential drug can "starve" cancer cells of energy, thus preventing them from developing into a tumour.
- Researchers from the NUS Department of Chemistry have shown that geometrically well-defined graphene quantum dots can be synthesized on a ruthenium surface using C_{60} molecules as a precursor, providing valuable insights into the diffusion and thermal dynamics of carbon clusters on metal surfaces.
- A cross-disciplinary team at NUS has conceptualized and built a graphene device, which can be potentially used to study any kind of diseased cell, and applied it to malaria detection.
- Researchers from the NUS Department of Biological Sciences and Temasek Life Sciences Laboratory have found what triggers plants to flower, a discovery that can potentially increase crop yields significantly in changing environments.
- NUS researchers on a cross-disciplinary team have developed the first technology in the world using nanoparticles for photodynamic therapy of deep-seated cancer. The method holds promise for a safe and non-invasive treatment of cancer.
- An international team, including researchers from the Centre for Quantum Technologies at NUS, have demonstrated that quantum discord, which is more robust and easier to access than the phenomenon of entanglement, can be used to enhance technology with a quantum advantage.
- Researchers from the NUS Yong Loo Lin School of Medicine have developed a gene silencing approach to fighting the chikungunya virus, a mosquito-borne disease that currently has no vaccine or cure.
- Researchers from the NUS Lee Kuan Yew School of Public Policy conducted a comparative study of water governance in the Asia-Pacific region, finding that developed and developing economies have statistically significant variations in their water governance arrangements.
- A group of scientists from the NUS Department of Biological Sciences and various countries have made use of powerful X-rays to decipher how an antibiotic-producing soil bacterium, *Streptomyces lasaliensis*, is able to convert an epoxide into a six-membered cyclic ether during synthesis of lasalocid, a natural polyether antibiotic.

As part of its research mission, NUS continually invests in facilities and infrastructure development. For example, NUS



has recently opened a Micro and Nano-Fabrication Facility as part of the Graphene Research Centre, the first such centre in Asia dedicated to graphene research. Also new is the Zeiss Microscopy Lab, housing state-of-the-art Zeiss microscopy equipment to further research in areas such as materials and bioscience. The Centre for Translational Medicine, which houses a simulation centre for medical students, includes facilities for research in diseases such as stroke, diabetes, dementia, cardiovascular and infectious diseases.

Recognizing that new breakthroughs are more likely to result from cross-disciplinary initiatives than through traditional divisions of inquiry, NUS has developed integrative research clusters on major themes: Finance and Risk Management, Biomedical Science and Translational Medicine, Ageing, Integrative Sustainability Solutions, and Asian Studies. These clusters provide a novel infrastructure to foster synergy among specific knowledge domains, enabling researchers to tackle complex, multi-disciplinary issues. NUS' cross-disciplinary approach is also evident in its educational programmes, such as the NUS Graduate School for Integrative Sciences and Engineering, which encourages its students to transcend traditional subject boundaries.

Forming alliances at home and abroad

Through key alliances in the East and West, NUS further fosters research and education in Singapore and overseas. For example, the Duke–NUS Graduate Medical School is now in Phase II of the partnership to provide medical education and conduct patient-oriented research. Yale–NUS College, set to open in August 2013, will usher in a new model of liberal arts and science education for a complex, globalized world.

NUS' University Town is home of the national-level Campus for Research, Technology and Enterprise (CREATE), an initiative of the National Research Foundation of Singapore. CREATE houses 15 interdisciplinary groups from ten renowned universities — Massachusetts Institute of Technology, ETH Zurich, Technical University of Munich, Technion–Israel Institute of Technology, Hebrew University of Jerusalem, Ben–Gurion University, Peking University, Shanghai Jiao Tong University, University of Cambridge, and University of California, Berkeley.

NUS also leverages on the close proximity of its main campus to several of Singapore's key science and technology hubs, building partnerships with industrial and government entities. Additional collaborations are facilitated by NUS Enterprise, a university-level cluster dedicated to promoting enterprise and leveraging on the university's intellectual property in various fields. Further afield, NUS is the first foreign university to establish a research institute in the Suzhou Industrial Park, one of the most developed industrial zones in China.

An Asian thought leader, NUS takes an active role in developing global initiatives. NUS President Professor Tan Chorh Chuan was elected and served two terms as chair of the International Alliance of Research Universities, a select group of ten leading research universities from eight countries. He was instrumental in the establishment of the NUS Global Asia Institute, which aims to bring together existing expertise from NUS and other institutions in addressing fundamental issues confronting Asia and the world.

In its global approach to transformative education and cutting-edge research, NUS strives to provide real-world solutions and influence the world's future for the better. ■

NUS
National University of Singapore
nus.edu.sg

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 Asia-Pacific covers the period from 1 January 2012 to 31 December 2012.

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

Institution 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 website. The global index 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 rankings group 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 the Asia-Pacific region can be tracked online through a comprehensive service which is updated weekly. nature.asia/publishing-index-asia-pacific 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)




Nagoya University

MAKING OUR MARK AS A WORLD-LEADING UNIVERSITY

Research expertise and top-flight experimental facilities are necessary to be counted among the elite universities, but these are not enough. A university must also be able to cultivate the next generation of scholars and scientists with skills and leadership capacity.

Nagoya University is on that track. Various initiatives spurred by the Hamaguchi Plan, brainchild of university president Michinari Hamaguchi, have brought in equipment, established new interdisciplinary programmes and institutes and forged industrial collaborations. These developments have been supported by generous grants from the Japanese government and grants from industry, as well as donations by alumni and industry. As it lays that foundation, the Hamaguchi Plan also ensures that students are confident, capable and ready to compete in an increasingly international work environment.

World-leading research

The university has a solid base of intellectual excellence. Founded in 1871, it became one of Japan's seven prestigious imperial universities. In the modern era the university has flowered into a thriving, internationally competitive research university. Symbolic of that achievement, the

Michinari Hamaguchi, president of Nagoya University

university claims more than its fair share of Japanese Nobel Prize winners — two each in physics and chemistry.

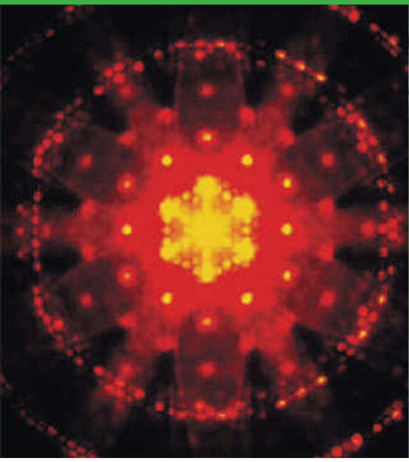
Those fields still mark strongholds of the university as it revolutionizes them to align with the contemporary demands of interdisciplinary research. The Kobayashi–Maskawa Institute, established in 2010 and named after the Nobel laureates for their work in theoretical physics, integrates theoretical and experimental particle physics, theoretical and observational astrophysics, mathematical physics, and cosmic ray physics. The synthesis has kept its scientists at the forefront of physics. "Nagoya University researchers have, for example, made great contributions to the observation of a particle consistent with the Higgs boson," says Hamaguchi.

The Graduate School of Pharmaceutical Sciences, established in 2012, similarly integrates various fields, including biology, biochemistry, bioagricultural sciences, chemistry and biotechnology. The Institute of Transformative Bio-Molecules (ITbM), a centre created through the World Premier International Research Center Initiative (WPI), brings together ten prominent researchers from four countries who represent a variety of disparate specialties to focus on an ambitious goal: creating a bounty of synthetic bio molecules that can revolutionize food and biomass production, optics and alternative energy.

Over the past five years, the university has also been awarded a series of Global Centers of Excellence, covering transformational fields such as 'clinical environmental studies,' 'micro–nano mechatronics' and 'systems biology.' "These have made the university much more visible globally," says Hamaguchi. "As a result, applications from foreign students and postdocs have been increasing."

Internationalization

Internationalizing the university has been a central focus for the president. The Global 30 Project, for example, opens up undergraduate and graduate study opportunities for non-Japanese speakers. "Professors have to recruit talent from all over the world and lecture in





NAGOYA UNIVERSITY

English," Hamaguchi says. "It makes the university much more international." The Hamaguchi Plan will raise the number of foreign exchange students from the current 2,000 to 3,000 by 2020. English is already the customary language for meetings and discussions at the ITbM.

Facilities and collaboration

Nagoya University's facilities are also a major draw. The High Voltage Electron Microscope Laboratory enables the observation of chemical reactions in a low-pressure gas atmosphere. The Nagoya University Synchrotron Radiation Research Center, which operates the Aichi Synchrotron Radiation Center that launched in 2013, has already made the university a bustling hub of beam line activity. The university's biomedical research capacities expanded with the recent addition of the Center for Advanced Medicine and Clinical Research for translational research. And in 2012, the Graduate School of Medicine installed Asia's first NeuroMate, an image-guided robot which can be used for various cutting-edge neurosurgical procedures including deep brain stimulation and stereotactic electroencephalography.

These facilities are attractive not only to researchers but also to companies. The synchrotron has "a keen focus on industry–academia–government collaboration," says Hamaguchi. The synchrotron and other facilities' location in the Chubu region — the centre of Japan's manufacturing industry — has allowed Nagoya University to foster collaborations with some of Japan's most powerful companies, leading to successful outcomes such as the development of a state-of-the-art gallium nitride-based blue LED. These partnerships include the Plasma Nanotechnology Research Center as well as the Green Mobility Collaborative Research Center, which shares close ties with the nearby Toyota Motor Corporation. The Business Capacity Development Center (B-JIN) helps to turn these collaborations into short- and long-term career opportunities for students.

Cultivation of global leaders

Indeed, much of the Hamaguchi Plan is focused on cultivating students who are prepared to take on the challenges that their generation will face. Nagoya University won funding for four specialized programmes in graduate education. The Gateway to Success in Frontier Asia, launched in 2012, is establishing a training programme that teaches students strong communication skills and prepares them for leadership roles in Asia, whether in the world of science or in other fields.

The Integrative Graduate Education and Research Program in Green Natural Science, which started in 2011, brings together chemistry, biology and physics to cultivate leaders who can find practical solutions to environmental problems, such as new materials for harnessing solar energy. The Leadership Development Program for Space Exploration and Research, launched in 2012, is teaching young scientists not only about physics and astronomy but also prepares them to lead and implement space programmes. The Cross-Border Legal Institution Design programme, established in 2011, is likewise training leaders in the international legal terrain.

The university, while steeped in tradition, is young at heart and devoted to making the most of its potential. The average age of the principal investigators at ITbM is 43. With its community of young researchers and its interdisciplinary nature, the ITbM is "a driving force for change at our university," says Hamaguchi. The Institute for Advanced Research's Young Leaders Cultivation (YLC) Program also gives an opportunity for young researchers to focus on scientific research in their selected field.

This dedication to supporting scientists who can both identify and overcome future challenges, which is at the heart of the Hamaguchi plan, will ensure Nagoya University's place as one of the world's top research institutions.

Nagoya University

NAGOYA UNIVERSITY'S LEADING PROGRAMMES IN DOCTORAL EDUCATION

Since its founding in 1871, Nagoya University has established an international reputation for research and education backed by an outstanding record of scientific achievements, with distinguished alumni and affiliates of the university including four Nobel laureates. The university values diversity, innovation and integrity, and encourages independence and originality of thought.

Committed to the highest standards of teaching and research at the undergraduate, graduate and postdoctoral levels, today the university has grown to comprise over 20 research institutes, with 14 graduate schools and around 300 academic exchange partners worldwide. Located in the modern and vibrant city of Nagoya, set amid one of Japan's largest central hubs of commerce and industry, Nagoya University has an exceptionally forward-looking, international character. The university has a student body of around 17,000, including over 2,000 international students from 87 countries. The multinational faculty comprises more than 900 scholars and professors from 63 countries and territories.

As part of the Leading Programs in Doctoral Education, supported by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), Nagoya University offers world-class, interdisciplinary programmes with a focus on fostering innovation across various fields, and on cultivating internationally attuned future leaders in academia, industry, government and society, who will play important roles in the global future.

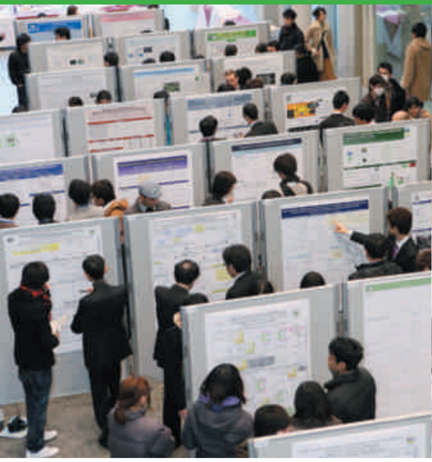
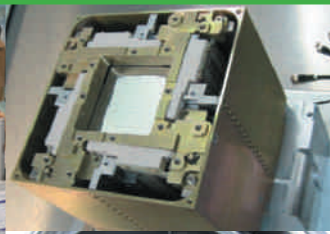
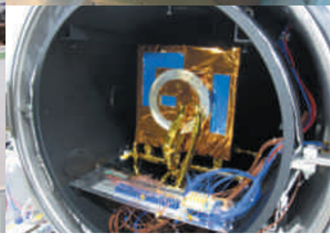
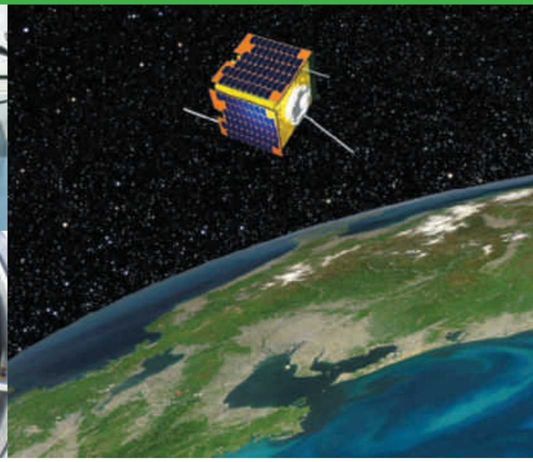
There are three categories of programmes available under this initiative. In the 'all-round' category, the PhD Professional: Gateway to Success in Frontier Asia programme provides an integrated education for talented students interested in pursuing careers in international development. In the 'composite' category, two programmes — the Integrative Graduate Education and Research Program in Green Natural Sciences and the Leadership Development Program for Space Exploration and Research — provide high-level training for top science and engineering graduates. Lastly, in the 'only-one' category, the Cross-Border Legal Institution Design programme operated by the Nagoya University Graduate School of Law aims to educate future leaders in legal reform and policy. The following pages highlight just some of the exciting range of courses on offer.

Thinking green

Launched in December 2011, the Integrative Graduate Education and Research (IGER) Program in Green Natural Sciences fosters a multidisciplinary approach for training the next generation of global environmental leaders. Included in the programme of foundational science disciplines are chemistry, biology and physics, taught by outstanding faculty from the Nagoya University Graduate Schools of Science, Engineering, and Bioagricultural Sciences.

Educational support is also provided by visiting lecturers from institutes including Japan's Institute for Molecular Science, the National Institute of Basic Biology, RIKEN, the National Institute of Advanced Industrial Science and Technology, the Toyota Central R&D Laboratories and the Toyota Physical and Chemical Research Institute, as well as overseas partner universities. The IGER programme provides opportunities for students to engage in face-to-face interactions with working scientists and industry leaders, offering an effective platform for education, research training and recruitment.

The programme is primarily designed to encourage a balance of both academic and industry-based skills, with opportunities for students to attend seminars to stimulate discussion and collaboration,

NAGOYA UNIVERSITY

as well as undertake English-language training and internships. Students receive guidance through evaluations and feedback as part of a 'Portfolio' system, aimed at broadening future career paths.

Gender equality is an integral part of the programme. A dedicated 'Women in Science Team' comprising around 20 eminent female scientists actively encourages young female students to become world-class scientific leaders through professional development seminars and career advice. Women make up around a quarter of the total number of 263 students currently enrolled in the programme.

The programme provides excellent opportunities for those who wish to develop leading-edge skills and deepen their research experiences. A number of financial support options are available on enquiry. The door is open to all graduates who have a spirit of *kokorozashi* — a determination and vision to succeed in a fast-paced and competitive environment and contribute to our understanding of critical issues in the green natural sciences.

Integrative Graduate Education and Research Program in Green Natural Sciences

http://iger.bio.nagoya-u.ac.jp/index_e.php

Trailblazing into the future

The Leadership Development Program for Space Exploration and Research offers a practical, interdisciplinary approach to space science and engineering. Combining taught courses with real-world, hands-on experience, the programme not only enables students to consolidate their theoretical knowledge but also encourages their participation in activities such as satellite instrument design and development.

A range of online study options and lectures gives prospective students a sense of the breadth and span of cross-disciplinary research at Nagoya University. In the Minima A curriculum, students can reinforce their knowledge of fields including mechanics, thermodynamics and computer programming through tailored, online resources. The Minima B curriculum consists of lectures on topics including space observatories, the solar–terrestrial environment, space propulsion, advanced materials, signal processing and simulations, as well as project management and intellectual property issues.

One of the projects that third-year students can actively engage in is the innovative instrument development project for ChubuSat, a microsatellite being developed by a group of universities and aerospace industries led by Nagoya University. Named after the Chubu region of central Japan, ChubuSat is intended to catalyse commercial use of microsatellites and students can experience firsthand satellite instrument design, project planning and management, testing systems and implementation.

Cross-disciplinary seminars and workshops are held on a regular basis; students are encouraged to develop a wide set of skills outside the scope of ordinary coursework and to cultivate a culture of lively, interdisciplinary dialogue.

A variety of research grants are available for successful applicants. The programme also provides funding for all students to participate in a three- to six-month placement either at a company or a research institution outside Japan, where they can hone their skills in a global research environment.

With its overall emphasis on developing a global mind set and strong leadership skills, the Leadership Development Program for Space Exploration and Research is designed to inspire and nurture the next generation of leaders in space science and technologies.

Leadership Development Program for Space Exploration and Research

www.frontier.phys.nagoya-u.ac.jp/en

NAGOYA UNIVERSITY

Gateway to success

The PhD Professional: Gateway to Success in Frontier Asia graduate programme provides an all-round education that integrates science and the humanities, with a focus on creative and innovative research. The programme offers a unique training experience for postgraduate students who aspire to work at the interface of research, practice and policy in a global context.

The programme's overarching aim is to promote interaction and collaboration between Japan and 'Frontier Asia' countries including Vietnam, Cambodia, Thailand, Uzbekistan and Mongolia through various field research projects and exchange activities. The programme emphasizes the importance of developing cross-cultural communication and problem-solving skills in order to undertake collaborative projects with people from many different backgrounds and cultures.

"While Japan needs its manufacturing business to prosper in the global market, Frontier Asian countries can benefit from Japan's expertise in technology and investment for venture capitals to assist their economical growth," says Naoshi Sugiyama, programme coordinator of the PhD Professional programme. "This new academic programme aims to foster young minds from arts, sciences and engineering to be a leading workforce in strengthening ties between Japan and Frontier Asia."

Through a combination of core and optional modules, the five-year PhD programme offers those from both science and arts backgrounds the opportunity to develop core expertise and build on their analytical, communication and leadership skills. Upon completion of the programme, students will be equipped with the necessary skills to pursue careers in public policy, government service, the judiciary, non-profit organizations, media, education and research.

An upcoming research project run by the programme will involve conducting environmental pollution studies in Mongolia through the analysis of snow samples taken in the field. This study aims to promote deeper understanding and evaluation of environmental and development policies.

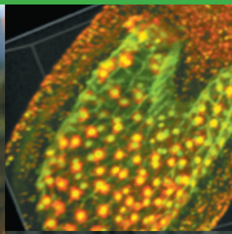
Students participating in the programme have the opportunity to attend workshops and discussion sessions with representatives from academia, industry, government and the mass media, including Nobel laureate Toshihide Maskawa and current or former CEOs of world-renowned companies such as the Toyota Motor Corporation and IBM Japan. These sessions are intended to promote dialogue and awareness of contemporary issues in Japan and Asia, taking cross-sector perspectives into account. Students are encouraged to develop effective approaches to complex problems and examine how Frontier Asian countries can benefit from technology-led economic development strategies.

Nagoya University welcomes a high number of international students including those from Frontier Asian countries, and there are currently around 2,000 international students making up approximately a tenth of the university's enrolment. A collaborative atmosphere is promoted at the university and students are encouraged to engage in interdisciplinary learning and cultural exchange.

The first cohort of students for the PhD Professional: Gateway to Success in Frontier Asia programme will be selected in April 2013 and the intake is expected to be 20 students per year. The programme will officially begin in October 2013.

PhD Professional: Gateway to Success in Frontier Asia

www.phdpro.nagoya-u.ac.jp/en



NAGOYA UNIVERSITY

Innovation at the molecular level

Bringing focus to the exciting interface between chemistry and biology, Nagoya University is driving the development of innovative functional molecules.

The new Institute of Transformative Bio-Molecules (ITbM) is set to become a premier research hub for biomolecular design and synthesis. Through the development of novel, 'transformative' molecules with carefully targeted properties, research at the ITbM is expected to have wide-ranging applications in medicine, food science and energy production, as well as the advancement of imaging technologies, helping scientists to study biological systems with extraordinary precision.

"Nagoya University is the ideal place for establishing this new interdisciplinary research institute," says Kenichiro Itami, director of the ITbM. "The institute builds not only on the strong tradition of research in chemistry and biology at Nagoya University but also on the free and vibrant academic culture that has traditionally nurtured the creativity of young scientists."

Among the university's many eminent affiliates include Osamu Shimomura, co-awarded the Nobel Prize in Chemistry in 2008 for the discovery and development of green fluorescent protein, and Ryoji Noyori, co-awarded the Nobel Prize in Chemistry in 2001 for his work on chirally catalysed hydrogenations.

By providing a unique platform for cross-disciplinary research encompassing synthetic chemistry, molecular catalysis, systems biology, plant science, peptide science and live-cell imaging, the ITbM aims to inspire and enable young researchers to become part of the next generation of scientific leaders.

There are currently 10 principal investigators (PIs) at the ITbM, overseen by the International Advisory Board of 8 distinguished members, and there are plans for the institute to grow to 130 core members by 2015. Itami explains that one of the distinctive features of the institute will be the introduction of a "co-PI system, whereby bright young scientists are paired with overseas PIs to facilitate research activities at the ITbM." New laboratories called 'Mix-Labs' will also enable researchers from different fields to work together and think beyond the boundaries of traditional disciplines.

"This is an unprecedented endeavour and the first such research institute in the world," says Itami. With his extensive background in organic synthesis, Itami himself leads a research group that has developed novel catalysts for carbon-proton (C-H) coupling, opening up new avenues for research into pharmaceuticals, natural products and the development of new enzyme inhibitors.

Based within the ITbM, the Molecular Structure Center and Live Imaging Center are equipped with leading-edge technologies that are drawing international interest. The ITbM has already established collaborative research agreements with the RIKEN Center for Sustainable Resource Science in Japan and the NSF Center for Stereoselective C-H Functionalization in the United States.

The ITbM's International Promotion Unit will also play a "crucial role in providing researchers worldwide with access to the transformative biomolecules developed at the institute," says Itami. "This will include negotiating issues with regard to intellectual property and also the distribution and scale-up of molecules discovered at the ITbM."

In October 2012, the ITbM was selected as a member of the World Premier International Research Center Initiative (WPI) supported by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT). The programme is dedicated to supporting excellence in research and attracting high-calibre researchers from around the world. The ITbM officially launches in April 2013. ■

ITbM Nagoya University

www.itbm.nagoya-u.ac.jp

Asia–Pacific Top 200

The Nature Publishing Index keeps growing. The 2012 edition lists 738 institutions and universities from the Asia-Pacific region — an increase of 25% on the previous year. Below we present the top 200, with article number and corrected count (shown to two decimal places only) for 2012 and 2011, along with combined scores for the five years 2008–2012. Only primary research — Articles, Letters and Brief Communications — is included, not research reviews.

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 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					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CORRECTED COUNT (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	18.18	54	5	17.43	48	5	77.38	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	10.68	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

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
45	Korea University	South Korea	2.43	6	42	2.71	12	40	9.28	34
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	Tokyo University of Science	Japan	2.08	6	62	1.38	5	83	3.65	14
55	National Cancer Center	Japan	2.01	8	119	0.63	2	70	4.98	18
56	Institute of Genomics & Integrative Biology (IGIB)	India	2.00	2	288	0.14	1	128	2.14	3
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	13.11	34
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	6.97	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	2.60	10
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	Korea Institute of Science & Technology (KIST)	South Korea	1.44	7	168	0.32	3	84	3.64	16
81	Juntendo University	Japan	1.44	8	334	0.11	1	91	3.22	23
82	Jawaharlal Nehru University	India	1.38	2	85	1.00	1	117	2.38	3
83	Chiba University	Japan	1.37	9	60	1.42	6	62	5.44	26
84	Kyung Hee University	South Korea	1.36	6	191	0.28	4	111	2.44	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

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
101	University of Toyama	Japan	1.06	5	473	0.04	1	192	1.15	7
102	Tokyo Metropolitan Institute of Medical Science	Japan	1.05	3	92	0.94	3	88	3.38	15
103	South China University of Technology	China	1.05	3	202	0.25	2	159	1.48	11
104	Anhui Medical University	China	1.03	7	104	0.73	4	75	4.26	17
105	Teikyo University	Japan	1.01	3	–	–	–	181	1.23	5
106	Waseda University	Japan	1.00	6	47	2.18	6	71	4.58	20
107	National Institute of Infectious Diseases (NIID)	Japan	1.00	1	217	0.24	3	115	2.40	8
108	F. Hoffmann-La Roche Ltd	Japan	0.94	1	–	–	–	141	1.94	2
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
121	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
131	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

2012					2011			2008–2012		
RANK	INSTITUTION	COUNTRY	CC	ARTICLES	RANK	CC	ARTICLES	RANK	CC	ARTICLES
151	International Rice Research Institute (IRRI)	Philippines	0.60	1	–	–	–	305	0.60	1
152	The National Institute of Radiological Sciences (NIRS)	Japan	0.59	1	–	–	–	307	0.59	1
153	Peter MacCallum Cancer Center	Australia	0.59	6	364	0.08	3	113	2.43	24
154	Akita University	Japan	0.59	6	255	0.18	2	140	1.95	11
155	Garvan Institute	Australia	0.57	4	292	0.14	2	101	2.85	16
156	Tokyo University of Pharmacy & Life Sciences	Japan	0.57	2	252	0.18	2	223	0.97	6
157	University of Ulsan	South Korea	0.57	7	354	0.09	2	245	0.84	11
158	Lanzhou University	China	0.56	3	276	0.15	3	262	0.75	7
159	Ocean University of China	China	0.56	4	114	0.67	2	182	1.23	6
160	Fukui Prefectural University	Japan	0.56	1	–	–	–	173	1.31	2
161	The Hong Kong Polytechnic University	China	0.56	2	–	–	–	144	1.81	4
162	Yokohama City University	Japan	0.55	4	48	1.90	8	56	5.92	25
163	National Institute of Health Sciences (NIHS)	Japan	0.54	2	180	0.29	2	227	0.92	5
164	University of Electro-Communications	Japan	0.54	2	374	0.08	1	240	0.85	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
170	RMIT University	Australia	0.50	1	388	0.08	1	254	0.80	3
171	National Hospital Organization Nagoya Medical Center	Japan	0.50	1	–	–	–	344	0.50	1
172	Koito Manufacturing Co., Ltd.	Japan	0.50	1	–	–	–	343	0.50	1
173	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
188	Korea Institute for Advanced Study (KIAS)	South Korea	0.40	1	–	–	–	387	0.40	1
189	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
195	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

Nanyang Technological University

BECKONING THE BEST

Against the alluring garden views and lush tropical surroundings, the energy and dynamism of Singapore's Nanyang Technological University (NTU) are almost palpable. As a principally engineering-oriented institution, NTU has always focused on research with a practical perspective, fostering a spirit of entrepreneurship and technological innovation in its talented researchers. Under the lead of its visionary president, Bertil Andersson, NTU is on a bold journey of reinvention, integrating new disciplines and partnerships to enable it to flourish in the rapidly changing global research environment. Just halfway into its ambitious five-year plan, NTU has propelled itself to the forefront of the international education arena and is poised to establish itself as a major global centre of cross-disciplinary innovation-driven research.

"NTU has identified Five Peaks of Excellence — key areas of interdisciplinary research in which the university aims to make its mark globally by 2015," says Andersson. The Five Peaks are Sustainable Earth, Future Healthcare, New Media, the New Silk Road, and Innovation Asia — a broad range of fields that exploits NTU's existing strengths and attracts new expertise. These fields are seamlessly combined to achieve interdisciplinary synergies. In tandem with the Five Peaks, the range of research conducted by NTU has broadened rapidly in recent years with the establishment of two national Research Centres of Excellence namely the Earth Observatory of Singapore (EOS) and the Singapore Centre on Environmental Life Sciences Engineering (SCELSE), as well as world-class institutes including the Nanyang Environmental and Water Research Institute (NEWRI), the Institute for Media Innovation and the Energy Research Institute @ NTU (ERI@N), which works closely with the TUM CREATE Centre for Electromobility.

These ambitious expansions have paid off. In September 2012, NTU was the fastest-rising university in the world's top 50, leaping 11 places to 47th position. In the last two annual university rankings by Quacquarelli Symonds (QS), NTU has jumped 27 places. The university moved up one place to 5th position for faculty diversity, five notches to 59th place for academic reputation and up four spots to 47th position for employer reputation. Among Asian universities in the list, NTU is ranked 9th. "This is a remarkable achievement that reaffirms our global standing in education and research," says Andersson. "We are up there with the best in the world, because Singapore believes and invests in quality education and research."

Bertil Andersson, president of Nanyang Technological University

Global appeal

NTU's success and vibrancy have attracted top-flight academics from around the world to join its ranks. Among them is Emma Hill, a Singapore National Research Foundation fellow and assistant professor at the EOS. In the specialised field of geodesy, which involves studying the size and shape of the Earth, Hill has achieved considerable success in her studies of natural hazards and climate change for the regions of South and Southeast Asia. "As an earth scientist wanting to do good science that is directly relevant to helping society, the mission of EOS really called out to me. I feel motivated and inspired the moment I walk through the door each day," shares Hill, who recently led a team to discover a very shallow part of the subduction megathrust which caused the 2010 Mentawai

earthquake and tsunami in Indonesia, a finding made possible by combining data obtained from the tsunami and global positioning systems (GPS). "Along with generous funding opportunities, at NTU I have the most conducive environment to pursue my interest and to contribute to answering all the big, unexplored questions in earth science."

Another internationally renowned scientist who was drawn to NTU is Hilmi Volkan Demir, a National Research Foundation fellow. Hailing from Turkey, Demir is the founding director of the LUMINOUS! Centre of Excellence for Semiconductor Lighting and Displays at NTU. The centre aims to exploit the science and technology of nanocrystal optoelectronics to achieve high efficiencies for quality LED lighting and displays. Supporting Demir's vision, NTU provided the optoelectronics expert with suitable and efficient infrastructure right from the beginning to ensure a seamless inception. "I am really grateful to have all the right components to enable a quick and successful start," expresses Demir. "The vision of the senior management is ever so important. Here at NTU Singapore, we are now seeing the fruit borne by those visions — I can see that more great things are about to happen here." By precisely controlling nanocrystal emitters, Demir and his team can engineer solid-state lighting devices that emit at a set of strategic wavelengths tailored to specific applications, such as street lighting, greenhouse lighting and light therapy. When asked about his life as a scientist in Singapore, Demir quips, "Singapore is an exciting place to be. I've never felt like a foreigner here, everyone is just so welcoming and friendly — it helps that I love the food here too!"

Continuing growth

This year, NTU will enrol the first intake of students at its new Lee Kong Chian School of Medicine, established jointly with Imperial College London, which is offering its first undergraduate programme outside the United Kingdom. This partnership ushers in an important new chapter in Singapore's development as a regional and international hub for medical science and research.

The presidents of Wageningen University, the Netherlands, and NTU recently cemented a tie-up to boost research in food science and technology in a ceremony witnessed by the visiting Queen Beatrix of the Netherlands. NTU aims to develop fully fledged programmes in the field at both undergraduate and Master's levels, involving schools and departments from both universities. This will contribute to a critical mass of trained workers for the food industry, both locally and regionally.

Under a new Campus Master Plan, NTU will undergo its biggest physical transformation since 1991 with the building of a new learning hub, conceived by renowned English designers Heatherwick Studio. Since cooperation is central to learning, the hub is designed to encourage connections, with a shape guided by this central function. The futuristic building is set to become the next physical icon at NTU after the award-winning 'green' building that houses its School of Art, Design and Media. Other developments planned for the next three years include a multifunctional campus centre with restaurants and cafés, and an interdisciplinary research building. "When fully implemented, the NTU campus will be transformed into a 'univer-city'. We pride ourselves as the first high-level university in the tropics surrounded by lush greenery and nature. That, in itself, is one of the unique attributes of NTU," remarks Andersson. ■

Top institutions by journal

Aggregated contributions to Nature titles from 2008 to 2012.

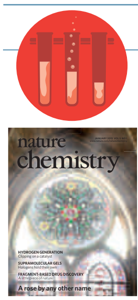
The Nature Publishing Index is comprised of 18 journals. The flagship journal is *Nature*, founded in 1869, and there are many subsidiary publications, including one online-only journal: *Nature Communications*. *Nature* and *Nature Communications* are multidisciplinary whereas most others fall into one of our four subject categories: life sciences, chemistry, physical sciences and earth & environmental sciences. The exception is *Nature Chemical Biology*, which falls under 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	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	32.27	107
2	Chinese Academy of Sciences	China	25.80	87
3	Kyoto University	Japan	19.44	52
4	RIKEN	Japan	18.36	76
5	Osaka University	Japan	17.12	45

NATURE CHEMISTRY



RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	12.88	17
2	Osaka University	Japan	4.68	7
3	Kyoto University	Japan	4.57	8
4	Nagoya University	Japan	3.32	4
5	National Institute of Advanced Industrial Science & Technology	Japan	2.15	5

NATURE BIOTECHNOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	BGI	China	3.25	7
2	Kyoto University	Japan	2.14	5
3	RIKEN	Japan	2.14	4
4	The University of Queensland	Australia	1.98	6
5	The University of Sydney	Australia	1.23	3

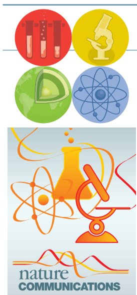
NATURE CLIMATE CHANGE

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	James Cook University	Australia	3.22	5
2	The Commonwealth Scientific & Industrial Research Organisation	Australia	2.07	9
3	The University of Queensland	Australia	2.05	4
4	Chinese Academy of Sciences	China	1.85	5
5	The University of Melbourne	Australia	1.06	6

NATURE CELL BIOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	11.83	18
2	Osaka University	Japan	7.53	18
3	RIKEN	Japan	6.77	13
4	Chinese Academy of Sciences	China	4.24	10
5	Agency for Science, Technology & Research (A*STAR)	Singapore	4.20	12

NATURE COMMUNICATIONS

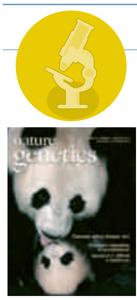


RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	29.90	69
2	Chinese Academy of Sciences	China	21.83	43
3	Kyoto University	Japan	19.90	42
4	Osaka University	Japan	15.59	35
5	RIKEN	Japan	11.03	40

NATURE CHEMICAL BIOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	6.33	10
2	RIKEN	Japan	3.63	8
3	Kyoto University	Japan	3.62	8
4	Nagoya University	Japan	2.00	4
5	Chinese Academy of Sciences	China	1.89	6

NATURE GENETICS



RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	RIKEN	Japan	15.27	50
2	The University of Tokyo	Japan	7.00	50
3	Chinese Academy of Sciences	China	6.26	21
4	BGI	China	5.68	16
5	Queensland Institute of Medical Research	Australia	4.98	48

NATURE GEOSCIENCE

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	5.41	17
2	Japan Agency for Marine-Earth Science & Technology	Japan	5.01	12
3	Australian National University	Australia	4.34	13
4	Kyoto University	Japan	3.58	5
5	Macquarie University	Australia	2.81	8

NATURE NANOTECHNOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	6.11	9
2	National Institute of Advanced Industrial Science & Technology	Japan	4.70	8
3	Pohang University of Science & Technology	South Korea	3.98	8
4	Agency for Science, Technology & Research (A*STAR)	Singapore	3.19	5
5	Osaka University	Japan	3.06	5

NATURE IMMUNOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	RIKEN	Japan	7.14	22
2	Chinese Academy of Sciences	China	6.46	13
3	Second Military Medical University	China	5.85	9
4	Osaka University	Japan	5.75	19
5	The University of Melbourne	Australia	5.05	12

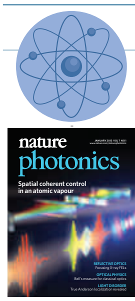
NATURE NEUROSCIENCE

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	Chinese Academy of Sciences	China	7.99	12
2	RIKEN	Japan	6.22	16
3	Kyoto University	Japan	5.17	15
4	The University of Tokyo	Japan	5.14	14
5	Hong Kong University of Science & Technology	China	3.27	4

NATURE MATERIALS

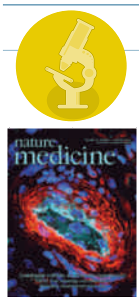
RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	15.03	31
2	Tohoku University	Japan	10.68	23
3	Kyoto University	Japan	8.60	17
4	Seoul National University	South Korea	6.42	9
5	Chinese Academy of Sciences	China	4.28	9

NATURE PHOTONICS



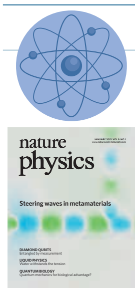
RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	University of Science & Technology of China	China	5.65	8
2	The University of Tokyo	Japan	4.90	9
3	NTT Group	Japan	4.27	6
4	Kyoto University	Japan	3.46	5
5	Osaka University	Japan	2.94	5

NATURE MEDICINE



RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	8.27	27
2	Kyoto University	Japan	3.54	7
3	Keio University	Japan	2.77	8
4	Osaka University	Japan	2.29	13
5	The University of Melbourne	Australia	1.97	8

NATURE PHYSICS



RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	14.15	35
2	Kyoto University	Japan	5.52	11
3	RIKEN	Japan	5.15	18
4	Chinese Academy of Sciences	China	5.00	17
5	Tohoku University	Japan	4.46	11

NATURE METHODS

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	RIKEN	Japan	3.61	7
2	Osaka University	Japan	2.21	5
3	Hokkaido University	Japan	1.94	3
4	Monash University	Australia	1.53	3
5	The University of Tokyo	Japan	1.49	5

NATURE STRUCTURAL & MOLECULAR BIOLOGY

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	The University of Tokyo	Japan	9.51	21
2	Chinese Academy of Sciences	China	8.47	14
3	RIKEN	Japan	4.77	12
4	Osaka University	Japan	3.27	9
5	Tsinghua University	China	3.07	7

Global Top 100

The Nature Publishing Index is expanding. Like the regional Top 200, the Global list counts only primary research — articles, letters and brief communications — and not reviews. 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 only get credit 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, which is dominated by the United States and Europe. Asia-Pacific is still well represented, with 13 institutions from the region making the list. ■

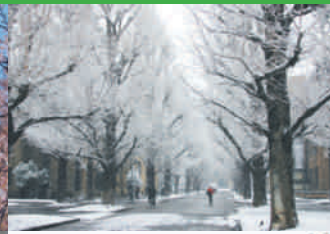
RANK	INSTITUTION	COUNTRY	CC	ARTICLES
1	Harvard University	United States	152.11	368
2	Stanford University	United States	76.34	161
3	Max Planck Society	Germany	64.31	186
4	Massachusetts Institute of Technology (MIT)	United States	60.49	199
5	French National Centre for Scientific Research (CNRS)	France	45.90	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

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
21	Northwestern University	United States	25.34	54
22	The University of Chicago	United States	24.88	54
23	University of Illinois	United States	24.49	55
24	California Institute of Technology	United States	24.28	63
25	Kyoto University	Japan	22.47	55
26	The Scripps Research Institute	United States	22.20	44
27	University of Pennsylvania	United States	21.24	58
28	Washington University in St Louis	United States	21.04	74
29	Weizmann Institute of Science	Israel	20.54	34
30	Helmholtz Association of German Research Centres	Germany	20.40	100
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	19.53	64
35	New York University	United States	18.53	47
36	Osaka University	Japan	18.18	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	15.63	79

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
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	14.58	30
45	University of Geneva	Switzerland	14.06	42
46	University of Pittsburgh	United States	14.01	44
47	University of Minnesota	United States	13.89	47
48	Lawrence Berkeley National Laboratory	United States	12.97	73
49	The University of Texas MD Anderson Cancer Center	United States	12.48	33
50	University of Maryland	United States	12.35	52
51	University of Bristol	UK	12.30	41
52	Utrecht University	Netherlands	12.08	45
53	The University of Edinburgh	UK	11.95	52
54	University of Colorado Boulder	United States	11.89	37
55	Salk Institute for Biological Studies	United States	11.84	24
56	University of Massachusetts Medical School	United States	11.68	28
57	University of Zurich (UZH)	Switzerland	11.49	41
58	The Rockefeller University	United States	11.35	31
59	Spanish National Research Council (CSIC)	Spain	10.85	46
60	University of Wisconsin-Madison	United States	10.80	31
61	The University of Melbourne	Australia	10.78	48
62	National Institute for Health and Medical Research (INSERM)	France	10.68	92
63	University of Copenhagen	Denmark	10.59	54
64	F. Hoffmann-La Roche Ltd	United States	10.53	20
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

RANK	INSTITUTION	COUNTRY	CC	ARTICLES
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	66
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







The University of Tokyo

GLOBAL AND RESILIENT

The University of Tokyo has long held the reputation as one of the world's most prestigious universities. To see that it deserves that rank, one can look at the achievements of any of a number of laboratories. Kazunori Kataoka's supramolecular 'smart' nanocarriers, for example, are ready to revolutionize the way we think about medicine. The Kavli Institute for the Physics and Mathematics of the Universe (Kavli IPMU) is transforming what we know about dark matter. Other examples — a few are noted in this article — abound. These successes have been built on the back of facilities that attract researchers from across the world, such as the Hyper Suprime-Cam on the Subaru Telescope and the Super-Kamiokande neutrino facility.

But the university's obligation goes beyond facilities and prominent publications. It must also educate the next generation of leaders in academic and industrial research. Today, this means cultivating students that are comfortable in an international setting, able to communicate effectively and tenacious enough to overcome setbacks. This mandate has inspired university president, Junichi Hamada, to describe his vision for education with the slogan: "More global, more resilient."

With his 'Action Scenario FOREST 2015,' Hamada is leading the way to change the function not only of the University of Tokyo but of all Japanese universities by setting a model for them to follow.

The University of Tokyo will toughen students by exposing them to other cultures. Hamada aims for all students to have spent time abroad, studying in a different cultural setting, by 2015.

Internationalizing is easier said than done in Japan. University enrolment begins in April, whereas 70% of other universities worldwide start in autumn. Hamada proposes to change Japan's system to autumn enrolment. This would allow students to align their schedules with study abroad programmes and give them summer 'gap' terms to undertake internships, volunteer activities or study programmes. And it would also make it easier for its own faculty to work abroad and for foreign faculty to remain at Japanese campuses.

"Many companies support the transition, but Japan's university system is conservative," says university vice-president, Yoichiro Matsumoto. "The University of Tokyo is leading the charge to change that system, but it will take time."

Unwilling to wait, the University of Tokyo is moving forward with various internationalization projects of its own, such as a strategic partnership with Princeton University, one of 360 partnerships with universities overseas. The agreement with Princeton, however, is first of several planned agreements that takes these ties a level deeper. The partnership will provide matching funds for faculty and student exchanges, and promote other mechanisms for extending collaborations in teaching and research. Already in January 2013, a joint committee launched a call for proposals for joint teaching and research projects, and the University of Tokyo's Kavli IPMU has already planned an observational cosmology project with Princeton researchers.

With increasing exposure to other research cultures, problem-solving methods and healthy competition, University of Tokyo students will be more stimulated, more resilient and better leaders.

Junichi Hamada, president of the University of Tokyo

THE UNIVERSITY OF TOKYO

Master of surprises

In 1996 Takuzo Aida took over the laboratory of a retiring professor at the University of Tokyo and made a bold decision: to head in a completely new direction.

Abandoning the synthetic polymer chemistry work that had been the laboratory's bread and butter, Aida threw himself into the study of supramolecular systems. "Physically I took over, but conceptually I didn't take anything with me," he says.

"The synthetic chemistry field was very congested," Aida explains. "But if you step out of it, you can quickly become more innovative and visible." The gamble paid off, and he soon published research showing how branched macromolecules known as dendrimers could be used to harvest light from low-energy sources efficiently enough to effect chemical transformations.

For the last decade and a half, Aida has been investigating various kinds of macromolecules with critical applications in a wide range of fields.

For example, Aida's team developed hydrogels, substances that might replace some plastics and thus reduce their negative environmental and health burden. Researchers had been having difficulty making hydrogels sufficiently sturdy; Aida's team overcame this with an inspired recipe. Adding a small amount of clay and a tiny amount of organic material, they produced a hydrogel that, though 98% water, had unexpectedly strong mechanical properties.

In a series of publications, his team also mapped out a method to create self-assembled graphite nanotubes that become conductive when exposed to light. Mimicking the photoconductors used in laser printers but at the nanometre level, these nanotubes are being applied in nanoscale photovoltaics and photodetectors.

Aida encourages students and junior staff to "follow their curiosity" and to remain free from the rut of received wisdom. "If something happens, they need to change the colour filter to try to see something that no one else can see," he says.

Sometimes this adventurous spirit reaps big benefits. Once, despite Aida's scepticism about the project, a postdoctoral researcher dropped some nanotubes into ionic liquid to see what would happen. Returning from lunch, he discovered "a paste-like material". After many attempts, they finally succeeded in repeating this experiment and now these 'bucky gels' are used by other groups in elastic conductors that cover movable robotic arms and flexible organic LEDs that can be made into stretchable displays. A company is developing a technology to use bucky gel-based actuators for controlling Braille displays on hand-held devices for the blind.

This series of successes has won him acclaim, including an Alexander von Humboldt Research Award, an American Chemical Society Award, and the Medal with Purple Ribbon, bestowed by the Japanese emperor.

Aida is coy when discussing future directions, largely because he defines them by where others will not be. "People predict based on past experience. I try to look in different ways. Sometimes it's lonely," he says, with a laugh.

But he has dozens of up-and-coming researchers, students and staff to keep him company. One-third come from foreign countries, and laboratory meetings, held in English, can be intimidating for some. At times he surprises students with questions in English during master's degree oral examinations. "I want to emphasize that the University of Tokyo is supposed to be one of the top research universities," he says. "You should be ready."

Aida Laboratory
Department of Bioengineering

http://macro.chem.t.u-tokyo.ac.jp/AIDA_LABORATORY/

THE UNIVERSITY OF TOKYO

Overcoming resistance

Takashi Kadowaki is not afraid of opposition to his theories, especially those concerning diabetes.

In 2001, using a mouse model, Kadowaki and his colleague, Toshimasa Yamauchi, showed that low levels of adiponectin, a hormone released by fat cells, were related to insulin resistance and that higher levels could correct this problem. "Adiponectin protects us from diabetes," says Kadowaki. "It's the good guy."

The highly-cited paper reporting these findings sparked the "adiponectin hypothesis", subsequently refined by Kadowaki to predict that low adiponectin levels — primarily induced by lifestyle factors such as a high-fat diet and sedentary habits — induce insulin resistance, type 2 diabetes, and related disorders such as atherosclerosis. Despite some results that clashed with convention, Kadowaki has overcome scepticism to find himself on the verge of translating his discoveries into clinical applications.

A major advance occurred in 2003, when Kadowaki and Yamauchi discovered the adiponectin receptors, AdipoR1 and AdipoR2. *In vitro* experiments revealed their involvement in the AMP kinase pathway, which is activated by caloric restriction and/or exercise. Like G protein-coupled receptors, they transmit signals received at the cell surface to activate corresponding signalling pathways in the cell. AdipoR1 and AdipoR2 share two-thirds amino acid sequence identity and an unexpected orientation in the cell membrane: flipped, with an internal amino terminus and an external carboxyl terminus.

But the biggest surprise for Kadowaki was his difficulty in convincing other scientists of the receptors' close relationship with diabetes. A 2007 study showed that replenishing the two receptors in obese diabetic mice with reduced AdipoR1 and AdipoR2 expression lowered glucose levels, increased fat burning and alleviated diabetes symptoms. Conversely, disrupting the function of AdipoR1 in wild-type mice reduced AMP kinase activation.

"It was direct proof *in vivo* of adiponectin's connection with insulin and diabetes," says Kadowaki. "But it took several years to convince other scientists of this."

Kadowaki has also studied the receptors' roles in skeletal muscle, which, like the liver, helps to efficiently burn fat and glucose; AdipoR1 knock-out mice are seen to fall behind on a treadmill while controls consistently remain at the front.

These studies have helped to explain why, despite the availability of effective drugs, glycaemic control cannot be realized and complications like eye disease, kidney dialysis, myocardial infarction and stroke are unpreventable in around 65% of patients, worldwide. "Current diabetes drugs heavily depend on the ability of patients to diet and exercise, but they have difficulty doing it," he says.

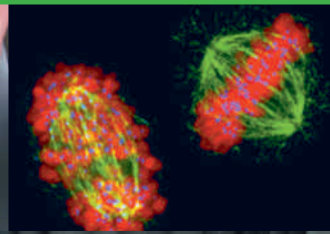
Undoubtedly, the vast resources at the University of Tokyo that have supported Kadowaki's work thus far — including research into human genetics and disease biology, mouse genetic manipulation facilities and a top-rated hospital — are greatly contributing to finding a solution. At present, Kadowaki and Yamauchi, together with colleagues Miki Okada-Iwabu and Masato Iwabu and in partnership with the university's pharmaceutical department, are developing a drug that binds to adiponectin receptors, mimicking caloric restriction and exercise.

"We want to be the first and best in the class," says Kadowaki. "The integration of clinical, genetic, and mouse expertise at the University of Tokyo has led us to where we are. And it will also make this possible."

Internal Medicine
Graduate School of Medicine and Faculty of Medicine

www.m.u-tokyo.ac.jp/english







THE UNIVERSITY OF TOKYO

Unwittingly biomedical

Yoshinori Watanabe does not own a mobile phone and, in a world in which biologists increasingly seek speedy commercial application of their research, he concentrates on deciphering the fundamental mechanisms that drive living cells.

In contrast to this nostalgia for an earlier age, Watanabe's discoveries in chromosome dynamics have pulled him to the cutting edge of biomedical research across the fields of infertility, birth defects, and cancer.

He focuses on how cells divide, and especially the ability of the thread-like mitotic and meiotic spindles that organize the chromosomes to pull apart sister chromatids. Failure of this mechanism in mitosis can cause chromosomal instability and lead to cancer. Failure in meiosis can result in abnormal chromosome numbers in gametes — something that occurs in roughly 20% of human eggs and accounts for the majority of miscarriages.

Meiosis occurs in two stages; initially, sister chromatids must stay together but later on they are pulled apart. Watanabe set out to understand how sister chromatid cohesion is preserved in the first stage. The crucial clue came from a comparison with mitosis, a process during which the spindles must pull the chromatids apart so that the cells can split into two identical daughter cells. If the chromatids stick together, the cells die. Using this insight, Watanabe's group screened fission yeast for gene products expressed in meiosis that kill cells undergoing mitosis. They detected a protein that formed a complex to prevent the separase enzyme from snipping the chromatids apart, naming it shugoshin (Sgo) — meaning "guardian spirit" — after its protective nature.

In spite of the many answers provided by Watanabe and the "guardian spirit", even more questions were raised by the discovery. Given that other factors seem to interact with Sgo, Watanabe is now carrying out large-scale biochemical screens to look for them. His team has also pinpointed Sgo's role in providing chromosomes with their correct orientation. "We would like to make clear everything about shugoshin's functions," he says.

The next project is set to examine the role of Sgo in cancer cells. Watanabe's group has already found that Sgo shows an abnormal distribution in tumour cells. "Although fine regulation of shugoshin localization is important to prevent chromosomal instability and tumourigenesis, its inactivation selectively kills dividing cells such as cancer cells," Watanabe explains.

The applications are clear. "Shugoshin is a potential anti-cancer drug target," says Watanabe, though he does not intend to pursue it himself. "I'm not so interested in medicine — I'm more interested in using my brain to find basic principles," he says.

Sgo could also aid the understanding of Down's syndrome and other chromosome disorders. Existing evidence — such as reduced cohesion between chromatids in aged mice — already suggests Sgo's potential involvement in such conditions.

Watanabe's work on Sgo is the flowering of a long, quiet period spent studying fission yeast before he settled on chromosomal segregation as a research focus. "I did a lot of experiments but they weren't so productive," he says. With typical modesty, Watanabe shies away from plotting out a future direction, other than to say he will build upon what he's already achieved: "I usually don't have a long-term goal. I'm a slow thinker, but might be good at accumulating knowledge." ■

Laboratory of Chromosome Dynamics
Institute of Molecular and Cellular Biosciences

www.iam.u-tokyo.ac.jp/watanabe-lab/watanabe_lab/Home-e.html




Tokyo Medical and Dental University (TMDU)

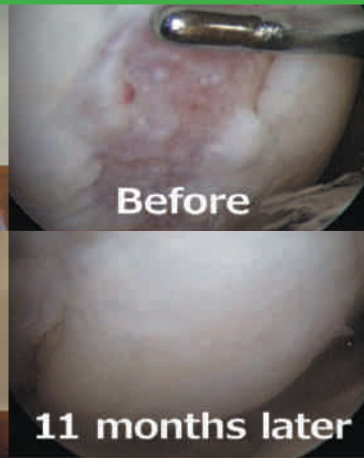
AT THE FOREFRONT OF BASIC AND CLINICAL LIFE SCIENCE RESEARCH AND EDUCATION

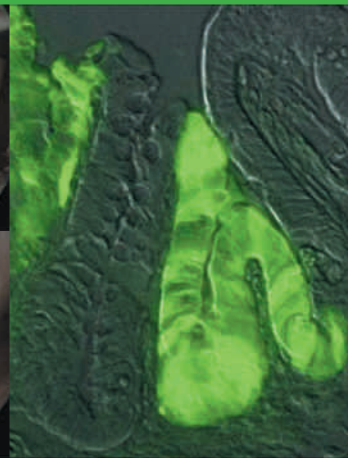
Tokyo Medical and Dental University (TMDU) is proud to have been founded, in 1928, as the first national dental school in Japan. Today, under TMDU President Takashi Ohyama, approximately 3,000 students are pursuing medical, dental, and life science degrees at TMDU, with a nearly equal number of students in undergraduate and graduate programmes. Undergraduates begin their career at the College of Liberal Arts and Sciences to ensure a well-rounded education. After moving on to the Faculty of Medicine or Faculty of Dentistry, students concentrate on a curriculum that is increasingly integrated between medical and dental sciences and utilizes an inter-professional educational approach, just as graduate students at TMDU have traditionally enjoyed. In all, TMDU offers over 200 life science degree programmes in its three graduate schools. In addition, thousands of patients are treated daily at the attached university hospitals of medicine and dentistry, institutions that further facilitate the school's educational efforts, basic and clinical research activities, and community service.

In 2012 Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) awarded TMDU a very substantial grant to help its graduates gain an internationalized perspective through innovative and intensive education in English, critical thinking and global issues. This initiative, the Project for Promotion of Global Human Resource Development, will be fundamental in improving Japan's global competitiveness and enhancing ties between nations. TMDU also received funding for another large-scale project to foster direct international outreach. The Re-Inventing Japan Project — Support for the Formation of Collaborative Programs with ASEAN Universities — will promote student exchange between TMDU and ASEAN universities through the harmonization of academic curricula, the mutual recognition of credits, the strategic recruitment of international students and the deepening of TMDU's collaborations with its partner universities in Southeast Asia.

The university's three overseas research/education centres are also central to its educational and research goals. The Ghana–TMDU Research Center at the Noguchi Memorial Institute for Medical Research at the University of Ghana concentrates on the research of emerging and re-emerging tropical diseases, including malaria, HIV, tuberculosis and neglected tropical diseases. The Latin American Collaborative Research Center for Colorectal Cancer in Chile builds on the foundation laid by TMDU, the Japan International Cooperation Agency (JICA) and institutions in South America to detect and treat colon cancer at the earliest stage possible. The third centre, the Chulalongkorn University–TMDU Research and Education Collaboration Center in Thailand, facilitates a great deal of cooperation between the two schools, especially in the dental field.

TMDU currently has 210 international students, who are predominantly enrolled in the graduate school. In fact, despite its relatively small size, TMDU has the largest number of international students in the medical and dental fields of any school in Japan. TMDU is also recruiting outstanding young scientists from around the world for assistant professorship positions focused on medical science research through its tenure track initiative. Another important part of the university's international outreach is the annual International Summer Program (ISP). Each year, TMDU invites approximately 25 students from Asia to visit TMDU for three days of lectures, poster sessions, cultural and social events, and laboratory tours. Many of these students





have since become graduate students at TMDU or other schools in Japan. ISP2013 — Biomaterials: From the Laboratory to the Clinic — will focus on the development and applications of biomaterials and bioengineering.

The TMDU Research Organization coordinates all research activities at the school, and the recently established Bioresource Center collects and maintains high-quality bioresources and promotes the application of cutting-edge medical technologies. TMDU also plays a central role in MedU-Net, a networking initiative created by medical schools that accelerates industry–government–academia cooperation. One such example is a project with Dai Nippon Printing (DNP) to create nanomedicine products. Another example of this initiative is a project with Sony Corporation that is already bearing fruit through the development of an innovative technique which identifies cancer cells by their unique electrical signatures.

In these and all of its activities, TMDU has one ultimate goal: to serve the needs of patients and their families, in Japan and around the world, by working to fulfil its mission statement of "Cultivating Professionals with Knowledge and Humanity".

Two areas of stem cell research at TMDU are currently delivering significant results.

Cartilage and meniscus regeneration with synovial stem cells

Articular cartilage and meniscus — cartilage in the knee — have poor healing potential and when injured result in osteoarthritis of the knee. Mesenchymal stem cells derived from synovium have been shown to be a superior cell source for cartilage regeneration compared to those from other mesenchymal tissues due to their higher rates of colony formation, proliferation potential with autologous serum and *in vitro/vivo* chondrogenic potentials. Ichiro Sekiya's laboratory has found that approximately 60% of synovial mesenchymal stem cells placed on cartilage and meniscus defects adhere to a defect within 10 minutes, and this action has resulted in cartilage and meniscus regeneration in pig models. Based upon previous basic research studies they have performed, his lab has commenced transplanting synovial stem cells arthroscopically in a clinical study for the treatment of cartilage defects, resulting in the regeneration of cartilage and a marked decrease in symptoms in most patients without any adverse effects over the last 4 years. The lab is planning a new clinical study for meniscus regeneration using synovial stem cells.

The feasibility of adult stem cell therapy for gastrointestinal diseases

Embryonic stem (ES) cells and induced pluripotent stem (iPS) cells hold great promise for regenerative medicine while adult stem cells offer another physiological and safe option for treatment. However, practical applications of adult stem cells in various clinical situations are limited mainly due to the dormancy of adult tissue stem cells. Mamoru Watanabe's research group established the original culture protocol for murine adult colonic epithelial stem cells that maintain self-renewal and multi-differentiation properties. The group found that a single Lgr5+ adult colonic epithelial stem cell could expand unrestrictedly *in vitro* and regenerate functional normal epithelium *in vivo*. This 'epithelial transplantation' showed therapeutic benefits in an acute colitis model (*Nature Medicine*, April 2012). In future, these culture technologies will provide a new avenue for cell-based therapies for various gastrointestinal disorders and will also enable the application of personalized medicine based on stem expansion technology using a patient's own biopsy samples.

Okinawa Institute of Science and Technology Graduate University (OIST)

A MULTI-DISCIPLINARY EXPERIENCE FOR EDUCATION AND RESEARCH

The Okinawa Institute of Science and Technology Graduate University (OIST) is bringing about change in the global practice of education and research. Jonathan Dorfan, president of OIST, describes the challenges faced by universities in the twenty-first century.

"For many centuries, 'knowledge creation' and 'knowledge dissemination' have been the two central missions that defined a university and these two fundamental roles have not changed in recent times. However, the demographics and dynamics of the society that universities serve have changed quite dramatically. The world is now highly globalized and interconnected and universities must adapt their role and function accordingly if they are to maintain their societal relevance.

"To ensure sustainability for our fragile planet, humanity must meet enormously complex challenges. Knowledge creation is potentially the most powerful tool for providing solutions to the problems of energy supply, climate change, human health and food and water shortages. Universities have an increasing obligation to engage in, and help solve, the problems that beset our global society. Universities also need to foster global networking and collaboration, in addition to educating their students to become effective citizens and leaders in a globalized world. It remains important, therefore, that society continues to protect the tenets that have allowed universities to fulfil their societal role effectively, namely, academic freedom, institutional autonomy and openness in research.

Jonathan Dorfan, president of OIST

"Research universities must continue to pursue basic research: historically, the most impactful innovation has come from high-risk, long-term R&D. Of course, the agenda of R&D must also include applied research, namely research which is focused on near-term outcomes. In creating the appropriate balance between basic and applied research, great care must be taken not to squeeze out funding for the pursuit of basic research whose relevance emerges powerfully only with time. While maintaining a balanced research agenda, it is incumbent on research universities to more aggressively and systematically support their faculty and researchers so that intellectual property can be responsibly transferred to the private sector, thus accelerating the adoption of inventions for the benefit of all."

Funded by the Japanese government with the goal of creating a best-in-class research university, OIST began attracting principal investigators and researchers to the island of Okinawa, located in Japan's southernmost prefecture, in 2005 and received accreditation to award the qualification of PhD from the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in October 2011. The university officially opened in November 2011 and currently encompasses 46 members of faculty and approximately 300 researchers. The first intake of students, comprising 34 graduate students, began their studies in September 2012.

OIST was created to be a truly international university: educational and research functions are conducted in English, and the academic year begins in September. Almost two-thirds of faculty staff and half of the university's researchers come from around the world, originating from about 30 countries. OIST's current students hail from 18 different countries and regions spread across the continents of Africa, Asia, Europe and North America.

In seeking to fulfil its mission of knowledge creation, OIST has set high standards to ensure that it appoints only the most talented individuals and can provide an optimized environment for cross-disciplinary innovation and research. The university also networks extensively with other global institutions of higher education and research. In pursuit of knowledge dissemination, its second mission, OIST is able to recruit its students and researchers from a global pool of exceptional candidates. As a university, OIST encourages individuality of purpose, thought and action among its students and researchers and immerses them in a research environment that promotes cross-disciplinary opportunity and a broad-based graduate curriculum.

OIST believes that the major discoveries and innovation at the beginning of the twenty-first century will occur at the interface of the traditional life, physical and environmental sciences disciplines. In anticipation, considerable care was taken by the founders of OIST to enhance such interdisciplinary opportunities by removal of the barriers that separate these fields in traditional universities. As an example, OIST has no formal academic departments. Instead, the educational experience is provided and shaped by the faculty as a whole. The university has implemented a North American-style, tenure-track academic structure where every member of faculty has full independence, each heading his or her own research unit. In addition, the physical layout of the university's campus promotes the mixing of students, researchers and faculty staff. Much of the research equipment at OIST — which includes microscopes, sequencers, spectrometers and clean room facilities — operates as part of shared or common facilities, providing highly skilled support personnel — many of whom are educated at the doctoral level — and training to facilitate broad and efficient use of the state-of-the-art equipment. By operating in this way, all members of the university are provided with straightforward access to the majority of OIST's diverse suite of equipment, meaning that curious students or postdoctoral researchers can easily expand their horizons far beyond the confines of their supervisor's sphere of study.

The curriculum at OIST is multi-disciplinary. Students embark on courses in their area of specialization but also elect to take courses from outside their core discipline and which contribute to a sizeable portion of their studies. Students also undertake a research project in three different research laboratories during their first three terms at the university. At least one of these 'rotations' must be completed in a laboratory from outside their anticipated core discipline. For instance, a life sciences student will have the opportunity to experience research in a physical sciences laboratory. By making the curriculum and the rotation system so diverse, OIST students are introduced to the language and methods used across a number of disciplines and this enables them to apply their core capabilities to solving important problems in unrelated disciplines, which they might otherwise find to be inaccessible.

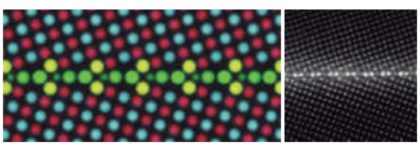
As befits a newly established university, OIST has created a new and exciting model for research and education in science and technology which has been specifically adapted to meet the demands and challenges of the twenty-first century. Through this model, the university will train a new breed of talented students and young researchers who, after receiving strong interdisciplinary training, will be well-equipped to become future leaders of academia and industry.

ADVANCING MATERIALS TO BUILD A BETTER FUTURE

Advanced Institute for Materials Research

The AIMR's top-class international researchers are adding new dimensions to the burgeoning field of materials science, as well as developing innovative functional materials and devices. Their interdisciplinary research is based on atomic and molecular control. The AIMR was established at Tohoku University in 2007 within the framework of the Japanese government's World Premier International Research Center Initiative (WPI) program.

Research Highlights



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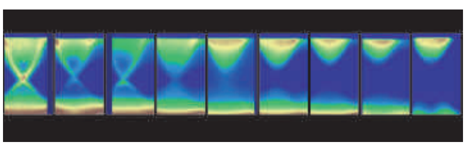
Structural defects: Know the boundaries

Z. Wang, *et al.* Atom-resolved imaging of ordered defect superstructures at individual grain boundaries. ***Nature*** 479, 380 (2011).



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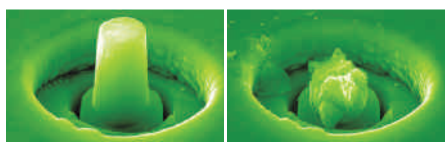
Insulators: Electrons gaining mass

T. Sato, *et al.* Unexpected mass acquisition of Dirac fermions at the quantum phase transition of a topological insulator. ***Nature Physics*** 7, 840 (2011).



© 2012 K. M. Reddy *et al.*

Ultra-hard ceramics: Open up and toughen up

K. M. Reddy, *et al.* Enhanced mechanical properties of nanocrystalline boron carbide by nanoporosity and interface phases. ***Nature Communications*** 3, 1052 (2012).

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