

# CHINA SCIENCE AND TECHNOLOGY NEWSLETTER

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## **Guidelines for 2015 Priorities in Basic Research Released by MOST**

In late March, MOST issued guidelines for 2015 priorities in basic research, involving 9 fields with 64 directions, namely, agriculture, energy, IT, resources and environment, health, traditional Chinese medicine (TCM), materials, manufacturing and engineering science, and interdisciplinary field. Other eight specific themes are: major epidemic diseases, frontier sciences, nano research, quantum regulation, protein, fertility and reproduction, stem cell and global climate change.

In each field, several research directions are selected.

For instance, such directions in the field of agriculture, are genetic improvement of cash crops, breeding of animal and plant varieties, soil improvement, photosynthesis and agricultural microorganism. In the field of energy, the directions involve the properties of oil and natural gas resources, principles of energy and heat storage, energy process optimization and energy saving. IT field involves the theories of coordination between network communications and computation, big data computation and information transmission in deep space environment.

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In the field of health, molecular nutriology of metabolic syndrome, immune cell populations in chronic inflammation, inflammation-cancer bio-signals of tumors will be main directions. The field of frontier sciences covers mathematic basis of big data research, dynamic

microscopic features of non-crystals, planetary science in deep space exploration, and biological functions of non-coding RNA.

(Source: MOST, March 24, 2014)

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## Significant Progress Made in Health Research

China's national key basic research program, launched by MOST in 1997, is known as "973" Program. During 2006-2014, a total of 3.32 billion yuan was earmarked to support 144 projects in the field of health under this Program, which has borne a lot of remarkable achievements, such as:

--Research findings in immunology have been used for clinical purposes. For example, research on micro RNA-related immunoregulation has revealed miRNA families in normal livers, pathological livers and liver carcinoma tissues, and has gone on to discover miRNA that might be key to the occurrence and development of liver cancers. This could be new potential target for liver cancer treatment.

--The mechanism and characteristics of cell apoptosis have been investigated. Apoptosis is just one form of cell death. Some cells die through intracellular components and regulatory mechanism, a way similar to apoptosis and yet different. In this case, a kinase called Rip3 is playing key role to cell death.

--A mechanism relating to invasion, integration and release of viruses including influenza and coronaviruses, has been revealed, offering potential targets for next-generation anti-viral drugs. Cross-host transmission and pathogenesis of major pathogens have been identified, notably the ecological and molecular mechanism for

H5N1 and H7N9 avian influenza viruses to break barriers between species. The interaction mechanism of some important immune molecules such as CD8 has been revealed.

In 2012, MOST issued the 12<sup>th</sup> Five-year Plan for scientific research in the fields of protein, fertility and reproduction, and stem cell, which has deepened the basic research nationwide. International collaboration has also been intensified in life sciences. Joint labs have been internationally established between Chinese universities and foreign universities and world-class research institutes.

In terms of stem cell research, a kind of mouse with fertility has been developed by using iPS cell for the first time, proving the iPS' pluripotency. The research result was selected by the US *Time* magazine as one of the top ten medical breakthroughs 2009. This progress provides an ideal source of cells for future cell therapy and artificial organs.

In terms of protein research, Chinese researchers have developed the biggest database about expression and modification profilings of human liver protein to make systemic analysis. They have mapped the biggest protein interaction network of the human liver.

In the field of fertility and reproduction, scientists have completed the high-precision whole genome

sequencing of the single human oocyte, which is expected to be used in diagnosing embryo genetic diseases. Azoospermia Genome-wide association and anti-depression small molecules have been studied.

China has launched 203 projects in the above three

fields, involving a total of 4.88 billion yuan. Among that, 3 billion yuan is earmarked by the government.

(Source: China High-tech Industry Herald, February 24, 2014)

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## NSFC Boosting Basic Research

In early March, Yang Wei, Director of the National Natural Science Foundation of China (NSFC), talked to the press about its programs on basic research.

Founded in 1986, NSFC has become a main funding agency in the country for fundamental studies and is now widely recognized by the researchers. In 2012, the funding budget of NSFC amounted to 17 billion yuan, which was more than 8 times of that in 2003, enjoying an average annual growth rate of 28.5 percent. The remarkable growth indicates how the Chinese government values basic research.

Last year, NSFC received 161,888 project applications from 2,223 institutes, and granted a total of 23.524 billion yuan to 38,920 projects in 1,489 institutes.

In the same year, NSFC supported 15,367 young researchers with 3.7 billion yuan of the Young Scientists Fund, granted 399 with 399 million yuan of the Excellent Young Scientists Fund, and sponsored 198 with 388 million yuan of the National Science Fund for Distinguished Young Scholars. With substantial support to the young scientists, such funds were playing an important role in leading the research direction

and providing the early research basis for the young scholars, whose achievements reflect the overall research performance of the sci-tech personnel in China. Over the years, NSFC has funded a group of distinguished scientists, some of whom have grown into the winners of the State Top Scientific and Technological Award, including Liu Dongsheng, Ye Duzheng, Wu Mengchao, Li Zhensheng, Min Enze and Wu Zhengyi, etc., and over 85 percent of the CAS academicians under the age of 60 used to receive support from the National Science Fund for Distinguished Young Scholars.

In accordance with the State Council's requirements of improving and optimizing sci-tech programs and funds, NSFC will reduce the number of specific funding programs to 18 and make them better planned with clearer targets. The organization will also launch a strategic study to ensure forward looking planning over the 13<sup>th</sup> Five-Year Plan period by understanding the needs of China's innovation driven development and the trends of frontier sciences.

(Source: Science and Technology Daily, March 9, 2014)

## CAS Topped the Asia-Pacific in NPI Ranking

*Nature* is one of the earliest and most renowned science journals in the world. A relevant annual review Nature Publishing Index is reckoned as the benchmark for high quality basic studies. According to NPI 2013 institutional ranking, the Chinese Academy of Sciences (CAS) knocked the University of Tokyo off the top in the Asia-Pacific region for the first time and ranked sixth in the world, with 165 papers in *Nature* and its sister journals and 63.15 in corrected count. It was also the first time for any Chinese institute to become world's top 10 in NPI ranking. The progress was from one angle a result of the country's marked improvement of research capacity. Generally, some features are as follows:

### **China Boosting Research Papers in Asia-Pacific Region**

*The 2013 NPI Asia-Pacific* noted that 2013 was a year of scientific discovery for China, in terms of its fruitful achievements in cutting-edge technologies, such as the successful launching of Shenzhou 10, Tianhe-2 supercomputer operating twice as fast as the previous leader, and the safe landing and delivery of China's first lunar rover, Yutu, etc., which have led to China's moving up in NPI rankings. It also predicted that China is on pace to take over Japan as the top Asia-Pacific contributor to the NPI within the next two or three years.

### **Good performance in Physics and Chemistry**

According to the NPI, China's strength is chemistry. In the field, China's top three institutions, namely CAS,

University of Science and Technology of China (USTC) and Xiamen University, published 38 chemistry papers in *Nature* research journals in 2013. In physics, the Institute of Physics and the Shanghai Institute of Biological Sciences of CAS made the greatest contributions to the NPI. And Nanjing University out-numbered any other Asia-Pacific institutions for articles published in *Nature Physics*, and ranked the third for papers in *Nature Materials*. It was also shown that around 90 percent of the NPI articles from both Beijing Genomics Institute (BGI) and Shanghai Jiao Tong University came from international collaborations.

### **Increased Investment in Basic Research Boosted NPI Performance**

Nick Campbell, Head of the Greater China Region, the Nature Publishing Group and executive editor of *Nature*, indicated that high quality research activities are shifting to the East. Though the institutions from the West are still taking the lead, the enhanced input in basic research in China, a major contributor in Asia-Pacific, is multiplying the number of academic papers in the region, which is good news for the global research community.

Campbell noted that China's efforts of increasing R&D input in the past two decades have resulted in its achievements in both basic and applied sciences manifested by the NPI.

(Source: Science and Technology Daily, April 13, 2014)

## Basic Research Updates in China

### ➤ Chinese Scientists Cloned Key Gene Influencing Grain Chalkiness in Rice

A research team from the National Key Laboratory of Crop Genetic Improvement, Huazhong Agricultural University, cloned Chalk5--the key gene affecting grain chalkiness for the first time. The team, led by Zhang Qifa, academician of the Chinese Academy of Sciences, studied in detail the molecular and cytological mechanisms controlling chalkiness, and published a paper in *Nature Genetics*.

Chalkiness is the opaque part in rice kernel, which has a major bearing on the head rice yield and many other quality traits, such as opaqueness, cooking flavor and nutrition. It is, therefore, a major indicator of rice quality and a key factor restricting rice quality and yield.

Scientists have been looking for the key genes affecting chalkiness over the years. The team from Huazhong Agricultural University cloned one of such key genes, Chalk5, after 10 years of hard work.

(Source: Science and Technology Daily, March 23, 2014)

### ➤ Chinese Scholars' Great Achievement on Study of a Key Protein Related to Hematologic Neoplasms

Scientists from Fudan University have made great achievement on the study of the three-dimensional (3-D) structure of TET2--a key protein for the bone marrow's function to produce red blood cells of mammals. The achievement is of great significance for researches on the pathogenesis of various diseases, especially the development of therapeutic drugs for hematologic neoplasms such as myeloid leukemia. One of the top international academic journals *Cell* recently published this achievement online.

The research group led by Dr. Xu Yanhui, researcher from the Institutes of Biomedical Sciences, Fudan

University and professor of the Shanghai Cancer Center, Fudan University found out about the 3-D structure of the TET2-DNA complex after 4 years of concentrated studies. The research also found that a variety of TET2 protein mutations exists in the blood of hematologic neoplasm patients, and the mutation rates are quite high. It's the mutations that have affected the activity of TET2 and eventually caused the diseases.

(Source: Science and Technology Daily, December 21, 2013)

### ➤ Chinese Scientists' Successful Development of a Vaccine Strain for the Human Infection with Avian Influenza A(H7N9) Virus

In October, 2013, Chinese scientists declared in Hangzhou that they have successfully developed a vaccine strain for the Human Infection with Avian Influenza A(H7N9) Virus.

The vaccine seed strain has passed the ferret safety test by the Drug Safety Evaluation Center of the Institute of Laboratory Animal sciences, Chinese Academy of Medical Sciences, and Peking Union Medical College (CAMS&PUMC). The National Institutes for Food and Drug Control has also undertaken tests on the seed strain. The result of the test shows that the basic indicators of the strain are all in accordance with the requirements for influenza vaccines. Thus it is qualified to put into production and can go through production declaration process.

As part of the national key programs for science and technology on the prevention and control of major infectious diseases, the vaccine was jointly developed by the First Affiliated Hospital of Zhejiang University's School of Medicine, the University of Hong Kong, the Chinese Centre for Disease Control and Prevention, the

National Institutes for Food and Drug Control, and the Chinese Academy of Medical Sciences.

Dr. Shu Yuelong, Director of the WHO Collaborating Centre for Reference and Research on Influenza and the Chinese National Influenza Center, said the achievement would provide a strong technical support for the response to influenza outbreaks, and contribute to the world's efforts to control the H7N9 avian influenza.

(Source: Science and Technology Daily, October 27, 2013)

#### ➤ Chinese Scientists' Discovery of a Key Protein that Causes Depression

In August, 2013, one of the world's top scientific journals *Science* published the new discovery on the molecular mechanism of depression, which was made by the research group led by Dr. Hu Hailan from the Institute of Neuroscience, Shanghai Institutes for Biological Sciences, CAS. A kind of protein kinase named Molecule $\beta$ CaMKII is indentified as the key cause for depression. The research has discovered for the first time that Molecule $\beta$ CaMKII is the key that causes superexcitation in a certain brain region, while the certain brain region was considered to have engaged in the formation of depression. Thus the research has revealed

a new pathogenesis for depression, and provided a new target for the gene therapy of depression.

(Source: Science and Technology Daily, August 31, 2013)

#### ➤ Chinese Scholars' Initiative Proposal about a Super Covalent Bond Model

According to the news from Anhui University in June, 2013, the research group with Dr. Cheng Longjiu from Anhui University and Prof. Yang Jinlong from the University of Science and Technology of China as members has made great progress in the research on the electronic structure of metal clusters. They have proposed a new super covalent bond model to depict the electronic structure of metal clusters, and explained about the complex stability from the perspective of electronic structures for the first time through a super covalent bond model, thus it is possible to solve the problem on alloy properties that has puzzled theoretical physical chemists for nearly a century. The achievement has been published recently in the form of communication in the *Journal of Chemical Physics* published by the American Institute of Physics and the journal *Nanoscale* by the Royal Society of Chemistry.

(Source: Science and Technology Daily, June 2, 2013)

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## International Cooperation as Impetus for Basic Research

#### ➤ Chinese and American Scientists' Cooperation on the Research on the Mechanism of HIV Infection in Human Cells

In September, 2013, American journal *Science* declared that it would publish the breakthrough achieved by the cooperative team from Shanghai Institute of

Materia Medica (SIMM), Chinese Academy of Sciences (CAS) and the Scripps Research Institute from the US on a factor receptor named CCR5. The achievement can be conducive to the research on the infection mechanism of HIV, and promote the development of new anti-HIV drugs.

The research group used a new fusion protein to stabilize the CCR5 protein conformation, thus successfully determined the high-resolution three-dimensional (3-D) structure of CCR5 protein molecules. The 3-D structure of CCR5 reveals its fine conformation to fight against the combination with HIV. Meanwhile, the team also revealed accordingly the molecule mechanism of how an anti-HIV drug acts upon the receptor molecules and blocks HIV's entry, which would contribute to further biological studies on HIV.

(Source: Science and Technology Daily, September 14, 2013)

#### ➤ Chinese and Australian Scientists' Sequencing and Analysis of the Whole Genome of Sorghum

University of Queensland in Australia cooperated with scientists from Beijing Genomics Institute (BGI) and other organizations from China to undertake a sequencing and analysis of the whole genome of sorghum. They found out that there were a large number of genetic mutations in the sorghum genome, which provided valuable resources for the genetic improvement of sorghum and other crops. The new achievement was published in *Nature Communications* on August 28, 2013.

Scientists from China and Australia found out through their research that sorghum and sorghum propinquum are both rich in genetic diversity. Through comparative analysis, researchers also found that different sorghum varieties are with strongly different variety structures and complex domestication histories in

the genome, including at least two distinct domestication events. They also proved that there are indeed obvious differences between the genomes of the varieties from the west of Africa and that of other cultivated varieties.

(Source: Science and Technology Daily, August 30, 2013)

#### ➤ China and Mexico's Cooperation to Decipher the Genetic Map of Capsicum

According to news from the media in March 2013, the research group formed by scientists from China and Mexico has been devoting to looking for the super capsicum since 2012. They sequenced the genetic map of different varieties of capsicum to have a better understanding of the varieties' properties and found a way to develop the improved varieties.

Getting to know about capsicum would be firstly beneficial for commercial cultivation, with the enhancement of its property to resist pests and droughts. It would be also possible to control the spiciness of the products according to different levels of taste tolerances. Scientists from both countries hoped to find more wide varieties to figure out the different way of growth from commercial varieties. They chose a variety of capsicum from the State of Mexico, and compared it with the varieties on sale in China's markets. Currently they have already sequenced the genomes of 18 varieties of capsicum.

(Source: References Newspaper, March 23, 2014)