

CHINA SCIENCE AND TECHNOLOGY

# NEWSLETTER

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## IN THIS ISSUE

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\* Top Ten Campus S&T Progresses for 2005

\* Major Progresses for Popular Science

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## SPECIAL ISSUES

### Top Ten Campus S&T Progresses for 2005

On the eve of 2006, an S&T Committee under of the Chinese Ministry of Education publicized top ten campus S&T progresses for 2005 as follows:

1. Solar wind genesis height. (Peking University). A study team, headed by Prof. TU Chuanyi, Institute of Space Physics and Applied Technology, School of Earth and Space Science, Peking University, has worked out the height for generating solar winds, through extrapolating solar magnetic field structures and analyzing solar air spectrums. Based on the findings, the study team proposed a new roadmap for solar wind descriptions, which runs a substantial difference against previous models. In the past, all solar wind models are one dimensional, and the energy generated by magnetic reconnection is an artificial addition to the magnetic flux tubes at an altitude lower than 1000km, with outgoing plasma coming from an ionized layer beneath the one-dimensional magnetic flux tubes. The new model, however, is a 3-D platform, with its outgoing solar wind plasmas stemming from magnetic reconnections. In the new model, the initial heating of solar wind plasmas is obtained from a magnetic loop structure at an altitude of 5000km, and the accelerated solar wind is realized in magnetic flux tubes 5000km above the funnel. This is a brand new 3-D model for solar wind genesis.
2. Carbon monoxide separation technology using CuCl/molecular sieve adsorbent (Peking University). A study team, chaired by Prof. XIE Youchang, the national key lab for structural chemistry affiliated to Peking University, discovered the principle of monolayer dispersion in basic studies. Based on the principle, researchers scattered CuCl molecules over the surface of molecular sieves, and worked out a highly absorptive and selective adsorbent, taking advantage of the bondage between copper plasmas and carbon monoxide. Having obtained invention patent grants in China, the United States, and Canada respectively, the new adsorbent makes a world leader in the area. The new finding has entered commercial applications, with a national certification for new products.
3. 3-D fine structures for mitochondrial membrane protein (Tsinghua University). A study team, headed by Prof. RAO Zihe, Tsinghua University Key Lab for Proteins, part of the Ministry of Education, extracted mitochondrial complex II from pig's heart, and analyzed the membrane proteins at 2.4 Å resolution and its complex structures with inhibitors 3-nitropropionate and 2-thenoyltrifluoroacetone (TTFA) at 3.5 Å

resolution. The efforts improved biological studies of mitochondrial respiratory complex. Chinese scientists created a Complex II structure model based on the findings, and studied human diseases that have bearings with the complex. Scientists found that mutations usually sit around electron transmitting bodies or UQ connections, where mutations may interrupt the normal transmission, constituting a root cause for diseases. The Complex II structure provides a bona fide model for study of the mitochondrial respiratory system and human mitochondrial diseases related to mutations in this complex. The finding was published in the July 1, 2005 issue of the journal *Cell*.

4. New approaches for studying mammals' genetic mutations and associated genetic modification. A study team, co-chaired by Prof. WU Xiaohui and Prof. XU Tian, Institute of Developmental Biology and Molecular Medicine, School of Life Sciences, Fudan University, have successfully transformed PB factors and applied them in mammals, after a number of failures in using different approaches for genetic modifications and inserted mutations. The study team found that PB elements that carry multiple genes can efficiently transpose in human and mouse cell lines. In addition to permitting the expression of the marker genes it carried, PB could excise precisely from original insertion sites and transpose into the mouse genome at diverse locations, preferably transcription units. Comparing with conventional approaches, PB based method allows for the following merits: 1) genetically modified genes can be further consolidated in a single copy form; 2) a genetically modified carrier can have a number of genes at the same time; 3) PB allows a long term stable expression in genetically modified genes; 4) better integration of genetically modified genes; 5) non-injury visible markers can be used to replace traditional ones such as PCR in tracking genes, with a raised efficiency and economy; 6) easy for positioning.

The new approach makes a desirable solution for studying mammals' genetic functions on a large scale. It can quickly sort out diseases causing genes on an extensive basis, and is apt for establishing diverse disease models, studying disease causes, and defining drug targets. In addition to being a new genetic therapeutic approach for human diseases, it can also be used to identify and study genes of important biofunctions, and to improve cash animals.

Published as a cover story in the August 12, 2005 issue of *Cell*, the finding has entered PCT process.

5. A Novel DNA Modification by Sulfur (Shanghai Jiaotong University). A study team, led by Profs. DENG Zixin and ZHOU Xiufen, have found that DNA molecules' instability is caused by its own sulfur modification. The

September 2005 issue of the journal *Molecular Biology* published the story with a title "A Novel DNA Modification by Sulfur", co-authored by scientists from Bio-X Life Science Research Center and School of Life Science and Biotechnology, Shanghai Jiaotong University and scientists from the UK and the USA. The paper unveiled a brand new modification role played by sulfur in bacterial DNA molecules.

6. Technology integration for rectification process (Tianjin University). A study team, headed by Prof. LI Xingang, Tianjin University, worked out an enhanced rectification process, using modern transmission theory, fluid dynamics and computational fluid dynamics, optimized systematic analysis and 3-D technology. The finding has noticeably raised distilling strength and extraction rate of light oil. The study team developed a calculation system for the distribution of large towers, based on a turbulence theory. It also landed breakthroughs in predicting fluid dynamics behaviors of fluids. Since the end of the 20<sup>th</sup> century, the team studied the rectification process, using innovative computational fluid dynamics, which led to the birth of a line of novel filling materials, 3-D gradient floating valves, gas-liquid distributors in trough style, multi-level and fully-connected liquid distributors, dual-directional feeding distributors that have a liquid capture function. All these patented and proprietary technologies have provided powerful solutions to the fluid dynamic and chemical thermodynamic puzzles that confuse feeding towers with large diameters and shallow beds. The proprietary rectification technologies constitute a technology backup for developing China's own super large tower at the 8-m level or above.
7. Fuel battery sedan cars (Tongji University). At the end of 2001, Tongji University, in collaboration with Shanghai Auto, was contracted to a special project "fuel battery sedan cars" under the National 863 Program. Since 2002, researchers have rolled out three prototypes for fuel battery sedan cars. In 2005, the 3<sup>rd</sup> generation prototype witnessed a range of innovative changes in structural design, dynamic modules, power control unit, water cooling system, and supporting systems. In the meantime, ten fuel battery sedan cars (bearing the names of S3000, MPV and Oriental Son) equipped with the new dynamic platform rolled off the assembly line for trial and demonstration running. On December 17, 2005, under the sponsorship of the Ministry of Science and Technology, the National Center of Supervision and Inspection on Motor Vehicle Products Quality (Shanghai) staged a performance test on the fuel battery sedan cars at Shanghai Volkswagen Test Ground. The test vehicles reached a maximum speed of 122km/hour, with a hundred mile acceleration at 19 seconds, and a consecutive cruising mileage for 220km. The vehicle burns only 1 kilo of hydrogen gas per hundred kilometers (equivalent to 3.87 liters of gas). Stating from the late

November 2005, the study team kicked off a full-lane running test, with the participation of 4 S3000 vehicles. So far they have run 30,000 km on a combined basis, with single car's mileage at some 10,000 km. Individual vehicle has reached prescribed target of no-failure running for 2000km.

8. Milky Way Qilin server operating system (the National University of Defense Technology). The research project has produced a number of breakthroughs in cutting edge technologies involving operating systems. Researchers developed a scalable multi-level inner core structure, marking an advance from traditional single inner core and mini-core structures. The development makes home made operating systems compatible with LINUX codes, and helps them walk out of survival dilemma as the result of lacking upper stream application software. By working on the integration of inner cores with coding modalities, and the integration of operating system with applications, the project team raises the security of operating system to a new height. Derived from the efforts are 17 invention patent applications, and 5 copyright grants. As the first non-LINUX inner core operating system accredited by LSB in the world, and with a top security performance in the country, the new system is featured with high performance, high utilities and high security. The system has rendered a general performance compatible with mainstream operating systems in the world, though enjoying an apparently better safety performance.
9. Vehicle and track coupling dynamics and associated key technologies (Southwestern Jiaotong University). A study team, chaired by Prof. ZHAI Wanming, Southwestern Jiaotong University, proposed a brand new theoretical system, which resulted in a unified model for vehicles and tracks, including typical locomotives, passenger cars, cargo compartments, and all sorts of tracks. The new model renders solutions to two major international puzzles for wheel-track coupling models and rail bed oscillations. Based on the new theory, researchers developed the proprietary VICT and TTISIM simulating systems for vehicle and track coupling, which successfully ran safety experiments for the Qinghuangdao-Shenyang express passenger line, and the Dalian-Qinghuangdao heavy duty cargo compartments.
10. TD-SCDMA chip (Chong'qing Institute of Posts and Telecommunications). Chong'qing Institute of Posts and Telecommunications rolled out the world's first 0.13-micron chips for TD-SCDMA 3G handsets. Named Tongxin I, the new chip constitutes a hardware platform for handling 3G digital signals. Compared with its counterparts developed by other domestic or overseas vendors, it works on higher technical indicators at the 0.13-micron level. With a smaller

inner core and greatly reduced power consumption and costs, the new system operates on a proprietary TD-SCDMA circuit, including joint test, Viterbi coding, and Turbo coding. With internationally proven IP core technologies, namely dual DSP and ARMO framework, the chip can work on 11 millions of transistors to produce diverse mobile telecommunication functions. It supports all applications under a speed of 384-kilobit/second. With a rationalized structure for easy scalability, it saves power consumption using a unique approach.

### Major Progresses for Popular Science

Chinese Ministry of Science and Technology has recently published a popular science statistics made on 30,514 government agencies and popular science organizations at the county level or above. It reflects the following features of China's popular science activities.

- 1) China's popular science expenditure has reached a preliminary scale. Of RMB 2.4 billion popular science expenditure in the year, RMB 1.6 billion was appropriated by the government at different levels, or 65% of the total, with a self-raised fund exceeding RMB 600 million, public donations amounting to RMB 45 million, and contributions from other channels approaching RMB 200 million. In 2004, China's special expenditures for popular science activities accounted for RMB 800 million, with a per capita average of RMB 0.60.
- 2) A popular science contingent is forming up. China has a popular science contingent made up of 780,000 people, of whom 110,000 are full time employees, or 14% of the nation's total popular science employee population. Part time number accounts for 670,000.
- 3) Popular science venues and facilities witnessed a constant improvement. In recent years, China has accelerated the construction of popular science venues and facilities. The efforts have raised the number of popular science venues and facilities to 704 (each occupying an area of at least 500m<sup>2</sup>), of which 185 are S&T museums, including S&T museums, observatories, aquariums, specimen halls, and general museums with a natural science division, 265 are professional S&T museums, and 254 teenagers' S&T stations. There are also in the country 1,282 popular science bases at the provincial level or above, with more than 60,000 popular science galleries (each with a minimum length of 10m). China has more than 30,000 urban popular science activity rooms, and nearly 120,000 rural popular science activity sites, with 640 vehicles designated for the purpose.

- 4) Increased public participation. In 2005, China has sponsored 380,000 popular science seminars, with a direct participation of 80 million people, and organized some 70,000 popular science theme shows, attracting more than 100 million visitors. In the meantime, the number of popular science contests, sponsored by different organizations, amounted to 33,255, with a participating population over 20 million. China has organized more than 260,000 teenage S&T teams, with 11.41 million members. Teenagers S&T summer and winter camps also run popular, with a participating population over 2 million in some 10,000 sessions.

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Comments or inquiries on editorial matters or

Newsletter content should be directed to:

Mr. Mao Zhongying, Department of International Cooperation, MOST 15B,  
Fuxing Road Beijing 100862, PR China Tel: (8610)58881360 Fax: (8610)  
58881364

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