中国生物制药技术进展

ADVANCES IN Biopharmaceutical Technology in China

Eric S. Langer, Editor

Society for Industrial Microbiology

BioPlan Associates, Inc.

Advances in Biopharmaceutical Technology in China

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Eric S. Langer
Managing Editor

Preface

This study was undertaken, managed and coordinated by BioPlan Associates, Inc., a biopharmaceutical management and marketing research consulting firm in Rockville, MD, based on nearly 20 years experience and knowledge of the market segment. BioPlan surveyed the industry to identify required content, and then selected subject matter experts to author relevant chapters to this study.

The Society for Industrial Microbiology (SIM), in recognizing the importance of applied sciences in biotechnology processes, has lent its name to this endeavor. The Society for Industrial Microbiology is a nonprofit professional association dedicated to the advancement of microbiological sciences, especially as they apply to industrial products, biotechnology, materials, and processes. Founded in 1949, SIM promotes the exchange of scientific information through its meetings and publications, and serves as liaison among the specialized fields of microbiology. Membership in the Society is extended to all scientists in the general field of microbiology.

China is one of the fastest growing economies in the world. And the country's interest in advancing biopharmaceutical technology for the betterment of its healthcare system, its population and its economy is well recognized.

Scientists in China have made important contributions to healthcare and biotechnology at all levels. This study provides a framework from which both basic and applied research scientists can establish common ground for furthering novel technologies associated with biotherapeutics and vaccines. The findings of this study support worldwide public health and economic policy.

Each chapter provides a unique, unbiased, peer-reviewed perspective of the current state of the science and technology associated with biopharmaceuticals in China. While no single body of work can encompass all the advances being made in the field, this work offers the most comprehensive information to date on technologies and processes in China.

The intended audiences are decision-makers at biopharmaceutical research organizations, biotherapeutic manufacturers, contract manufacturing organizations, suppliers to the industry, policy-makers, and international entities evaluating this market. We plan to keep this study current by providing regular updates as technologies, and the industry advance.

Advances in Biopharmaceutical Technology in China

Table of Contents

19 Biopharmaceutical Research Collaboration between Western and Chinese Life Science Organizations: A Guide to Prospective Partnerships

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ABSTRACT

Biopharmaceutical research, and in particular development of innovative drugs require concentrated efforts on many levels, as well as multiple skills and expertise. Research collaborations between two or more life science organizations are therefore common in the biopharmaceutical industry. Moreover, these collaborations many times involve organizations from different countries and different continents.

The changes in the political, social and economic climate in China in the past three decades, as well as China's recent advances in the arena of life-science research, have made Chinese life-science organizations attractive collaborators to their western counterpart. These collaborations have been facilitated by Chinese life-science returnees who have established links in the West.

This chapter is intended to serve as a guide to prospective collaborators in China and in the West. It provides information regarding the research focus and expertise of leading life-science organizations in China, including academic and private enterprise, as well as government-affiliated organizations. Furthermore, the chapter provides information regarding the variety of mechanisms and programs available from western organizations, and in particular the NIH and CDC, that may facilitate the establishment of such collaborations, and discusses in some detail successful collaborations established through these mechanisms. Finally, the chapter discusses some of the cultural and societal differences still existing between the West and China and provides prospective collaborators with guidance regarding the negotiation processes associated with collaborative agreements.

Biopharmaceutical Research Collaboration between Western and Chinese Life Science Organizations: A Guide to Prospective Partnerships

Interest by Chinese academic and business life science organizations to collaborate with their western counterparts, and conversely, the interest of western life-science organizations to partner with their Chinese counterparts has been increasing.

1. Introduction

Life science organizations in China with their low-cost, highly skilled technologists and scientists, strong track record in life science research, high-quality returnee pool, access to advantageous policies and tax treatments and bolstered by a growing entrepreneurial culture have a promising future still largely untapped by outside groups. Interest by Chinese academic and business life science organizations to collaborate with their Western counterparts, and conversely, the interest of western life-science organizations to partner with their Chinese counterparts has been increasing over the years, as both sides start to recognize the synergism and the opportunities that these collaborations may create. In spite of the tremendous potential that such collaborations may offer in biomedicine and other life science areas there is still, however, some hesitation on the part of many western R&D groups about working in China, mainly because of a lack of current knowledge concerning the capability of the scientific organizations in the country as well as experience in working effectively with them.

This chapter will provide a guide for western scientists and business people who are looking to cooperate with China's increasingly varied bioscience organizations in order to expand their activities into China and to establish R & D, commercialization, manufacturing operations and partnerships, as well as just for basic research projects. Highlighted will be the major organizations of the central government relating to life science in China such as the Chinese Academy of Sciences, Chinese Medical Academy of Science, Chinese Military Medical Academy of Sciences, and Chinese Agriculture Academy of Sciences. Life science research conducted by universities, various research institutes under the Ministry of Health, local institutes in the medical and agriculture field and small & medium commercial enterprises will be also be outlined.

Under these sections the structures of these organizations as well as the range of their specific strengths or expertise will be described. These may vary,

for example, from SiBiono GeneTech Co., Ltd.'s regulatory-approved gene therapy product to the Beijing Genomics Institute's participation in the Human Genome Project to important projects relating to Traditional Chinese Medicine (TCM).

Before collaborating with the Chinese, it is also very important for Western organizations to understand Chinese culture and to know that Chinese have certain beliefs that may be different from the Western world as Chinese think and do many things in the ways different from that in the West. Importantly, some of the relevant cultural and societal issues that western research or business organizations may frequently encounter when collaborating in China will be explained such as understanding, managing expectation, negotiating as well as building up personal networks "Guanxi".

Finally, examples of some current collaboration in the life sciences either conducted or funded by the U.S. National Institutes of Health or the U.S. Center for Disease Control and Prevention will be illustrated. Several important research and development efforts are currently ongoing or have already been completed. These include work in such areas as Severe Acute Respiratory Syndrome (SARS), HIV/AIDS, natural products-based drug discovery as well as TCM and involve a number of useful mechanisms for collaborations such as contracts, grants, formal and informal joint research efforts as well as technology licensing. Of particular note is a case study relating to rotavirus vaccine development license by two Chinese institutions from the National Institutes of Health. Through these various examples and information guides provided, it should be possible to improve and enhance the number of collaborative research and development efforts between western research organizations and their counterparts in China for the benefit of global public health.

Before collaborating with the Chinese, it is also very important for Western organizations to understand Chinese culture and to know that Chinese have certain beliefs that may be different from the Western world.

2. Science and Technology Organizations In China

Chinese language directories now currently list 514 different research, education, development, manufacturing, management and information organizations related to biological technology in China. Although an in depth analysis of each of these groups involved in the life sciences is beyond the scope of this chapter, we will try to highlight the leading organizations from the government, academic and industry sectors that should be considered by western organizations for potential collaborations.

Moreover, the Chinese government has been working very hard to fund and further develop local organizations in the life sciences. China's science and technology organizations are the beneficiary of a new development phase with the implementation of the 10th five-year plan (2001-2005) which includes a number of relevant areas (footnote Newsletter of China Science and Technology (No. 402 January 10, 2006):

- Encouragement and support of basic research.
- Rationalization and restructuring of the domestic generics industry.
- Development of biopharmaceutical technologies and industry.
- Export orientation
- Improved quality generics
- Modernization of Traditional Chinese Medicines

To assist newcomers to find the most appropriate group for their individual project, this chapter will introduce the current leading life science organizations in China from seven (7) different areas: Chinese Academy of Sciences; Chinese Medical Academy of Science; Chinese Military Medical Academy of Sciences; Chinese Agriculture Academy of Sciences; universities; research/industrial parks and small /middle-sized enterprises, as well as some state owned enterprises. Under each section, we will describe the structure of the distinct organizations as well as their strength/expertise.

The Chinese government has been working very hard to fund and further develop local organizations in the life sciences.

3. Chinese Academy of Sciences

Organization

Chinese Academy of Sciences (CAS) is a leading academic institution and comprehensive research and development center in natural science, technological science and high-tech innovation in China. CAS was founded in Beijing on November 1, 1949 on the basis of the former Academia Sinica (Central Academy of Sciences) and Peiping Academy of Sciences. Under CAS there are five Academic Divisions, 108 scientific research institutes, over 200 science and technology enterprises, and more than twenty supporting units including one university, one graduate school and five documentation and information centers. They are distributed over various parts of the country. Twelve branches of CAS were established in Shanghai, Nanjing, Hefei, Changchun, Shenyang, Wuhan, Guangzhou, Chengdu, Kunming, Xi'an, Lanzhou and Xinjiang. CAS has a total staff of over 58,000, of whom 39,000 are scientific personnel according to 2000 figures (see Figure 19-1: The Organization Chart of CAS). In this chapter, we focus on the field of life science and biotechnology in CAS. The headquarters of CAS is located in Beijing.

Expertise/Special Research Programs

In the field of life science and biotechnology, about 6,000 CAS research professionals are now attached to 24 research institutes, 13 research centers, 26 key State laboratories and key CAS laboratories, 12 botanical gardens, 18 specimen museums, and nine repositories for type culture collection, as well as a dozen field observation and experimental stations for ecological studies.

There are seventeen CAS institutes in this field: Institute of Botany; Institute of Zoology; Institute of Psychology; Institute of Microbiology; Institute

[1] TBD

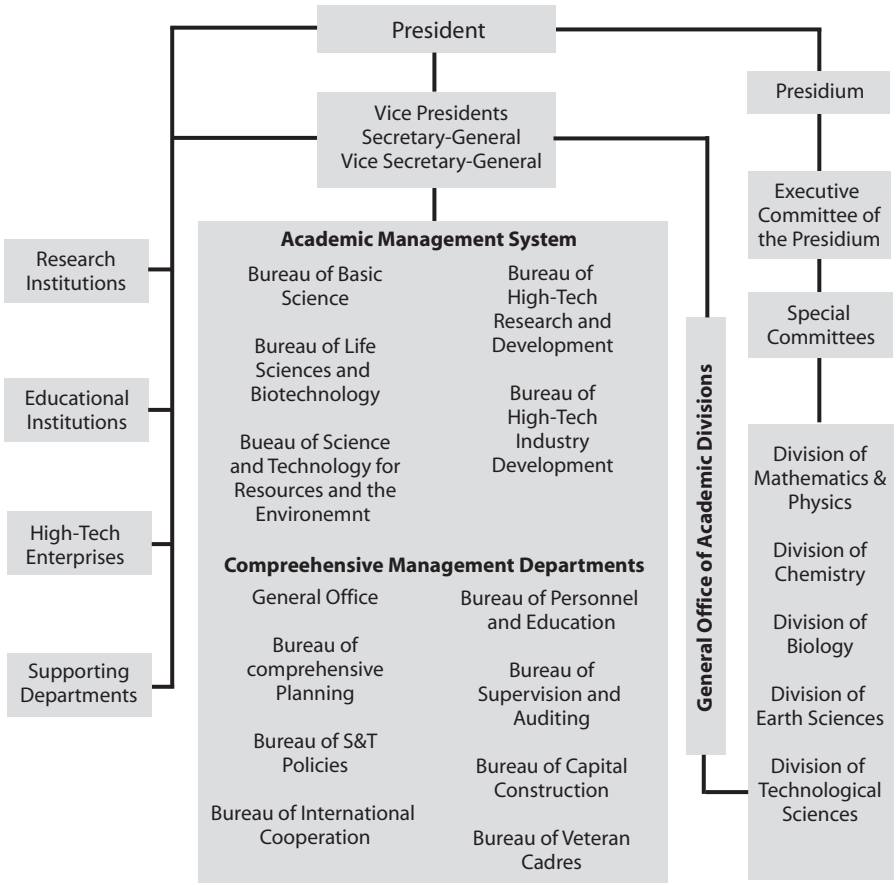

Figure 19- 1: Organization Chart Chinese Academy of Sciences

of Biophysics; Institute of Genetics and Developmental Biology, Shanghai Institutes for Biological Sciences; Wuhan Institute of Virology; Institute of Hydrobiology; Wuhan Botanical Garden (Wuhan Institute of Botany); South China Institute of Botany; Chengdu Institute of Biology; Kunming Institute of Zoology; Kunming Institute of Botany; Xishuangbanna Tropical Botanical Garden; Cold and Arid Regions Environmental and Engineering Research Institute as well as Northwest Institute of Plateau Biology. Among these, the six institutes that are in Beijing mainly focusing on hi-tech research in agricultural and environmental biology, while the five institutes in Shanghai (the Shanghai Institutes for Biological Science) mainly focus on biomedical sciences related to human health. Four institutes in Southwest China study bio-resources and bio-diversity conservation, three institutes in Hubei Province for studies of aquatic biology and virology, and two institutes in Qinghai and Guangdong Provinces for studies of plateau biology and botany, respectively.

Major achievements reported by CAS biologists include the syntheses of bovine insulin and yeast alanine transfer ribonucleic acid for the first time in the world, the physical mapping of the rice (Oryza japonica) genome, the draft

sequence of the rice (O. indica) genome and the decoding of rice chromosome 4 (both O. japonica and O. indica). CAS scientists have also completed China's assignment for the genome-sequencing task allocated by the HGP consortium.

In addition, CAS scientists have made significant accomplishments in the fields of taxonomy, evolutionary biology, biodiversity, agrobiology and environmental biology, including the compilation of the 255-volume corpus of Flora Sinica, Fauna Sinica and Cryptogamica Sinica, and have set up a complete taxonomic system for Chinese pteridophytes. Research in such areas as locust and grasshopper ecology and integrated management, the ecological effects of invasive alien species, restoration ecology, sustainable use of bioresources, integrated pest management, croup breeding and designing, key marine aquaculture technologies (southward transplant of kelp, scallop implant and all-course artificial breeding of Chinese prawns), the establishment of a breeding system for interspecies hybridization in Gosspium, making substantial contributions to agricultural development and environmental conservation in China.

A recent addition to the CAMS has been in the area of stem cell research with the Center of Excellence in Tissue Engineering.

CAS was the first organization in China to carry out such biotechnology research as that relating to monoclonal antibodies, transgenic animals and plants, somatic cell cloning, and stem cell and protein engineering, and has made important research and development findings, including the technology of microbial fermentation for producing Vitamin C, the improvement and industrial application of enzyme activity of Ast. Niger glucoamylase, the development of recombinant DNA vaccine of Hepatitis-B, and the super-high expression of human interferon in genetic engineering transgenic fish and somatic cell cloned cows. Moreover, more than 50 new drugs have been developed. Succimer (dimercaptosuccinic acid), one of the best antidotes to heavy metal poisoning, is the first drug developed in China and produced by U.S. pharmaceutical firms with the approval of the U.S. Food and Drug Administration. Artemether, an anti-malaria medicine, is the only drug initiated by China for export, and was listed in the world pharmacopoeia in 1995. Meanwhile, the annual revenue from the new cardiovascular drug Di'ao Xinxuekang has reached 1.4 billion Yuan (US$175 million).

4. Chinese Medical Academy of Science

Organization

The Chinese Academy of Medical Sciences (CAMS) was China's only country- level medicine science academic center and comprehensive scientific research organization. Perhaps the best-known component of the CAMS in the west is the Peking Union Medical College, China's key specialized medical training facility that originally organized by the U.S. Rockefeller Foundation in 1917. The Peking Union Medical College is under the dual leadership of the national Ministry of Education as well as the CAMS.

In addition to the Medical College, CAMS has 18 research institutes, five branches, seven clinical hospitals (including the Temple of Heaven Hospital), five institutes, as well as the graduate school and the experimental animal education ministry. Recently CAMS also has added six new national level medicine research centers:

- The Medicine Development Engineering Research Center, located in the Institute of Pharmacology.
- The Metabolite Analysis Research Center, also located in the Institute of Pharmacology.
- The Anti-Tumor Clinical Research Center, located in the Oncology Institute, the Tumor Hospital.
- The Cardiovascular Clinical Research Center, located in the Angioplasty Research Institute, the Fu Wai Hospital.
- The Comprehensive Medicine Clinical Research Center, located in the Harmony Hospital.
- The Chinese Native Medicine Standard Comparison Research Center, located in the Medicinal Plant Research Institute.

The head of the group spent six years at the stem cell center in the University of Minnesota.

Expertise/Special Research Programs

CAMS has seven affiliate hospitals that have what many regard to be among the top national research institutes for oncology, cardiovascular and blood diseases, and plastic surgery:

- **Peking Union Hospital** is the Peking Union Medical College's clinical medical center as well as CAMS's principal clinical medicine research institute. The hospital undertakes scientific research in a wide variety of areas and has an active program of international exchange and research collaboration.
- **Fu Wai Hospital** is CAMS's cardiovascular disease research institute, and the national cardiovascular disease medical service. A World Health Organization cardiovascular disease cooperation training center also located here.
- **The Tumor Hospital** is CAMS's oncology institute and is one of the largest oncology research centers in Asia and also a cooperative center for the World Health Organization.
- **Hospital for Plastic Surgery** is CAMS's orthopedic surgery research institute.
- **Blood Sickness Hospital** is CAMS's hematology research institute.
- **Skin Disease Hospital** is CAMS's skin disease research institute. The hospital is also a fungus type culture collection center. The hospital has established the technological cooperation and the exchange agreements with organizations in 20 countries.
- **Beijing Temple of Heaven Hospital** is CAMS's neurosurgery department research institute. The hospital concentrates on study of aneurisms, the abnormal blood vessel formation and microsurgery training.

A recent addition to the CAMS has been in the area of stem cell research with the **Center of Excellence in Tissue Engineering**. The center was established in March 2002 for multi-disciplinary research collaboration between the Chinese Academy of Medical Sciences, Peking Union Medical College, Beijing University, Chinese Academy of Sciences and Center for Cellular Therapy Research, and the Ministry of Health. The Center cooperates with Tsinghua University to combine stem cell technology with tissue engineering technology. The center focuses on discovering tissue engineering applications for medicine with facilities in both Beijing and Tianjin. The head of the group spent six years at the stem cell center in the University of Minnesota. They have completed a preclinical trial of the mesenchymal stem cells in supporting hematopoiesis during bone marrow transplantation. They also have isolated pluripotent stem cells from human fetal heart, liver, muscle, lung, derma, kidney, and fat. (See: www.stemcellschina.com)

Six institutes that are in Beijing mainly focusing on hi-tech research in agricultural and environmental biology, while the five institutes in Shanghai (the Shanghai Institutes for Biological Science) mainly focus on biomedical sciences related to human health.

5. Chinese Military Medical Academy of Sciences

Organization

The Academy of Military Medical Sciences (AMMS) is the highest medical research institution of the Chinese People's Liberation Army (PLA). The Academy has eight research institutes:

- Institute of Medical Information
- Institute of Radiation Medicine
- Institute of Basic Medical Sciences
- Institute of Hygiene & Environmental Medicine
- Institute of Microbiology & Epidemiology,
- Institute of Pharmacology & Toxicology
- Institute of Medical Equipment and
- Institute of Bioengineering

In addition, there are some other subordinate units such as Affiliated Hospital, Experimental Instrument Plant and Laboratory Animal Center. AMMS also has 20 cross-disciplinary research centers and key laboratories such as the National Center for Biomedical Analysis, the National Center for New Drug Non-clinical Safety Evaluation (GUP laboratory), the National Base for Clinical Pharmacology, the Army Research Center for Preventive Medicine, and the Army Emergency Medical Aid Center for Nuclear Accidents.

Expertise/Special Research Programs

AMMS is an important base in transforming research achievements into practical applications. Relying on its hi-tech advantages, the Academy has established a series of new enterprises with emphasis on the research and development of drugs, biological products and health care products. In this chapter, we just focus on the field of life science and biotechnology in AMMS and discuss below five related institutes of AMMS.

- **The Institute of Basic Medicine Sciences** is mainly engaged in research on the basic medical and biological high technology related with military medicine and clinical medicine. The Institute consists of such departments as Neurophysiology, Cell Biology, Molecular Biology, Molecular Virology, Receptor Pathophysiology, and Biochemistry. The Institute occupies a dominant position in studies of molecular immunology, receptor theory, modulation of the biological function of cellular factors and their receptors, protein structures and functions, and genetic therapy.
- **The Institute of Bioengineering** is mainly engaged in the biotechnology research and assigned to the pilot experiment of biological products. It consists of the departments of Cell Engineering, Protein Engineering, and Genetic Engineering. The Institute has held a strong position particularly in the field of genetically engineered vaccines, microbiological engineering, and cell engineering.
- **The Institute of Pharmacology & Toxicology**[2] is mainly engaged in the study of the medical prevention against chemical injuries, is also engaged in the research and development of the drugs specially for the troops in war and peace time as well as the drugs for civilians. The Institute consists of the departments of Psychopharmacology, Neuropharmacology, Chinese Herb Pharmacology, Biochemical Pharmacology, Toxicology, Experimental Pathology, Drug Preparation & Metabolism, Drug Synthesis, Phytochemistry, and Toxicant Analysis & Detection Center.
- **The Laboratory Animal Center** is the Army research center and important supply base of medical laboratory animals. With the key laboratories of Laboratory Animal Research and Quality Detection, the Center is mainly engaged in researches on genetics, microbiology, biochemistry, pathology, nutrition and epidemiology of laboratory animals. It yields more than 20 breeds and strains of laboratory animals with different levels every year. Besides meeting the needs of the related medical research organizations, it has some animals exported to Japan, Europe and the United States.
- **The Institute of Microbiology & Epidemiology** is mainly engaged in research on the prevention & treatment of infectious diseases commonly encountered by the troops in peace and wartime. The Institute consists of the following departments: Bacteriology, Virology, Immunology, Epidemiology, Disinfection, Vector Control, Pharmaceutical Chemistry, Pharmacology, and the Army Microbiological Laboratory Center. This institute has expertise in rapid microbiological inspection and diagnosis, etiology of infectious diseases and epidemiology, disinfection, vector biology and control, as well as the development of anti-malarial drugs.

CAS was the first organization in China to carry out such biotechnology research as that relating to monoclonal antibodies, transgenic animals and plants, somatic cell cloning, and stem cell and protein engineering,

6. Chinese Agriculture Academy of Sciences

The Chinese Academy of Agricultural Sciences (CAAS) is China's national agricultural research organization directly affiliated to the Ministry of Agriculture. CAAS has about 10,000 staff members and 38 research institutes located across 17 different provinces, national municipalities and the autonomous regions (Appendix 3). The Plant Protection Research Institute of CAAS was rated number one in the nation. Six CAAS institutes were among the top 10 advanced strategic agricultural research institutions nation wide. CAAS also owns about 100 scientific and technology based enterprises with nearly 2100 personnel engaged in science and technology business development.

The Institute of Pharmacology & Toxicology is mainly engaged in the study of the medical prevention against chemical injuries, is also engaged in the research and development of the drugs specially for the troops in war and peace time

CAAS is a key open window representing China's agricultural science and technology for international collaboration. CAAS has extensive international cooperation relationships with more than 40 countries and international organizations. Designates by the Ministry of Agriculture (MOA), CAAS plays a strong leadership role in China's collaboration network with the Consultative Group for International Agricultural Research (CGIAR) in teamed efforts with agricultural universities and other agricultural research institutions.

7. Top Chinese Universities

Higher education such as universities in China has played an important role in research fields by bringing up large scale of advanced talents and experts. In 2002, there were 1396 Regular Higher Education Institutions (HEIs) in China and another 607 higher education institutions for adults. The total number of graduate students newly admitted by HEIs and research institutions was 202,600 among which 38,400 were for PH.D and 164,200 for master's degree. The total enrollment for graduate students was 501,000 in 2002. Thus, universities in China are great places for Western organizations to find any business or research collaborations.

In recent years, taking full advantage of their talents, knowledge, science and technology, HEIs have taken part in the construction of science parks, established high-tech enterprises run by HEIs and combined industry, teaching and research together to turn the scientific and research fruits into real productivity and spread them to the whole society. We will discuss the science parks in Section (7) and focus on the universities in this section.

Because of the limited space, we just mention the top universities in China based on the rank of Asiaweek.com as well as the rank of the annual education funds in 2005 (See: http://www.readers.net).

Peking University

Peking University (www.pku.edu.cn/) is a comprehensive and national key university and is situated at the northeast of the Haidian District at the western

suburbs of Beijing. The University consists of 30 colleges and 12 departments, with 93 specialties for undergraduates, 2 specialties for the second Bachelor's degree, 199 specialties for Master candidates and 173 specialties for Doctoral candidates. While still laying stress on basic sciences, the university has paid special attention to the development of applied sciences.

At present, Peking University has 216 research institutes and research centers, and there are 2 national engineering research centers, 81 key national disciplines, and 12 national key laboratories. The annual education and research funds for Peking University in 2005 was 2.408 billion RMB (US$301 million).

Tsinghua University

Tsinghua University (www.tsinghua.edu.cn/) is considered the best university in China for science, engineering, and business along with its longtime rival Peking University known for law, arts, science and medicine

Peking University has 216 research institutes and research centers, and there are 2 national engineering research centers, 81 key national disciplines, and 12 national key laboratories.

As of 2003, Tsinghua University had 12 colleges and 48 departments, 41 research institutes, 35 research centers, and 167 laboratories, including 15 national key Laboratories. The university offers 51 bachelor's degree programs, 139 master's degree programs and 107 Ph.D. programs. Recently, Tsinghua has become the first Chinese university to offer a Master of Laws program in American Law, through a cooperative venture with Temple University. The university is a member of LAOTSE, an international network of leading universities in Europe and Asia. The annual education and research funds for Tsinghua University in 2005 were 3.591 billion RMB (US$ 448.9 million).

Fudan University

Many people now consider Fudan University (www.fudan.edu.cn/) to be the best university in Shanghai, and one of the top few in China. Now, Fudan University comprises 17 full-time schools, 69 departments, 73 bachelor's degree programs, 22 disciplines and 134 sub-disciplines authorized to confer Ph.D. degrees, 201 master degree programs, 6 professional degree programs, 7 Key Social Science Research Centers of Ministry of Education P.R.C, 9 National Basic Science Research and Training Institutes and 25 post-doctoral research stations. It has 40 national key disciplines granted by the Ministry of Education , nationally third. At present, it encompasses 77 research institutes, 112 cross-disciplinary research institutes and 5 national key laboratories.

Fudan University has a high-level research faculty of over 2,400 full-time teachers and researchers, including 1,350 professors and associate professors. Also, Fudan University has eight teaching hospitals, such as Zhongshan Hospital and Huashan Hospital, integrating medical service, medicine education and research. These hospitals own advanced mechanisms and sophisticated skills, over 900 staff with advanced and associate advanced position, creating a good condition for medical education.

The annual education and research funds for Fudan University in 2005 were 1.312 billion RMB (US$161 million).

Tongji University

Tongji University (www.tongji.edu.cn/) is one of the leading universities directly under the State Ministry of Education in China. Tongji University consists of fourteen (14) schools including School of Sciences and Medical School. In addition, there are five (5) Institutes and three university hospitals located in different campuses.

As a university which had established a reputation for its research, Tongji became one of the first groups of universities which were authorized by the China State Council to establish its Graduate School. As one of the leading universities, it was successful in its application for the 211 Programs which provided universities with substantial government fund. Now Tongji University has become a comprehensive university which offers a wide range of programs in sciences, engineering, medicine, arts, law, economics and management.

The annual education and research funds for Tongji University in 2005 were 961 million RMB (US$120 million).

Nanjing University has received over 2,000 international students and visiting scholars from more than 50 countries or regions.

Nanjing University

Nanjing University (www.nju.edu.cn/), one of the oldest institutions of higher learning in China, is located in Nanjing and is a key comprehensive university directly under the State Education Commission.

Nanjing University consists of 10 schools including Natural Sciences, Chemistry and Chemical Engineering, Life Sciences, and Medicine. Nanjing University has 75 laboratories on campus, among which 7 are national key laboratories including Medical Biology Technology Lab in Department of Biochemistry.

For life science, the University has built a science and technology industry system, which consists mainly of biology and biochemistry, special materials, fine chemicals, electronic information, and mechanical and electrical equipment. Nanjing University takes an active part in international academic exchanges. In recent years, over 2,000 faculty members and students have been sent abroad for advanced studies, academic visits or joint research projects. At the same time, Nanjing University has received over 2,000 international students and visiting scholars from more than 50 countries or regions. Over 20 world-famous scholars have been conferred Nanjing University honorary doctorates and professorships. The University's links with over 100 universities and research institutions abroad has opened up channels for joint personnel training and cooperative scientific research. The Center for Chinese and American Studies was jointly founded with the Johns Hopkins University of

the United States, and the Research Institute of Sino-German Economic Law was jointly set up with Goettingen University of Germany. Since 1982, Nanjing University has conducted about 100 cooperative projects with institutions abroad and hosted 60 international academic conferences.

The annual education and research funds for Nanjing University in 2005 were 1.046 billion RMB (US$130.8 million).

Tianjin University

Tianjin University (www.tju.edu.cn/), established in 1895, is the first educational institution of higher learning in China. At present, Tianjin University has grown into a National Key University directly under the administration of the Ministry of Education of China.

The university has a strong team of professional and concurrent researchers over 4,600. In 2001, the Science and Technology Park of Tianjin University became one of the 22 university sci-tech parks in China. A scientific research system consisting of basic research, applied research and R&D has been formed at the university. The university's annual amount of financial aid received from the National Natural Science Foundation always ranks top among China's engineering institutions of higher learning. The university has established extensive cooperative relations with many large and medium-sized enterprises.

The annual education and research funds for Tianjin University in 2005 were 711 million RMB (US$88.9 million).

Nanjing University (www.nju.edu.cn/), one of the oldest institutions of higher learning in China, is located in Nanjing and is a key comprehensive university directly under the State Education Commission.

Zhejiang University

Zhejiang University (www.zju.edu.cn/) was founded in 1897 as one of the oldest institutions of higher learning in China. Reputed as "the East Cambridge" in history, it has always been ranked among the few top universities in China, in terms of its comprehensive academic strength showed in teaching, research and social service.

Under the direct administration of China's Ministry of Education, Zhejiang University is a key comprehensive university whose fields of study cover eleven branches including science and medicine. There are 6 hospitals affiliated with the University, providing medical services of various kinds for the public. It is a major research university comprised of 21 colleges such as the College of Life Sciences and the College of Agriculture and Biotechnology.

College of Life Sciences of Zhejiang University presently has two departments: Department of Biological Science and Department of Biotechnology with fields in Plant Science, Animal Science, Microbiology Science, Genetics, Biochemistry and Molecular Biology, Ecology, Cell Biology, Neurobiology and Marine Biology. The college receives research funds from National Natural

Science Foundations, National Science/Technology research and development programs, international cooperative research programs, and research and development programs from local governments and enterprises.

The College of Agriculture and Biotechnology of Zhejiang University is one of the leading agricultural education and research institutions in China, offering subjects majoring in Agronomy, Plant Protection, Horticulture, Tea Sciences, Biophysics as well as Biochemistry and Molecular Biology. The college has five departments with fields in Agronomy, Plant Protection, Horticulture, Tea Sciences, and Applied Biology. There are eight Institutes established under the relevant departments. In addition, the college has an affiliated Experimental Farm.

The annual education and research funds for Zhejiang University in 2005 were 1.874 billion RMB (US$234 million)

The most famous departments of Wuhan University in the life science fields include the Department of Virology, Department of Analytic Chemistry and Department of Botany.

Wuhan University

Wuhan University (www.whu.edu.cn/) is a key university directly under the administration of the Education Ministry of the People's Republic of China. It is located in Hubei Province's capital Wuhan and is widely known as one of the most beautiful universities in the world. Wuhan University is a combination of 4 first-rate universities in China and is usually considered in the top ten universities in China.

The most famous departments of Wuhan University in the life science fields include the Department of Virology, Department of Analytic Chemistry and Department of Botany.

The annual education and research funds for Wuhan University in 2005 were 1.048 billion RMB (US$131 million).

Huazhong University of Science & Technology

Huazhong University (www.hust.edu.cn/) of Science and Technology (HUST) is located in Wuhan, the capital city of Hubei Province. It is a key comprehensive university under the direct leadership of the Ministry of Education

The University's rank is at the top of China's leading universities in comprehensive strength. It has 36 academic schools and departments covering eleven disciplines including science and medicine. The university offers a variety of programs. It has 15 national key disciplines. A number of other leading research centers are located here. The University is active in setting up international academic exchanges and co-operation with around 100 foreign universities, research institutes and companies. Over 2 decades, the number of visiting experts and professors has amounted to over 2000. More than 200 of them have been awarded Honorary Professor, Guest Professor or Consultant Professor. About 3,000 HUST staff members have studied overseas, excluding

short-term visits, lectures and seminars. Approximately 1000 long-term international students have graduated here. Huazhong Medical College is one of the most important institutions which have a very close tie with Germany in cultural exchange. School of Life Science & Technology of Huazhong University has an integrated discipline with multi-subjects intercrossed. Various fields are concerned in the discipline. There is basic theoretical research in life science, and a prosperous applied foreground in medical and engineering fields. The university has five Life Science Institutes. They are Institute of Medical Chemistry; Institute of Bio-Medical Engineering; Institute of Biotechnology; Institute of Biophysics and Biochemistry; Institute of Phytogenetic Engineering; Institute of Biomedicine and Biophotonics and Institute of Median Biotechnology.

The annual education and research funds for Huazhong University in 2005 were 1.151 billion RMB (US$143.9 million).

Zhongshan University

Zhongshan University (www.sysu.edu.cn/) is a prominent university in located in the Guangzhou area. Zhongshan University offers a wide variety of subject areas and complete disciplines. The university has a batch of laboratories and research bases with advanced standards and complete facilities. University of Medical Science has reached national top rank in scientific research in medical genetics, ophthalmology, tumor study, parasite study, the kidney disease of internal medicine, organ transplant, infectious liver disease, biological medical project and molecular medical science. The university has four comprehensive affiliated hospitals: the First University Hospital, Second University Hospital (Sun Yat-sen Memorial Hospital), Third University Hospital and fifth University Hospital (Zhuhai Hospital), as well as Sun Yat-sen Ophthalmology Center (including the Ophthalmology Hospital), the Center of Prevention and Cure of Cancer (including the Cancer Hospital), and Guanghua Stomatological Hospital.

The annual education and research funds for Zhongshan University in 2005 were 804 million RMB (US$101 million).

Research/Industrial Parks in China are other good places for Western organizations to cooperate/do business.

8. Research/Industrial Parks and Small and Middle-Sized Enterprises

Research/Industrial Parks in China are other good places for Western organizations to cooperate/do business with Chinese because of the following reasons:

- Availability of local talent for required functions.
- Proximity to leading research institutions, potential partners, and regulatory agencies.
- Quality and completeness of infrastructure and services.

- Quality and quantity of similar enterprises in the same community.
- Favorable cost of doing business.
- Availability of required land and possible future expansion.
- Support of the local and central government and specific incentives for overseas companies.
- Suitability for Western life science organizations.

There are currently nearly 70 research/industrial parks; however, we will only discuss three of the most important ones for life science organizations.

For a large organization planning a serial expansion in China, the CBP is particularly attractive because of the large parcels of land available.

Beijing Bioengineering and Pharmaceutical Industrial Park (CBP)

CBP (www.cbp.net.cn), in Beijing's Daxing District with close to 7,000 acres land available for development, is the largest industrial park in China that is dedicated to life science companies. For a large organization planning a serial expansion in China, the CBP is particularly attractive because of the large parcels of land available. About 40 prominent Chinese pharmaceutical companies and institutions have signed leases to move into the CBP park in the next two or three years. The industrial park also boasts the highest concentration of research talents in its surroundings, given its proximity to more than 100 universities and top-notch research institutions.

The Shanghai Zhangjiang Hi-Tech Park has grown very fast in the past 10 years by attracting dozens of local and overseas life science companies,

Shanghai Zhangjiang Hi-Tech Park

The Shanghai Zhangjiang Hi-Tech Park (www.zjpark.com) has grown very fast in the past 10 years by attracting dozens of local and overseas life science companies, including Roche and Eli Lilly. Shanghai's pragmatic commercial culture and flexibility make it an attractive destination for international businesses. The top leaders of the new Shanghai Pudong area and Zhangjiang Hi-Tech Park are also looking into the possibility of establishing a life science venture capital investment fund modeled after successful U.S. venture capital (VC) funds. The goal is to help stimulate and promote the growth of the nascent Chinese biotech industry in the park and leverage the proven U.S. VC model in terms of screening, evaluating, and managing investment opportunities.

Shenzhen High and New Technology Park

Shenzhen High and New Technology Park (www.sz.gov.cn) is directly under the leadership of State Ministry of Science and Technology and the State Ministry of Foreign Trade and Economics. The Shenzhen park has been worked very hard for past 10 years in order to establish international first-class level facilities for the biomedicine industry. Facilities include an experimental animal center and a GMP manufacturing center.

Enterprises by Overseas Returnees

Overseas returnee entrepreneurs play a key role in China's life science world. Most of the Chinese students who came to the United States in the 1980s

and 1990s to pursue graduate degrees in biology or chemistry established their scientific careers at pharmaceutical and biotech companies or academic research institutes. A small but growing number have found a second passion in the business side of healthcare. Many returned to school for an MBA or JD degree, while others found opportunities in business and management.

Back in China, armed with Western education and corporate experience, the returnees are bridging the gap of understanding between Western and Eastern business cultures. Their companies and organizations have brought new ideas and modern business paradigms to China's economy--and they often represent the best investment/collaborative opportunities for U.S. and European companies. Below we discuss the three of the most successful companies or business organizations founded by these overseas returnees.

About 80 percent of the members reside in the United States; the rest live and work in China. Virtually all the top pharmaceutical companies are represented in the membership, as well as leading biotech companies such as Amgen, Genentech, and Biogen Idec.

- **The BayHelix Group:** The group's 180 members aspire to shape the growth of the life sciences and healthcare industry around the Pacific Rim and beyond, foster and create business opportunities, supply and nurture the leaders for the community, and network and share information and experience. Membership is by invitation only. Nearly 20 percent of the members are C-level executives, and 96 percent have a PhD, MBA, or both. About 80 percent of the members reside in the United States; the rest live and work in China. Virtually all the top pharmaceutical companies are represented in the membership, as well as leading biotech companies such as Amgen, Genentech, and Biogen Idec, and top investment banking and consulting firms such as Merrill Lynch, Lehman Brothers, McKinsey, and BCG. One of the most influential members is Hua-Cheng Wei, chairman of Beijing Pharmaceutical Group, one of the largest pharmaceutical companies in China. More information is available on the website: www.bayhelix.org/.
- **South Gene Technology (SGT):** SGT is the commercial arm of Shanghai's National Human Genome Center (NHGC), a major center for Chinese genomic research with the ability to access disease-associated genes discovered by NHGC and patient samples from its wide network with hospitals and universities. The president of SGT is Dr. Kevin Chen who is one of the earliest returnees. After receiving his PhD from the University of Minnesota and doing postdoctoral training at Caltech, Chen held positions at MIT and DuPont and was hired in 1997 to establish a research center in Beijing for Novo Nordisk. In addition, Chen heads Shanghai IgCon Therapeutics, a joint venture between SGT and California-based Genetastix that pursues therapeutic human antibodies. More information is available on the website: www.chgc.sh.cn/.
- **WuXi PharmaTech:** Ge Li, another returnee, founded and runs WuXi PharmaTech, a Shanghai-based company specializing in contract chemistry research and product development services. WuXi PharmaTech has

Overseas returnee entrepreneurs play a key role in China's life science world.

more than 60 pharma and biotech clients in the United States, Europe, and Japan, including 14 of the top 20 pharma companies and eight of the top 10 biopharmaceutical companies. More information is available on the websites: www.pharmatechs.com and www.pharmatechs-us.com

State Owned Enterprises

BioAsia Co.- a Shanghai-based bio-services provider that U.S. biotech product and service giant Invitrogen Corp. recently acquired (www.invitrogen.com).

- **Beijing Genomics Institute (BGI):** BGI made China to be the only developing country to participate in the Human Genome Project. BGI, which was established as a nonprofit research entity in 1999 and is part of the Chinese Academy of Sciences, has since decoded a subspecies of rice and moved on to sequencing chicken, pig, and silkworm genomes. More information is available at: www.genomics.org.cn/.
- **SiBiono GeneTech Co:** Shenzhen-based SiBiono GeneTech Co., Ltd. received international recognition in 2003 when it developed the world's first licensed gene therapy medication. The PRC State Food and Drug Administration granted SiBiono permission to produce its gene therapy medication, now called Gendicine, after five years of clinical trials. The company's founder, chair, and CEO, Dr. Peng Zhaohui, believes the cancer treatment that fights tumors by injecting a tumor-suppressing gene into the body is a safe and life-saving product. Because the U.S. Food and Drug Administration has not yet approved the sale of Gendicine (or any human gene therapy) in the United States, most likely because of unclear clinical trial results, some scientists in the international community are wary. The company receives state and private funding and is now working with New Brunswick Scientific Co., Inc., a U.S. lab equipment supplier, to produce 150 million doses of Gendicine per year. For more information see: www.sibiono.com.
- **Beike Biotechnology Company:** Beike Biotechnology Company was founded with capital from Beijing University, Hong Kong University of Science and Technology and Shenzhen City Hall. The research and clinical work comes as a collaboration of Beijing University, Hong Kong University of Science and Technology, No. 3 Army Medical University, Zhongshan Medical University, Guiyang Medical College and Zhengzhou University. Beike is one of the leading expert groups in China for separating purifying, nurturing, and multiplying embryonic, fetal, adult and most importantly – blood cord stem cells. Beike has been able to grow human organ cells as well which they expect to help pave the way for future cures. For more information see: www.stemcellschina.com.

9. Traditional Chinese Medicine (TCM)

Traditional Chinese Medicine (TCM) has played an important role in the health care of Chinese and other oriental countries for thousands of years. There are perhaps 4000-5000 different TCM drug preparations that constitute about one-third of Chinese pharmaceutical sales. TCM products are typically herbal formulations and are available for many conditions, including serious chronic conditions such as hepatitis and even cancer. Chinese herbal medicines have a long history of use and strong evidence of effectiveness. Many take advantage of the synergistic action of certain plants or ingredients, much like the drug cocktails used in Western medicine.

The Chinese government policy has promoted TCMs to be one of the fastest growing businesses in the Chinese industry, and a number of government departments are guiding the TCM industry's attempts to modernize to enable TCM to enter international markets. To date, Chinese companies have mostly in-licensed compounds from the Western world, but companies looking to license novel compounds from China will find an increasing number of opportunities in the future. Some of the most interesting are expected to come from the area of TCM. The huge resource of Chinese herbs with well-documented medical use and cultivation could become a hidden gold mine in complementing traditional Western approaches to drug discovery.

In the past three years, Shanghai Institute of Materia Medica (SIMM) in partnership with Novartis has isolated 1,828 natural compounds from Chinese herbs for treating a wide range of diseases, including diabetes, cancers, and central nervous system disorders.

Multi-national pharmaceutical companies are aware of this potential gold mine. In the past three years, Shanghai Institute of Materia Medica (SIMM) in partnership with Novartis has isolated 1,828 natural compounds from Chinese herbs for treating a wide range of diseases, including diabetes, cancers, and central nervous system disorders.

A few companies have made significant strides in developing therapeutics derived from traditional medicine with the scientific rigor and sophistication of Western medicine. In 1998, for example, PolaRx Biopharmaceuticals, an early- stage U.S. biotech company, obtained commercial rights for arsenic trioxide, a small-molecule compound developed from a TCM compound to treat acute promyelocytic leukemia (APL). PolaRx set an industry record by obtaining FDA approval in 30 months after the first US patient received treatment in a corporate-sponsored clinical trial, beating the record set by GSK's Gleevec (imatinib). PolaRx was later acquired by Cell Therapeutics Inc. (CTI), a publicly traded biotech company in Seattle that develops oncology drugs.

At least two more compounds based on TCM are currently in development:

- A researcher from the Connecticut Institute for Aging and Cancer (CIAC) has successfully developed an herb mix for prolonging the survival of patients with advanced non-small cell lung cancer. This product is the first health- improving anticancer product and composite herbal mix funded by

NIH to enter a multi-center, FDA-supervised Phase III trial. Interestingly, FDA is allowing the product to be sold as a dietary supplement while the trial is in progress, significantly lowering the cost of clinical development.

- SIMM has identified a novel cholinesterase inhibitor from a Chinese herb that shows efficacy in Alzheimer's disease. SIMM has licensed the compound, ZT-1, to Debiopharm, a Swiss pharmaceutical company that is conducting Phase II clinical trials.

In the future, there is likely to be an increasing number of therapeutics derived from both single-ingredient and combination-ingredient herbal formulations. Thus, TCM is a promising field for Western people to cooperate with Chinese research organizations.

…and it is important for Western people to know that Chinese have certain beliefs that may be different from the Western world.

10. Cultural and Societal Issues

China is a big country with 1.3 billion people. China has 5,000-year history and it is important for Western people to know that Chinese have certain beliefs that may be different from the Western world. Chinese think and do things in the different way as Western people. It is very important for Western people to take the long-term view and think from a Chinese perspective. Below we discuses some important elements that play important roles in the cooperation with Chinese such as understanding, managing expectation, negotiating, building up "Guanxi" as well as dealing with conflicts of interest.

Understanding

It is very important that the foreign party understands how Chinese bureaucracy works such as where authority is, i.e. central, provincial, or municipal levels, so the foreign party can obtain the requisite approvals and official seals to set up a cooperation project. The foreign party should also know the level of any particular individual with whom the foreign party is dealing so the foreign party will not embarrass him or her by asking questions that are beyond his or her responsibility or control, which may end in your request being subsequently refused because of losing their "face". We will discuss more about "face" issue late.

It is also important for the foreign party to understand that the foreign party and the Chinese party are of equal importance. The foreign party must make every effort to enhance the understanding between each other and to show the Chinese party that what the foreign party is doing can add value to both parties, thereby making Chinese party realize that long-term commitments and cooperation is the only way to make the business grow.

In Chinese society, an emphasis is placed on family, humility and courtesy, and the concept of "face" is very important. When asked to do a favor or when inquired for their decision, the Chinese will usually avoid saying "no," since

doing so causes them to lose face. But, if a request cannot be met, the Chinese may say it is inconvenient, under consideration, or ignore it altogether. Unless the request is urgent, it is best to respect these subtleties and not press the issue.

The negotiation process is normally longer in China than in the West because many Chinese enjoy negotiations

Negotiating

The negotiation process is normally longer in China than in the West because many Chinese enjoy negotiations and want to get the best deal possible. In order to carry out successful negotiations, the foreign party should keep the following differences in mind:

- Americans often take straightforward dialogue, while the Chinese prefer an indirect way.
- At least one member of the foreign team should have full knowledge of every aspect of the business and have some knowledge of Chinese background.
- The Chinese party may appear uncaring about the success or failure of the meeting during the negotiations, and then make excessive demands. In this situation, it is best for the foreign party to remain calm and consider giving the Chinese party some flexibility scope on a specific issue – it may result in far greater benefits in the future.
- Every detail of the business partnership/agreement should be covered verbally at least twice before the contract is signed. The contract should be written in English and Chinese to make sure all points are clear.

Managing expectation

Another important element in cooperating with Chinese is patience. China is a 5,000-year-old civilization and they do not measure time in the same way as Westerners do. Westerners often prefer instant progress, instant change. However, Western people should not expect the Chinese party to do the same. Beside understanding the way Chinese bureaucracies works, western people should also realize that most Chinese can't be rushed. Western people should take a step-wise approach in China, until the final goals are accomplished. This is the secret of success.

Chinese bureaucracy is similar to many other bureaucracies in the world. It takes time to deal with them and in getting the required approvals from the different authorities at different levels. It also takes time for a foreign party to communicate with the Chinese partner, especially when the Chinese partner is a state-owned enterprise. But it is necessary. Great patience is required to build up the necessary level of trust and you mustn't rush it, particularly when you are trying to acquire a substantial interest in a state-controlled industry.

It is very important that the foreign party understands how Chinese bureaucracy works such as where authority is [located].

Building up "GUANXI" (personal network)

Another important element for a foreign party to co-operate with Chinese is to understand how to build and maintain a stable and positive relationship

("GUANXI") with the Chinese counterparts. Personal connections are crucial in China, and essential for conducting successful business. The foreign party should make a great effort to earn the respect and trust of a Chinese counterpart before any "real business" is done, sometimes even before doing business with the Chinese. In addition, if possible, it is always best to have a mutual friend serve as the intermediary when meeting a Chinese counterpart for the first time.

At the time of the first introduction, both parties should exchange their business cards. The cards should be passed with both hands and the names of the cards should be readable by the receiving party such as in Chinese. During the meeting, business cards should be laid out on the table not being placed in a coat pocket or briefcase. Traditionally, the Chinese give a lot of gifts, so Western people should prepare an appropriate gift before visiting the Chinese counterpart. If one gift is given, it should be presented to the head of the Chinese group at a dinner banquet or at the conclusion of a business meeting. If numerous gifts are given, they should all be of roughly equal value. When receiving a gift, a humble acceptance and a few words of appreciation are appropriate.

China is a 5,000-year-old civilization and they do not measure time in the same way as Westerners do.

In general, relationships play an import role in business life in China. However, relationships play a role in every business in every society. What is different about China is the intensity of preoccupation with relationship building, which goes on continually, so that it is almost an all-consuming aspect of Chinese life. Thus, at every meeting, social or business, the Chinese participants are working on some aspect of the relationship so should the western people who want to do business in China.

11. Current Research Collaborations between U.S. and Chinese Life Science Organizations

Modern research collaborations between the U.S. and China properly date back to 1979, when President Jimmy Carter of the U.S., and Premier Deng Xiaoping of China signed the U.S.- China Agreement on Cooperation in Science and Technology (S&T Agreement)1 following normalization of the U.S. relations with the People's Republic of China. Since then, researchers in both countries have officially collaborated in work involving all aspect of science and technology, including medicine, health and disaster mitigation. Under the S&T Agreement, one of the longest-standing U.S.-China accords, U.S. federal agencies can negotiate specific protocols, memoranda of understanding (MOUs) and other limited agreements with Chinese government agencies. It is estimated by the U.S. State Department China desk that the United States now has in excess 30 active protocols and more than 60 sub-agreements with China.

Recently, on December 20, 2005, Dr. Elias Zerhouni, Director of the National Institutes of Health (NIH), U.S. Department of Health and Human Services (HHS), and Dr. Zhu Chen, Vice President, Chinese Academy of Sciences, signed an amended Memorandum of Understanding on Cooperation in Biomedical and Behavioral Research. The memorandum will expand the areas of collaboration between the two agencies. The signing capped off a trip by Dr. Zerhouni to Shanghai and Beijing, where he visited with the Shanghai Institutes of Biological Sciences of the Chinese Academy of Sciences, the Chinese Academy of Medical Sciences, the Ministry of Science and Technology, and the National Natural Sciences Foundation of China. Dr. Zerhouni also attended a meeting of the Heads of International Research Organizations. Details about the U.S.-China activities on the S&T Agreement in the area of life sciences, its derived protocols and MOUs can be found at the website of HHS Office of Global Health Affairs: www.globalhealth.gov and www.globalhealth.gov/asianaffairschina.html.

On December 20, 2005, Dr. Elias Zerhouni, Director of the National Institutes of Health (NIH), U.S. Department of Health and Human Services (HHS), and Dr. Zhu Chen, Vice President, Chinese Academy of Sciences, signed an amended Memorandum of Understanding on Cooperation in Biomedical and Behavioral Research.

Collaborations with China on environmental health have traditionally been sponsored by the Centers for Disease Control and Prevention (CDC) or the Environmental Protection Agency (EPA). Some environmental health-related projects have also been sponsored by the Department of Energy, or by the U.S. Department of Commerce through its National Oceanic and Atmosphere Administration (NOAA) unit.`Under the S&T Agreement, for example, the EPA and NOAA, have aided China's efforts to clean up industrial pollution and prevent further environmental degradation[1, 2]. The EPA is working closely with China's State Environmental Protection Administration (SEPA) on different projects related to emission trading, and wind power technology (jointly with the U.S. Department of Energy and China's National Development and Reform commission), with the full support of the Chinese Central government.

On the medicine and public health fronts, the Department of Health and Human Services (HHS) and the Chinese Ministry of Health cooperate under the auspices of a Health Protocol, originally signed in 1979[3] following the execution of the comprehensive S&T agreement between the two countries. The Health Protocol was last renewed in October 1998. The protocol has been amended several times over the years to add more programs and to provide more flexibility for cooperative endeavors. The National Institutes of Health and the Center for Disease Control and Prevention, both components of HHS, have played a major role in the initiation and implementation of many of the programs related to the scientific cooperation and collaborations called for by the Health Protocol. With each passing year, more and more activities have been undertaken using a variety of support mechanisms, such as grants, contracts, and research fellowships awarded on a competitive basis. U.S. and

Chinese scientists at the working level are collaborating, defining areas of mutual interest, developing research ideas or project plans, and then working with each country's respective centers or institutes to arrange for funding of the activity and official approvals on an activity-by-activity basis.

Collaborations between the U.S. (as well as other western nations) and China in the life sciences areas have taken various forms and have been facilitated through a variety of vehicles as will be described later in this chapter.

Since most of the mechanisms of collaborations as well as related examples and case studies provided in the this chapter are described primarily from the perspective of the NIH, and some from that of the CDC, a brief overview of these two government agencies is appropriate and will be provided below. In particular, the various funding instruments and other programs that may create the basis for collaborative research will be expanded. The examples for collaborations as detailed below represent a very small percentage of the ongoing collaborations between the U.S. and China. For the full list and short descriptions of all the currently ongoing collaborations, the reader is referred to Appendices A (NIH sponsored collaborations) and B (CDC sponsored collaborations) of this chapter. It is hoped that the information provided throughout the rest of this chapter will be of benefit to the reader who seeks to set up collaborative research or obtaining financial support from the U.S. government agencies, and will serve as a guideline for potential collaborators on both ends of the globe, east and west.

U.S. and Chinese scientists at the working level are collaborating, defining areas of mutual interest, developing research ideas or project plans, and then working with each country's respective centers or institutes

12. NIH – Specific Activities in China

The National Institutes of Health (NIH) (www.nih.gov), a component of the U.S. Department of Health and Human Services, is the primary Federal agency for conducting and supporting medical research. Helping to lead the way toward important medical discoveries that improve people's health and save lives, NIH scientists investigate ways to prevent disease as well as the causes, treatments, and even cures for common and rare diseases. Composed of 27 Institutes and Centers (ICs), the NIH provides leadership and financial support to researchers in every state and throughout the world. With the headquarters in Bethesda, Maryland, the NIH has more than 17,000 employees on the main campus and at satellite sites across the country.

Technology transfer, including licensing, has become part of the biomedical research effort at the NIH and is the vehicle through which the outputs of NIH funded research are transferred to industry to be ultimately developed into products to advance human health. The office responsible for managing the NIH invention portfolio and to carry out the mandates given by Congress

through its legislative Acts the Office of Technology Transfer (OTT), located at 6011 Executive Boulevard, Rockville, MD 20852 (www.ott.nih.gov). The licensing program[4,5] has also recently led to licensing and collaborative relationships with Chinese life science organizations related to rotavirus vaccine (see story below). In addition, a license agreement related to hair growth promoter, i.e. actin-binding peptides, was signed with Lee's pharmaceuticals from Hong Kong on June 10, 2003, granting the licensee an exclusive right for distribution of the hair growth promoter in China, Hong Kong and Taiwan.

NIH Collaborative Activities in China

The NIH supports and collaborates with the Chinese government and with a variety of Life Science organization in China in many different areas. An updated summary of these collaborations and their impact on public health is provided in Appendix A. More on collaboration with China in the area of infectious diseases can be found in the website of the Office of Global Health Affairs of NIAID (OGA), http://www3.niaid.nih.gov/about/organization/odoffices/oga. Generally, the Office of Global Affairs (OGA) provides overall coordination of NIAID international activities through a matrix of international liaisons; it accomplishes its work with other NIH components and HHS agencies through the Fogarty International Center. OGA also meets and greets international visitors and delegations, coordinates NIAID participation in bilateral and multilateral programs, negotiates and provides administrative support for the long-term assignment of NIAID staff and representatives overseas, and supervises the OGA/NIAID Epidemiology Group in support of intramural and extramural international projects

OGA also meets and greets international visitors and delegations, coordinates NIAID participation in bilateral and multilateral programs, negotiates and provides administrative support for the long-term assignment of NIAID staff and representatives overseas

13. CDC – Specific Activities in China

The Centers for Disease Control and Prevention (CDC) (www.cdc.gov) is one of the 13 major operating components of the Department of Health and Human Services (HHS). Since it was founded in 1946 to help control malaria, CDC has remained at the forefront of public health efforts to prevent and control infectious and chronic diseases, injuries, workplace hazards, disabilities, and environmental health threats throughout the world.

The CDC has a particular focus on field-based epidemiology and laboratory training for in-country public health professionals. The primary focus of CDC in China currently is HIV/AIDS prevention/treatment; influenza surveillance (avian influenza in birds and in human); and preparation for possible influenza pandemic. For specific activities of the CDC in China the reader is referred to Appendix B of this chapter.

14. Mechanisms for Collaborations

Collaborations between the U.S. (as well as other western nations) and China in medical research have taken different forms and have been created through a variety of mechanisms as described below: The following is primarily based on the NIH and the CDC experience.

a) Direct financial support through grants and contracts from the NIH, or other federal agencies, as well as grants from charitable foundations (see the CIPRA and GAP grants below (1, 2), the NIH support for research and surveillance of animal influenza strains including the pandemic H5N1 (3), and the support for tropical disease research (3), the grants from the Foundation for NIH and the Bill & Melinda Gates foundation, and grants from the Wellcome Foundation (4).

Chinese scientists are training in the West in increasing numbers. While many of them do not go back to China and prefer to launch their scientific careers in the west, now others in increasing numbers, are returning to China as a result of China's economic growth.

b) Indirect financial support where grantees of the NIH or other federal agencies have used their awards for collaborative projects in China, as exemplified in the epidemiologic studies conducted jointly by Harvard and Chinese institutions (see (5) below).

c) Transfer of technologies through informal collaboration with NIH laboratories. The story below (6) regarding collaboration between the National Institute of Child Health and Development (NICHD), a component of the NIH, and the Chinese Institutes of Biological Products, exemplifies the benefits of such informal collaboration where transfer of know-how, expertise and research materials from the NIH to China resulted in licensed vaccines that saved lives in China.

d) Collaborations with the NIH through specific programs dedicated to natural products and alternative medicine. The NIH sponsors and support collaborations in areas dedicated to natural products and alternative medicine. Particularly noted are the Developmental Therapeutic Program (DTP) offered by the NCI (see (7) below), and the collaborative program offered by the National Center for Complementary and Alternative Medicine (NCCAM). Detail regarding the NCCAM programs are provided in (8) below.

e) Transfer of technologies through the intramural programs of the NIH. The most important programs in this category are the licensing program offered and administered by the Office of Technology Transfer (OTT), and the various collaboration programs offered and administered by the Technology Development Coordinators (TDCs) at the Institutes' level (i.e. Cooperative Research & Development Agreement (CRADA); Clinical Trial Agreement (CTA); and Material Transfer Agreement (MTA)). Within the licensing program, OTT has been increasing its global efforts to license technologies and to partner directly with regional commercial entities, with the goal of disseminating vaccine and drugs vital for the developing countries as efficiently

and as broadly as possible. The recent success of licensing rotavirus vaccine technology to government-affiliated Chinese institutions as described in (9) below is one example of the success of the NIH strategy of interacting directly with regional entities around the globe. The merit of collaborations through CRADA or CTA as described above is worth reiterating here, as those are most commonly used and most effective vehicles for collaborations with the NIH.

f) Informal collaboration between individual scientists. Frequently, individual scientists with common research interest and synergistic expertise will engage in a collaboration that may result in important scientific knowledge or even commercially valuable inventions. Many of these collaborations occur with Chinese scientists trained in the U.S. (or other western countries) that upon their return to China continue to collaborate with their Western colleagues with whom they developed relationships while training in the West. Chinese scientists are training in the West in increasing numbers. While many of them do not go back to China and prefer to launch their scientific careers in the west, now others in increasing numbers, are returning to China as a result of China's economic growth and the increased number of opportunities created for medical researchers and entrepreneurs. The Chinese scientific communities on both ends, the west and China, are instrumental in creating the bridge for collaborative research that may in the future lead to breakthrough discoveries and important medicines. Two examples of collaborations between individual investigators are described in (10) below.

The NIH provided the Chinese CDC a five-year $14.8 million grant with the objective to help China to strengthen its HIV/AIDS research infrastructure.

g) Training grants for Chinese scientists to support collaborations. The NIH through Fogarty International Center provides financial support for foreign scientists, including Chinese investigators for training and collaborating with the U.S. This support has had and will continue to have a major impact on future collaborations and on open communications between China and the U.S. in the area of life sciences (see (11) below for detail regarding the programs offered by Fogarty International). There are similar programs in some of the European countries.

The mechanisms available for setting up collaborative research as outlined above have all been applied in collaborative research between the U.S. and Chinese life science organizations as will be described in the case studies below. These mechanisms and their associated case studies described below may serve as a useful guide for Chinese and Western organizations and for individual researchers that wish to establish collaborative research in the future. The reader, whether Chinese or in the U.S.A may determine the mechanism that best fits his/her circumstances. The synergism and the complementary expertise that each of the parties brings to the table, as well as other factors related to the fast growing Chinese economy and the new entrepreneurial spirit in China, warrant the scientific collaborations between China and the west and

assure the success of these collaborations and the impact they may have on global public health.

15. Case Studies for Collaborations

(1) The CIPRA and GAP HIV/AIDS Grants and the Research Collaboration with the NIH Vaccine Research Center (VRC)

In June, 28, 2002 the U.S. Health and Human Services Secretary Tommy Thompson and the Chinese Health Minister Zhang Wenkang signed a Memorandum of Understanding (MOU) in Washington aimed at promoting enhanced U.S.-China cooperation on HIV/AIDS prevention and research. At the signing ceremony Secretary Thompson announced two initiatives under the NIH and CDC, which resulted in the following collaborations:

In the first initiative, the NIH through the National Institute of Infectious Diseases (NIAID) and under its CIPRA program (Comprehensive International Program of Research on AIDS), provided the Chinese CDC a five-year $14.8 million grant with the objective to help China to strengthen its HIV/AIDS research infrastructure. According to NIAID, the CIPRA grant will help China develop infrastructure needed to high-quality research. The infrastructure includes the laboratory structure, ethical review boards, field and clinical research capacity, and data center and training personnel in good clinical practices. The grant also supports Chinese research projects on the epidemiology of HIV transmission; behavior interventions for preventing HIV transmission, safety and efficacy of HIV treatment drugs, and development of vaccines that prevent HIV infection. With respect to the latter, today there are already vaccine candidates lined up for testing, some designed by Chinese researchers in conjunction with U.S. organizations such as the Vaccine Research Center (VRC) at the NIH[6].

It should be noted here that scientific research collaborations between the Chinese CDC and the NIH/VRC regarding development of HIV vaccines has been going on for several years now. This collaboration has been headed by Dr. Gary Nabel, director of VRC and Dr. Yiming Shao in China. Dr. Shao is the chief expert of China's National Center for AIDS/STD control and prevention (NCAIDS), and the director of the Department of Research on Virology and Immunology, NICAIDS, China CDC. The productive research collaboration between VRC and Dr. Shao began in August 2001[5], when the VRC invited Dr. Shao, and later his research associates, to come to the VRC as visiting scholars. Initially the VRC and Dr. Shao discussed strategies in pursuit of a vaccine against AIDS, as well as conducting detailed reviews of DNA vaccine regulatory issues as they relate to ensuring the integrity and safety of clinical trials, and assessing efforts to develop vaccine candidates for the developing world. Since his initial visit Dr. Shao has become a frequent visitor to

VRC and spends approximately one month every year in the laboratories of VRC, adapting various assay techniques used at the VRC group. In addition, Dr. Shao's associates are regularly working with Dr. Nabel in the U.S., and as such serve as liaison in the collaborative work.

Recently, the VRC and Dr. Shao and his associates have concluded exciting research relating to enhanced breadth of neutralization by vaccination with modified HIV envelope with V3 regions derived from Clade C[7]. The genetic diversity of human immunodeficiency virUS-1 (HIV-1) envelope (Env) sequences provides information regarding its highly conserved and variable regions relevant to its immunogenicity and function. To understand the cross-reactivity of variable regions from different clades and to identify improved HIV immunogens that elicit neutralizing antibodies of greater breadth, the VRC and Dr. Shao's staff prepared alternative forms of Env derived from different Clades with modifications in the variable regions. Chimeric immunogens were prepared which suggested that the V3 region plays a dominant role in eliciting neutralization of viruses from different clades. A novel epitope was localized to the VI region that inhibited neutralization of the clade B HIV IIIB isolate and may be responsible for strain-specific responses to other viruses as well. Definition of relationships between the genetic diversity of the virus and neutralization sensitivity facilitates the rational development of broadly neutralizing antibodies and improved immunogen design for AIDS vaccines. The ability to define improved immunogens using genetic information based on viral diversity can improve the ability to design effective HIV vaccines. The research collaborations between the VRC and Dr. Shao have yielded suggestions that the genotypic sequence variation can result in neutralization sensitivities that are independent of clade. These findings therefore suggest that genetic variation is likely to be independent of immunotypic sensitivity for antibody neutralization and have important implications for the design of improved HIV immunogens based on genetic sequence. The ability to understand the genetic and structural determinants of envelope vaccine design can improve our understanding of HIV structure and function and assist in the development of improved vaccines for HIV.

Other than his collaboration with the VRC, Dr. Shao has also collaborated with several U.S. universities. In addition to the CIPRA grant, Dr. Shao's group has received several European grants used for HIV research in collaboration with European life-science organizations.

The cooperation agreement under the CIPRA grant includes also a provision for the Chinese team to engage expert consultants from the United States who collaborate on the design and implementation of research studies. The plan under the agreement specifies Yunnan and Shanxi provinces as the territories where the epidemiologic and behavioral intervention program will take place.

Concurrently, clinical and laboratory studies will be performed in collaboration with several institutions, including the Chinese Academy of Medical Sciences, and the Institute of Virology in Beijing, the Medical Primate Center in China, and at Nakai University in Tianjin.

It should be noted that the CIPRA grant, like other grants awarded by the NIH, is competitive and the award to the Chinese CDC was granted based on the highly rated proposal by the Chinese CDC.

The second initiative under the Global AIDS Program (GAP) of the U.S. CDC, established collaboration between the U.S. CDC and the Chinese CDC that is designed to help the Chinese government with HIV prevention, HIV/AIDS care and treatment, and capacity building in the public health response to AIDS epidemic in China. In addition to financial assistance, the U.S. CDC has assigned two staff to work at the Chinese CDC in Beijing and oversee this important cooperative agreement, as well as to provide other technical assistance to the Chinese government in this collaboration.

The research collaborations between the VRC and Dr. Shao have yielded suggestions that the genotypic sequence variation can result in neutralization sensitivities that are independent of clade.

(2) The Extension of the HIV/AIDS CIPRA to SARS

The outbreak of SARS (Severe Acute Respiratory Syndrome) in Southeast Asia in the spring of 2003, and the thought that this outbreak started in the Southeastern China's Guangdong province in November 2002, have led to a further initiative by the NIH to support China's research in this newly emerging infectious disease. The Division of Microbiology and Infectious Diseases (DMID), an extramural component of NIAID, provided the Chinese CDC supplemental funds to the already established AIDS CIPRA grant which was awarded the previous year. DMID's ability to utilize an already established network allowed the Institute to quickly initiate SARS research and aggressively address this emerging disease threat. Today, DMID continues to provide supplemental funds to the CIPRA network to support investigators at the China CDC and their collaborators for the following research activities[8]:

- Development of immune correlates of protection through study of pediatric and adult serum, stool, and cellular clinical samples obtained longitudinally from SARS patients.
- Development of a panel of convalescent human SARS-CoV antisera that can be used to standardize diagnostic assays (done in collaboration with the Food and Drug Administration and CDC)
- Attempted identification of animal reservoirs of SARS-CoV through surveillance of live animal markets.

(3) The NIH Support for Influenza Surveillance and the Support for Tropical Disease Research

NIAID supports the "Influenza Pandemic Preparedness in Asia" contract with St. Jude Children's hospital for a number of years now. The Principal Investi-

gator of this contract is Dr. Robert Webster, a renowned virologist with expertise in influenza and in particular in animal strains of Influenza. The main purpose of the contract is to provide support for surveillance of animal strains of influenza in Southeast Asia. The new emerging pandemic danger from the avian H5N1 influenza strain that broke out in Southeast Asia9 has received special attention in the last several years. Under the contract, St. Jude is collaborating with several Chinese organizations, but in particular the contract funds are used to administer the animal influenza surveillance center in Hong Kong, to provide characterized viruses suitable for vaccine development, to support training and new laboratory personnel, and to produce critical reagents. Also, the molecular basis of transmission of the avian strains has been studied extensively under this contract.

On yet another front, the NIAID has been supporting the Tropical Medical Research Center in Shanghai, with the purpose of strengthening research capacity related to schistosomiasis and hookworm infection. The support for this research has been awarded under The Tropical Medicine Research Centers (TMRC) program of the International Centers for Tropical Disease Research (ICTDR) of the NIAID. The ICTDR was established in 1991 to confront the challenges in international health more effectively. The program incorporates Institute-supported intramural and extramural tropical disease research centers into an interactive network focused on tropical infectious disease problems. Further detail about this program can be found in http://www.niaid.nih.gov/ictdr/tmrc.htm .

(4) Grants from the Foundation for the NIH/ the Gates Foundation, and the Wellcome Trust

The Foundation for the NIH (the Foundation) was created by congress for the purpose of providing financial support to special projects of high public health importance. The Foundation raises funds from private donors, including pharmaceutical companies. The Bill & Melinda Gates Foundation donated initially $200 million to the Foundation to be distributed to excelling research groups around the world to work on projects that will solve critical problems in global public health. Those projects have been administered directly by the Foundation. Furthermore, the Gates Foundation later donated $250 million more to finance additional projects. Those additional projects have also been facilitated by the Foundation for NIH, but administered directly by Gates. The "Grand Challenges in Global Health" has been initiated as a result of these donations, attracting 1,500 grant applications and proposals from 75 countries. At the end of the selection process the Grand Challenges in Global Health Initiative has offered grants for innovative research projects to 43 research groups, involving scientists from 33 countries. Two (2) Chinese Institutions were amongst the winners of the Grand Challenge awards; Dr. Hongkui Deng from

Peking University received an award of $1.9 million for 5 years for his proposal entitled "Development of Novel Mouse Models for HIV and HCV Infections" under the Grand Challenge Category of "Improving the Reliability of Vaccine Testing". The proposal focuses on creating mouse models for testing potential vaccines against HIV and Hepatitis C, using stem cells techniques. Current mouse models are inadequate for testing live-attenuated vaccines, and this project focuses on solving this critical element in vaccine development.

The second Chinese recipient is Dr. Jiang-Dong Jiang from Chinese Academy of Medical Sciences. Dr. Jiang's proposal entitled "Natural Products Inhibit Intracellular Microorganisms via Cellular Mechanisms" awarded him a grant of $2 million for 5 years, and was granted under the Grand Challenge Category of "Discover Drugs and Delivery Systems that Limit Drug Resistance". Dr. Jiang's team will focus on identification of components of human cells that are used by microbes to establish an infection and replicate, but that are not essential to the human host. Once identified, these host components can be used as drug targets. It is believed that targeting components of human cells rather than the microbe itself is the better approach to combat bacterial infections, as the development resistance to the drug may be avoided. The project will focus on potential treatments for HIV, tuberculosis, and hepatitis B.

It is anticipated that the two Chinese recipients of the grants will perform part of their research in collaboration with U.S. research groups.

More information about the Foundation for NIH and the Grand Challenges in Global Health can be found in http://www.fnih.org and http://www.gcgh.org.

The Wellcome Trust based in England is an independent, research funding charity with a mission of improving human and animal health around the world. The fund has supported China with more than £6 million for research over the last 10 years. Of particular note is the most recent donation of £3.5 million worth of high-powered sequencing machines to Beijing Genomics Institute (BGI) to carry out and contribute to a collaborative research led by Washington University in the U.S. The project involves decoding of the genome of chicken. The project is of particular significance since chicken is evolutionarily closer to mammals than other vertebrates, such as fish and amphibian, and thus has been used as a vertebrate model in biomedical research. This collaborative research between China and the U.S. has received attention from the scientific community. To quote Dr. Bin Liu, the head of research and collaboration at BGI, "These machines will allow us to take part in one of the most important genome projects and give us the opportunity to work with other high-class researchers around the world".

More information about the Wellcome foundation and this particular collaborative research can be found in http://wellcome.ac.uk.

(5) Collaborations of NIH and CDC Grantees with China – Two Epidemiologic Studies by Harvard Groups

Dr. Xiping Xu, now a professor for epidemiology and biostatistics at the University of Illinois in Chicago was one of the first Chinese scientists to leave China after the Cultural Revolution. He received his MD degree in Anhui University in China in 1982, and a Ph.D. from the University of Tsububa in Japan in 1988. He then came to the United States as a postdoctoral fellow at Tulane University. Subsequently, Dr. Xu joined the faculty at the Harvard Medical School where he also received an MS in Public Health (1993). His work at Harvard School of Public Health in the program of Population Genetics focused on research in genetic epidemiology, and as such he collaborated extensively with professor Scott T. Weiss of the Channing Laboratory at Harvard Medical School. For his research in the area of Asthma epidemiology and genetics he received initially a grant from Millennium Pharmaceuticals, which later followed with two grants from the National Heart, Lung and Blood Institute (NHLBI) of the NIH (grants HL56371 and HL66385). Dr. Xu used the funds he received from the NIH to conduct research in China in collaboration with investigators at Anhui Medical University, his old medical school in China. The work that took place between 1996 and 2002 has been summarized in multiple papers. Two of the papers[10,11] point at specific genes and their chromosome locations showing linkage to airway hyper responsiveness, one of the major clinical symptoms and intermediate phenotype of asthma.

The main purpose of the contract is to provide support for surveillance of animal strains of influenza in Southeast Asia.

Dr. David Christiani, a professor of occupational medicine and epidemiology departments at Harvard also conducted epidemiologic studies in China in collaboration with Chinese institutions. Under grants from the National Institute for Occupational Safety and Health (NIOSH), a component of the Center of Disease Control and Prevention (CDC), Dr. Christiani has led a 20-year study of respiratory disease in cotton-textile workers in Shanghai, China. The objectives of the study included determination of the rate of loss in lung function amongst cotton dust-exposed workers at various levels of dust exposure and evaluating the relationship of exposure to gram-negative bacterial endotoxin and acute chronic lung disease. The research was expanded to include an assessment of relevant genetic factors and is summarized in two papers; in the American Journal of Respiratory and Critical Care Medicine[12] and in Occupational and Environmental Medicine[13].

(6) Collaboration between the National Institute of Child Health and Development (NICHD) and the Chinese Institutes for Biological Products

The laboratory of Developmental and Immunity (LDMI) at the National Institute of Child Health and Development (NICHD) of the NIH has been doing pioneering work in the area of bacterial vaccines, and in particular in

the area of polysaccharide-based vaccines and conjugate vaccines, where the bacterial polysaccharide is attached to a carrier protein to increase its immunogenicity. For their distinguished contributions in the area of bacterial vaccines and their efforts in disseminating related vaccine technologies to countries in need of these vaccines, scientists at LDMI received numerous awards from global health organizations. Dr. Robbins, the head of LDMI, and Rachel Schneerson, a senior investigator with Dr. Robbins received the most prestigious WHO's Pasteur Award, and the Albert Lasker Award for clinical medical research (1996). Dr. Robbins is also a recipient of the 2001 Albert B. Sabin gold medal. For more than twenty years LDMI has been collaborating with leading Chinese life-science institutions in transferring technologies related to those vaccines to China. Over the years a number of Chinese vaccine researchers spent time at LDMI, in order to train in the techniques developed at LDMI, and conversely, investigators from LDMI traveled to China for further training of their Chinese colleagues, and for further consultations. These long time collaborations and open communication between the two parties resulted in the registration in China of two critical vaccines; the Vi Typhoid Fever Vaccine (Vi) and the Haemophilus influenzae type b vaccine (Hib). While the first is based on a polysaccharide purified from the bacteria cell wall, the latter is a conjugate vaccine where the polysaccharide is linked to a carrier protein.

China has six state operated Institutes of Biological Products which are responsible for providing EPI vaccines to the Chinese population. These Institutes are organized under the umbrella of China National Biotech Corporation (CNBC). The Institutes are located in Changchun, Shanghai, Lanzou, Chengdu, Wuhan and Beijing. The collaboration of LDMI with these Institutes on the Vi vaccine started in 1990 and was led by Dr. Shousun Chen Szu, a researcher at the LDMI under Dr. John Robbins. The NIH recognized the urgency in training and assisting China in the development of this vaccine, as typhoid fever is among the top 10 infectious diseases in China, and the need for this vaccine to be manufactured domestically was extremely important. The NIH also recognized that China had the technological ability and the capacity to manufacture polysaccharide vaccines. Dr. Szu traveled to Lanzou Institute at the province of Duhuang in China, and conducted a training concerning the production the Vi vaccine to a group of scientists from Lanzou, Chengdu and Beijing Institutes. These three institutions later transferred the technology to their sister institutes. Dr. Szu remained in a continuous contact with the Chinese institutions throughout the clinical trials, and the approval by WHO. The summary of the Clinical Trials are provided in two publications[14, 15]. In summary, following Phase I and II clinical trials that demonstrated the safety and the immunogenicity of the vaccine, a placebo controlled, double blinded, randomized phase III study in 73,000 people ages 3 to 50 demonstrated the

locally manufactured Vi to be 69% effective, similar to those reported by the scientists at the NIH. Subsequently, a second efficacy trial including 13,271 people was conducted in high endemic area in Guangxi and similar efficacy was demonstrated. The Vi vaccine was licensed in 1996 in China, and mass immunization in high endemic areas significantly reduced the rate of typhoid fever infection. For her important contribution to the Vi project in China, Dr. Szu received a special recognition award from the province of Duhuang, where the initial training took place.

Following the success of the Vi collaboration, LDMI have assisted Lanzou and other institutions with the development of the Hib vaccine. The transfer of this technology led by Dr. Rachel Schneerson, included in addition to training also assistance in setting up the production laboratory, transfer of biological materials (bacterial strains, carrier protein, and other reagents), establishing serological standards, and further exchange of scientific staff for short term trainings. The vaccine was approved and licensed by the Chinese sFDA on December 26, 2003, and has been put into market in China in October of 2004. It is the first conjugate vaccine registered in China.

Encouraged by the success of Vi and Hib, LDMI/NICHD is continuing to transfer technologies and to collaborate with China through Lanzou Institute on the following vaccines:

1. Vi conjugate vaccine
2. *Shigella* conjugate
3. Salmonella paratyphi A conjugate
4. Cholera conjugate

These vaccines are in various stages of development. A key person in the continuing collaboration on the Chinese side is Dr. Guilin Xie who is now the Director of Lanzou Institute of Biological Products. Dr. Xie spent three (January to April 1997) months at Dr. Robbins' laboratory to train in conjugate vaccine-related techniques. Upon his return to China, he built the conjugate vaccine department in Lanzou Institute for Biological Products (LIBP) and gradually developed projects for the Hib conjugate vaccine, Shiegella Salmonella, paratyphi A and more. Since he went back to Lanzou Dr. Xie has been in continuous contact with his colleagues at LDMI, consulting with them as well as exchanging data and other related information concerning these vaccines.

Another key person in the collaborations between the NICHD and China is Dr. Yong Hong Yang who spent three years at the laboratory of Dr. Robbins, between 1985 and 1988. Upon Dr. Yang's return to China, he established the Laboratory of Microbiology and Immunology in Beijing Children's Hospital, and started to do research in bacterial pathogen (Hib, pneumococcus, GAS, GBS, Staphylococcus and others), and bacterial diseases in children. Since Dr.

Yang's return to China he has been in regular contact with his colleagues at the NICHD. According to Dr. Yang, Dr. Robbins and his colleagues helped him in the following areas 1) assisted in obtaining WHO project for epidemiologic and etiologic study on bacterial meningitis, and especially Hib in Beijing Children's Hospital and Hefei. This project was the first epidemiologic study for Hib (and pneumococcus, meningococcus) in Asia. 2) supported his group's research by providing critical research materials such as antigens, antisera and others, as well as introducing to the lab the techniques for antigen detection and antibody measurement. 3) supporting his projects with advise and joint studies.

(7) Collaborations with NCI in the Area of Natural Products and Cancer Therapeutics

The Bill & Melinda Gates Foundation donated initially $200 million to the Foundation to be distributed to excelling research groups around the world to work on projects that will solve critical problems in global public health.

The National Cancer Institute (NCI) at the NIH instituted a program for anti-cancer drug screening and development through its Developmental Therapeutic Program (DTP, HYPERLINK "http://dtp.nci.nih.gov" http://dtp.nci.nih.gov). This program is offered on a global basis and is free to its participants. Many of the drug candidates sent to the NCI for screening are of natural sources, such as herbal extracts or from microorganisms. A positive screening may lead to a collaborative relationship between the source country organization and the NCI. The collaboration may include basic research related to the drug candidate (chemistry, molecular biology, pharmacology and toxicology) as well clinical trials.

The program has had some good success over the years in discovering promising drug candidates. A standard Memorandum of Understanding (MOU) is signed by the NCI and the source country prior to the screening. The MOU specifies the responsibilities of the parties, their reserved rights, and the handling of IP that may arise. It also specifies the nature of the collaboration that may arise from a positive screening, and emphasizes the obligation of the NCI to share data and information with the source organization. Most importantly, the MOU assures the source organization that in the event the drug is licensed from the NIH by a commercial entity, such license will require licensee to negotiate and enter into an agreement with the source organization, so as to assure that the source organization will be compensated for its contribution. Four Chinese life science organizations have signed MOU agreements with the NIH for this program, including:

- Chinese Academy of Science, Kunming Institute of Botany
- Hong Kong University of Science and Technology (HKusT)
- Peking University, Modern Research Center for Traditional Chinese Medicines
- Chinese Academy of Science, Shanghai Institute of Materia Medica

These MOU agreements may lead to future research collaborations and may provide a vehicle to bridge between the Traditional Chinese Medicine (TCM)

based on herbal formulations, and Western medicine.

In addition to the above, the NCI in collaboration with the University of Texas and Fudan University has established an International Center of Traditional Chinese Medicine for Cancer under an agreement to support research of non-traditional Chinese medical approaches for the next four years as described in the next section.

(8) The National Center for Complementary and Alternative Medicine (NCCAM) and the Promise of Natural Therapeutics

The National Center for Complementary and Alternative Medicine (NCCAM), which is part of the National Institutes of Health (NIH), is the federal government's center for scientific research on Complementary and Alternative Medicine (CAM). Established by congress in 1998, the NCCAM creates and sponsors programs related to CAM. Since China is a world leader in the non-traditional and alternative medicine, collaborations between Chinese institutions and western organization are encouraged under the NCCAM program. NCCAM as part of its mission explores complementary and alternative healing practices through rigorous science. This effort includes supporting carefully selected, designed, and conducted clinical trials of CAM therapies. NCCAM established three Centers of Excellence and two International Centers, and supports a large variety of projects concerned with basic and clinical research. These funded projects cover a broad spectrum of diseases. Many of these projects are performed in collaboration between U.S. organizations and Chinese institutions. A collaborative research proposal is frequently a prerequisite for obtaining the funds.

Following are some of the highlights regarding the activities of NCCAM: NCCAM supports eleven Phase I planning grants, jointly supported by the NCI, for global collaboration and cross-cultural exchanges on research into CAM approaches that have emerged from traditional indigenous medical systems. The project of International Center of Traditional Chinese Medicine (TCM) for Cancer, for instance, is led by Dr. Cohen of the Anderson Cancer Center at the University of Texas, which is collaborating with the Cancer Hospital at Fudan University (CHFU) in Shanghai to evaluate and establish three areas of research. The three programs that will be developed include: 1) evaluating herbal and natural product treatments that target disease outcomes and treatment- and disease-related symptoms; 2) determining the effects of acupuncture on specific clinical symptoms in patients with cancer; and 3) examining the bio-behavioral effects of qigong and other mind/body-based interventions in patients with cancer.

Additionally, the following projects are worth noting: The following projects

- Mount Sinai School of Medicine and Shenyang Pharmaceutical University

are working on evaluating the therapeutic effect of boswellin in prostate cancer.

- The University of Maryland Center for Integrative Medicine, the Chinese University of Hong Kong, and the University of Illinois at Chicago Program for Collaborative Research in the Pharmaceutical Sciences supporting three projects on irritable bowel syndrome (IBS), some already in Phase I and II clinical trials.
- Columbia University Health Sciences in collaboration with the International Center for Traditional Chinese Medicine and Women's Health at Fudan University utilizing a Phase I planning grant for initiating basic and clinical research of traditional Chinese medicine for women's health conditions.

Additional examples of programs currently supported can be found at http://nccam.nih.gov/research/oihr/activity.htm . The reader interested in establishing collaborative efforts regarding this area of complementary and alternative medicine is urged to visit the site.

Of particular note is the most recent donation of £3.5 million worth of high-powered sequencing machines to Beijing Genomics Institute (BGI) to carry out and contribute to a collaborative research led by Washington University in the U.S.

(9) Licensing of rotavirus vaccine technology from the NIH

In its efforts to transfer technologies related to neglected disease to developing counties, the Office of Technology Transfer (OTT) at the NIH in 2005 licensed a new rotavirus vaccine technology from the laboratory of Dr. Albert Kapikian at NIAID, to the Chengdu Institute of Biological Products and to the Wuhan Institute of Biological Products. As mentioned above, these two institutions along with four other similar institutions are the main providers of vaccines to the Chinese CDC. The licensed technology is based on reassortant viruses composed of bovine rotavirus backbone and the human VP7 immunogenic protein. The vaccine developed by this technology will include multiple serotypes of rotavirus in order to get full protection against rotavirus infection and will be administered to infants. Rotavirus infection causes severe diarrhea in children and result in death of 500,000 children worldwide every year, most of the deaths occur in developing countries.

In addition to the licensing of the intellectual property, the NIH is providing the two Chinese institutions with all the seed viruses, antibodies, cell lines and other reagents required for the project. Dr. Kapikian and his staff will continue supporting the Chinese efforts throughout the development process and the clinical trials and will host investigators from these two institutions for initial training.

The dialogue with the two Chinese institutions started in October 2003 at the first Rotavirus Vaccine Workshop in China, organized by China CDC and the U.S. CDC (Dr. Roger Glass). At this workshop Dr. Yonghong Ge, the deputy director of Chengdu, and Dr. Xiaoming Yang, the deputy director of Wuhan, initiated discussions with Dr. Kapikian regarding the technology, and expressed

interest in licensing it. It should be noted that Dr. Yang has spent five years at the NIH as a visiting fellow, working in the area of pertussis toxin, before returning to China to take the position of deputy director at Wuhan, and has since maintained contact with several laboratories in the NIH, including this of Dr. Kapikian. Dr. Yang has expressed his desire to collaborate with the NIH in the near future, in other areas related to vaccines for infectious diseases.

(10) Informal Collaborations between individual investigators

Dr. Yun-Bo Shi is a senior investigator at the Laboratory of Gene Regulation and Development at NICHD, NIH. He is a graduate of Wuhan University in China and received his PhD from UC Berkley. Dr. Shi is a frequent visitor to his native country. In his visits to China he discusses science with his old colleagues and in particular with one of his college classmates Dr. Dai-Wen Pang, now a professor at the College of Chemistry and Molecular Sciences, State Key Laboratory of Virology, Wuhan University. In one of his last visits, Dr. Pang discussed with Dr. Shi his latest work related to magnetic nanospheres. Dr. Shi offered some suggestions regarding possible applications of these nanospheres in biomedical research. Encouraged by this promising technology, Dr. Shi upon his return to the U.S., initiated some work in collaboration with Dr. Pangs and his group directed at demonstrating the utility of these novel particles in a number of biomedical applications, including visual sorting and manipulation of apoptotic cells. The results of this collaborative research are summarized in a joint paper published in June 2005 in the British journal, Chemical Communications[16]. Due to the potential commercial value of the novel nanoparticles, a patent application was filed in China and the U.S., naming Wuhan University and the NIH investigators as joint inventors. There are plans to license the technology to commercial entities where both the NIH and Wuhan will share the revenues from the royalties of such commercial license agreements.

In addition to the licensing of the intellectual property, the NIH is providing the two Chinese institutions with all the seed viruses, antibodies, cell lines and other reagents required for the project.

In addition to his ongoing collaboration with Dr. Pang, Dr. Shi recently started collaboration with a professor in the College of Life Sciences at Wuhan. This new collaboration involves the study of gene regulation and function during mammalian development.

A collaboration between Hong Kong University-Pasteur Research Centre (HKU-PRC) led by Dr. Ralf Altmeyer, and Drs. Kanta Subbarao and Anjeanette Roberts from the Laboratory of Infectious Diseases (LID) at the National Institute of Allergy and Infectious Diseases (NIAID), NIH resulted in a potential vaccine candidate against SARS. The vaccine was initially developed by HKU-PRC who approached the LID investigators requesting them to evaluate the vaccine in their hamster model. The results of this collaboration were presented in June 2005 at the Nidovirus Conference in Colorado Spring and are going to be published soon. In addition, due to the commercial value of the

invention, the parties have filed a patent application and will enter an agreement regarding the licensing of the technology to commercial entities.

(11) Fogarty International Grants

The Fogarty International Center (FIC) is the international component of the NIH. The center addresses global health challenges through innovative and collaborative research and training programs and supports and advances the NIH mission through international partnerships. FIC has been a critical component of NIH research efforts since 1968. It is named after Congressman John E. Fogarty who understood that "just as disease knows no boundaries, so also the benefits of medical research and indeed research itself can know no boundaries." FIC promotes its mission of international collaborations through international research grants, training grants, and fellowships. Applications for training grants have to be submitted jointly by the host institution in the U.S. and its Chinese counterpart. Application for research collaboration grants have to be submitted jointly by the Chinese organization that seeks the grant and the appropriate NIH group or other organization as the collaborative partner. In many cases the grant application is based on some previous relationship between the two partners.

Under grants from the National Institute for Occupational Safety and Health (NIOSH), a component of the Center of Disease Control and Prevention (CDC), Dr. Christiani has led a 20-year study of respiratory disease in cotton-textile workers in Shanghai, China.

International Training Grants are offered through a large variety of programs, including the ones listed below:

- AIDS International Training and Research Program
- Global Infectious Disease Research Training Program
- Informatics Training for Global Health
- International Bioethics Education and Career Development Award
- International Clinical, Operational and Health Services Research Training Award (ICOHRTA)
- International Clinical, Operational and Health Services Research Training Award for Aids and Tuberculosis (ICOHRTA-AIDS/TB)
- International Collaborative Genetics Research Training Program (in collaboration with multiple NIH partners and the World Health Organization (WHO)
- International Maternal and Child Health Research and Training Program
- International Training and Research Program in Environmental and Occupational Health
- International Training and Research Program in Population and Health

International Research Grants are offered through the programs listed below:

- Brain Disorders in the Developing Word: Research Across the Lifespan
- Ecology and Infectious Diseases Initiative
- Fogarty International Research Collaboration Award (FIRCA)
- Global Health Research Initiative Program for New Foreign Investigators

(GRIP)
- Health, Environment and Economic Development (HEED)
- International Cooperative Biodiversity Groups (ICBG)
- International Studies on Health and Economic Development
- International Tobacco and Health Research and Capacity Building Program
- Stigma and Global Health Research Program

Fellowship and Other Opportunities. This program award grants to post-doctoral fellows at the NIH or for visiting investigators from foreign countries. In many instances it has enhanced collaborations and communications, in particular when the foreign fellow goes back to his/her country and continues maintain relationship with his western colleagues.

The following lists the programs under this category:
- International Research Scientists Development award
- Fogarty-Ellison Oversees Fellowship in Global Health and Clinical Research
- U.S. Civilian Research & Development Foundation (CRDF)
- Human Frontier Science Program (HFSP)
- NIH Visiting Program (VP). Each year, more than 2,700 scientists from other nations conduct collaborative research at the NIH. Candidates under this program are invited to participate by senior NIH scientists, based on the research need of the host laboratory. There are two categories of VP participants: visiting fellows, who receive awards for research training, and visiting scientists, who receive appointments to conduct research.
- Guest Researcher and Special Volunteer Programs
- NIH Research Grant and Contract Awards. The grant is awarded for collaborative research projects grants in support of specified needs and specified by the funding institution at the NIH.
- National Research Service Award for Individual Postdoctoral Fellows
- National Research Service Award for U.S. Senior Fellows. These awards are provided to senior U.S. scientists who in most cases wish to travel to a foreign country and work in the foreign country facilities. Its purpose is also to enhance communications and collaborations with foreign countries. These grants include covering some of the expenses of the foreign laboratory.

All the programs offered by the FIC and supported by the different institutes at the NIH have been major contributing factors in the promotion international collaboration and communication in biomedical research. Many Chinese scientists have used these programs over the years, thus contributing to productive collaborations and scientific exchange between the U.S. and China. For example, in November 30, 2004 the Fogarty International Center announced an international grant award of $12 million for 5 years to help build greater medical research and training in four developing nations; among them is

China. In particular these grants are funneled into AIDS and TB research, under the International Clinical, Operational and Health Services Research Training Award Program for Aids and Tuberculosis which was mentioned above (ICOHRTA-AIDS/TB). The grant through FIC is co-sponsored by 9 NIH institutes, the United States Agency for International Development (USAID) and the CDC. The Chinese recipient of this grant is Dr. Zunyon Wu of the Chinese CDC in Beijing. Under this grant Dr. Wu collaborates with Dr Roger Detels of UCLA, to implement a research training program that addresses HIV/AIDS epidemic in China. The project will set up an independent HIV/AIDS training center at the Chinese CDC. The center will assist other academic and research institutions in China in training health professionals and researchers to fight the HIV/AIDS epidemic.

Over the years a number of Chinese vaccine researchers spent time at LDMI, in order to train in the techniques developed at LDMI

It should be noted in this section that that approximately 46% (2,700 of 5,900 in total) of the NIH doctoral-level staff are from foreign nations and 58% (2,200 of 3,780 in totals) of the postdoctoral/research/clinical fellows are also from foreign countries. Foreign scientists at the NIH contribute at all levels, including Graduate Students, Postdoctoral Visiting Fellows (up to 5 years permitted), Research or Clinical Fellows (permitted for up to 8 years), Staff Scientists and Staff Clinicians (collaborating on basic research or clinical research on long term basis), Tenure-Track Investigators being evaluated for permanent status, and finally tenured Senior Investigators, upon whom NIH has conferred a long term commitment of resources as independent research scientists. The foreign scientists at the NIH represent 95 countries. The following Table provides information related to the categories of foreign scientists at the NIH as per the end of 2004.

China is leading the list with respect to foreign scientists working at the NIH. The Table below provides the list of the top ten countries of NIH foreign scientists as per the end of 2004.

National Institute of Health	
Categories of Foreign Scientists	
Visiting Fellows (postdoctoral)	1,838
Temporary Employees FTE)	707
Unpaid (by NIH) Guests/Volunteers	187
Exchange Scientists	24
Other	17

National Institute of Health	
Top Ten Countries of NIH Foreign Scientists	
China (PRC)	407
Japan	363
Korea	291
India	240
Italy	138
Germany	120
Canada	111
Russia	105
France	102
United Kingdom	98

15. Conclusion

In recent years it has become recognized that research collaborations between Chinese and Western investigators are key to the enhancement and the expeditious development of innovative drugs, vaccines and diagnostics for use in China and other developing countries, and thus collaborations are critical for the advancement of global health. In many ways, the two cultures complement each other in their approaches to the development of new medicines, and furthermore, collaborations between the two are important for creating a bridge between complementary and alternative medicines based on natural products and holistic approach, and the traditional western medicine, and thus for creating new exciting opportunities in drug development.

The liberalization of China, its notable economic growth and entrepreneurial spirit of the last thirty years have created a climate where these collaborations have become possible and strongly supported by both the Chinese government and Western governments, in particular the U.S.A. Some of these collaborations have been initiated at the government level, and others have been initiated by individual laboratories or individual investigators with common and synergistic research interests. The latter have been benefited from the freedom of Chinese scientists to travel to the west for training, and from their freedom to participate in international conferences and thus to interact with western investigators. Furthermore, research collaborations in the medical field have now been established between commercial organizations. The need for collaborations has received a push from the recognition that improved global health is a key to the welfare of the world, and that western scientists thus have social responsibility to assist the development countries with their medical needs.

The Vi vaccine was licensed in 1996 in China, and mass immunization in high endemic areas significantly reduced the rate of typhoid fever infection.

The U.S. government through the agencies of HHS, such as the NIH and CDC has played a pivotal role in encouraging and facilitating collaborations in the medical fields. The NIH and CDC through their different components and functions offer large variety of programs to facilitate and support collaborations. These programs include financial support to Chinese life-science organizations and to the Chinese CDC, for health projects of critical importance, as well as the transfer of technologies to China via a variety of mechanisms as described above. In addition, these two government agencies encourage and provide incentives to NIH scientists and its laboratories to enter collaborations with Chinese institutions through either CRADAs (Collaborative Research and Development Agreement) or other formal or informal collaborations.

The goal of this chapter is to provide information and guidance to potential collaborators. It is hoped that the information provided in the chapter will contribute to the enhanced interest in establishing research collaborations, which are so critical for innovation and for the improvement in global public health.

References

1. "China, United States Share Long History for Science Cooperation", Washington File, U.S. Department of State http://usinfo.state.gov .
2. "Beijing Cleans Air for 2008 Olympics with U.S. Help", http://usinfo.stste.gov/xarchives/display.html?.
3. "U.S.-China Cooperation on HIV/AIDS", U.S. Embassy in China, http://usembassy-china.org.cn .
4. The Bayh-Dole Act of December 1980 is the most important technology transfer legislation that laid the foundation for federal laboratories' patenting and licensing as well as provided the NIH grantees with incentives to patent and license themselves. Public Law 96-517, *the Patent and Trademark Amendment.* See 35 USC 200-212.
5. Series of legislation that started in September 1980 with the Stevenson-Wydler Technology Innovation Act, Public Law 96-480, 15 USC 3710, and included the Bayh-Dole Act, as well as the Federal Technology Transfer Act (FTTA) of 1986, and several amendments.
6. "U.S. launches new initiatives to help China combat HIV/AIDS", Washington File, EPF206 07/23/2002, http://canberra.usembassy.gov/hyper/2002/0723/epf206
7. Communication from VRC at the NIH.
8. Communication from the Respiratory Disease Branch (RDB) at DMID/NIAID/NIH.
9. *National Geographic,* October 2005 issue pp 2-31.
10. Xu et al., "Single-nucleotide Polymorphisms of the KCNS3 Gene are Significantly Associated with Airway Hyper Responsiveness", *Human Genetics* (2005) 116: 378-383.
11. Xu et al., "A Genome-wide Search for Quantitative-trait Loci Underlying Asthma", *American. Journal of Human Genetics,* 69:1271-1277, 2001.
12. Christiani et al., "Longitudinal Changes in Pulmonary Function and Respiratory Symptoms in Cotton Textile Workers: a 15- year Follow-up Study", *American Journal of Respiratory and Critical Care Medicine 2001;* 163:847-853.
13. Christiani, et al., "Respiratory symptoms and cotton dust exposure – Results of 15-year Follow up Observation", *Occupational Environmental Medicine* 60(12): 935-41, 2003.
14. Yang, et al., "Efficacy trial of Vi polysaccharide vaccine against typhoid fever in Southwestern China", *Bulletin of the World Health Organization 2001,* 79(7).
15. Yang, et al., "A Mass Vaccination Campaign Targeting Adults and Children to Prevent Typhoid Fever in Hechi; Expanding the Use of Vi Polysaccharide Vaccine in Southeast China: A Cluster-Randomized Trial", BMC Public Health 2005, 5: 49.
16. Wang, et al., "Biofunctionalization of Fluorescent-magnetic-bifunctional Nanospheres and their Applications", *Chemical Communications,* 2005, 4276-4278.

A

Appendix A

Collaboration between the NIH and China

(by Institutes)

Agreements:

HHS - Chinese Ministry of Health MOU on HIV/AIDS

Agreement between the Department of Health and Human Services (HHS) and the Ministry of Health of the People's Republic of China signed in 2002 to cooperate in the fields of AIDS prevention, research, treatment, and care.

U.S. - China Public Health Agreement

Agreement between HHS and the Ministry of Public Health of the People's Republic of China to facilitate cooperation in disease control and prevention, public health protection, biomedical research, health services and health policy research, and health administration and finance. In the biomedical research area, NIH participates in exchange of scientists, joint seminars and meetings, and joint research projects.

U.S. - China Science and Technology Agreement

Science and Technology Agreement between the United States and China signed in 1991 and extended subsequently to provide intellectual property rights provisions and to determine the allocation of rights to any discoveries that may derive from cooperation in scientific research and provides for an annual review of major areas of scientific cooperation between the United States and China.

NIH - Chinese Academy of Sciences Agreement

Since 1983, NIH has had an agreement with the Chinese Academy of Sciences (CAS) for cooperation in the basic biomedical sciences. The Fogarty International Center serves as Executive Agent for the U.S. and the Bureau of Foreign Affairs, CAS, for the Chinese.

NIAAA - Beijing University Letter of Intent

Letter of Intent between the National Institute on Alcohol Abuse and Alcoholism and Beijing University signed in 2004 for cooperation in alcohol abuse research.

NIH Intramural Activities:

There are currently 400 Chinese scientists working in NIH intramural laboratories (includes Visiting Fellows, Visiting Scientists, Volunteers, Exchange Scientists, and those under Professional Services Contracts).

NIH Extramural Activities

NHLBI: ***National Heart, Lung, and Blood Institute***

The Tulane School of Public Health and the Chinese Academy of Medical Sciences are conducting a genetic epidemiological study of a blood pressure intervention. *Fiscal Years 2002-2005*

Harvard School of Public Health and Anhui University are conducting a genome-wide search for loci associated with metabolic syndrome. *Fiscal Years 2003-2007*

Vanderbilt University and Shanghai Cancer Center are evaluating the association between soy food consumption and coronary heart disease. *Fiscal Years 2005-2009*

NIAID: ***National Institute of Allergy and Infectious Diseases***

The Chinese Academy of Preventive Medicine is studying the genetic diversity of emerging helminthiases in China. *Fiscal Years 1997-2006*

The University of California, Berkeley and the Sichuan Institute of Parasitic Disease are collaborating on a project involving the use of remote sensing technology to detect ecological changes that alter the habitat of the snails that transmit schistosomiasis to humans. *Fiscal Years 2002-2006*

The National Center for AIDS/STD Prevention and Control is building capacity to support their Integrated Program for Research on AIDS. *Fiscal Years 2002-2007*

Vanderbilt University Medical Center and Shanghai Cancer Institute are examining dietary antioxidants in relation to the incidence of adult-onset asthma. *Fiscal Years 2003-2007*

Massachusetts General Hospital and the National Center for AIDS/STD Control and Prevention have a contract to collaborate on HLA typing and epitope mapping relative to HIV vaccine design. *Fiscal Years 2003-2007*

The University of Washington and the National Institute of Health Education are studying HIV-related beliefs among female sex workers in China. *Fiscal Years 2004-2007*

Baylor College of Medicine and the Institute for Viral Disease Control and Prevention are collaborating on SARS research under the Viral Respiratory Pathogens Research Unit Contract. *Fiscal Years 2004-2008*

The University of California at San Francisco and the Chinese Center for Disease Control and Prevention are conducting clinical trials to treat pelvic inflammatory disease. *Fiscal Years 2004-2010*

The Institute of Materia Medica is developing a peptide-based vaccine for SARS. Fiscal Years 2005-2009

The Chinese Institute for Viral Disease Control and Prevention is conducting a pilot study of HIV voluntary counseling and testing among high-risk women in China. *Fiscal Years 2005-2006*

Xinjiang Veterinary Research Institute is developing a vaccine candidate against E. granulosus in dogs to prevent transmission to humans. *Fiscal Years 2005-2007*

Vanderbilt University and China's Ministry of Health and Centers for Disease Control and Prevention are developing more accurate methods to estimate the prevalence of HIV in China. *Fiscal Years 2005-2006*

The University of Washington and Jinan University are studying genetic polymorphisms and their protective roles against HIV-1 infection. *Fiscal Years 2005-2007*

The National Center for AIDS Prevention and Control is developing two molecular virology and neutralizing antibody laboratories as part of China's Integrated Program for Research on AIDS. *Fiscal Years 2005-2006*

NCCAM: ***National Center for Complementary and Alternative Medicine***

Mount Sinai School of Medicine and Shenyang Pharmaceutical University are evaluating the therapeutic effect of boswellin in prostate cancer. *Fiscal Years 2004-2005*

NCI: ***National Cancer Institute***

The University of Southern California and the Shanghai Cancer Institute are studying dietary factors in the etiology of colorectal cancer. *Fiscal Years 2004-2008*

Vanderbilt University and Shanghai Cancer Institute are conducting a study of cancer risk reduction and diet in a cohort of women. *Fiscal Years 1996-2007*

The Chinese Academy of Medical Sciences is developing methods for the early detection of esophageal cancer. *Fiscal Years 1999-2008*

The Chinese Academy of Sciences is conducting nutrition intervention trials in Linxian. *Fiscal Years 1999-2008*

University of Wisconsin is collaborating with scientists at two Chinese cancer clinics and four hospitals in Vietnam to conduct a phase III randomized controlled trial of treatments to improve prognosis in women with pre-menopausal breast cancer. *Fiscal Years 1998-2005*

Vanderbilt University Medical Center and the Shanghai Cancer Institute are researching the relationship between soy food, gene polymorphisms, and endometrial cancer risk. *Fiscal Years 2001-2005*

Vanderbilt University Medical Center and the Shanghai Cancer Institute are performing a cohort study of cancer-inhibitory dietary factors in men. *Fiscal Years 2001-2005*

Vanderbilt University and the Shanghai Cancer Institute are continuing studies on breast cancer. *Fiscal Year 2001-2005*

Westat, Inc. and the Chinese Academy of Preventative Medicine are performing interdisciplinary studies of occupational and environmental cancer. *Fiscal Years 2002-2006*

USC/Norris Comprehensive Cancer Center and the Shanghai Cancer Institute are examining dietary factors in the etiology of cancer in Shanghai. *Fiscal Years 2002-2007*

Fox Chase Cancer Center and the Anti-Epidemic Station are studying the molecular epidemiology of hepatocellular carcinoma. *Fiscal Years 2002-2007*

Vanderbilt University and Shanghai Cancer Institute are examining cancer risk reduction through diet in a cohort of women. *Fiscal Years 2003-2007*

Texas Tech University and Guangxi Cancer Institute are studying the chemopreventive efficacy of green tea polyphenol on liver cancer. *Fiscal Years 2003-2007*

The University of Southern California, the Qingdao Sanitation and Anti-Epidemic Station, the Wuhan Public Health and Anti-Epidemic Station, and the Chengdu Center for Disease Control are studying environment and tobacco use across cultures. *Fiscal Years 2004-2008*

Johns Hopkins University and Sun Yat-Sen University are examining gene to gene interactions in nasopharyngeal carcinoma. *Fiscal Years 2004-2005*

The Chinese Environmental Monitoring Study conducting a study of non-smoking women in an area of China with high lung cancer incidence to identify genetic and environmental causes. *Fiscal Year 2005*

The University of Texas and Fudan University are establishing an International Center of Traditional Chinese Medicine for Cancer. *Fiscal Years 2005-2008*

NIDA: ***National Institute on Drug Abuse***

ABT Associates, Inc. and the Giangxi Center for HIV/AIDS Prevention and Control are working to prevent the spread of HIV across the border between China and Vietnam. *Fiscal Years 2002-2006*

Johns Hopkins University and the Guangxi Hygiene and Anti-Epidemic Center are studying the implications of HIV in low HCV clearance in Chinese drug users. *Fiscal Years 2003-2007*

Johns Hopkins University and Yunnan University are studying cardiovascular complications in HIV-infected methamphetamine users. *Fiscal Years 2004-2005*

Georgetown University and the China Center for Reproductive Health Technical Instructions and Training are examining drug use and HIV risk behaviors among Chinese male migrants. *Fiscal Years 2004-2005*

Children's Hospital of Philadelphia and Wuhan Centers for Disease Control and Prevention are studying the effects of opiate withdrawal on the progression of HIV and hepatitis C virus. *Fiscal Years 2004-2006*

The University of Southern California and the Chengdu Center for Disease Control and Prevention are examining substance abuse and HIV risk behaviors among rural migrants who relocate to urban areas. *Fiscal Years 2004-2006*

Columbia University Medical Center and Beijing University of Chinese Medicine are investigating links between post-traumatic stress disorder and substance abuse in young people. *Fiscal Years 2004-2006*

The University of California at Los Angeles and the Wuhan Center for Disease Control and Prevention are identifying HIV risk determinants among heroin users who are exiting detoxification programs. *Fiscal Years 2004-2005*

The University of Southern California, the Kunming Institute for Health Education, the Wuhan Center for Disease Control and Prevention, the Qingdao Municipal Centers for Disease Control and Prevention are assessing drug abuse-related implicit cognitions in youth at different acculturation levels. *Fiscal Years 2004-2005*

Johns Hopkins University and the Guangxi Center for HIV/AIDS/STDs Prevention and Control are characterizing the cognitive consequences of endocrine dysfunction in injection drug users. *Fiscal Years 2005-2007*

Johns Hopkins University and the Chinese Institute for Viral Disease Control and Prevention are conducting an exploratory study to estimate the incidence of HIV among men who have sex with men in China. *Fiscal Years 2005-2006*

NIEHS: ***National Institute of Environmental Health Sciences***

The University of California, Berkeley and the Chinese Academy of Preventive Medicine in Shanghai are collaborating to study toxic substances in the environment and their effect on sperm and semen quality. *Fiscal Years 2000-2005*

Johns Hopkins University and the Shanghai Cancer Institute are identifying the molecular biomarkers for environmental carcinogens. *Fiscal Years 2002-2007*

Harvard School of Public Health, Anhui Medical University and Peking University Medical Science Center are studying the links between genes, pesticides, and reproductive health. *Fiscal Years 2003-2006*

The University of California and the Chinese Centers for Disease Control and Prevention are environmental toxins that are determinants for chromosomally defective sperm. *Fiscal Years 2004-2005*

Texas A&M University and Peking University are conducting an epidemiological study of the environmental determinants of neural tube defects. *Fiscal Years 2005-2009*

NICHD: ***National Institute of Child Health and Human Development***

The University of North Carolina and the Institute of Nutrition and Food Hygiene, Beijing are monitoring the health, reproduction, and aging aspects of social change. *Fiscal Years 2000-2007*

Michigan State University and the Wolong Nature Reserve (the largest reserve for endangered giant pandas) are studying the relationships between human population and the environment. *Fiscal Years 2001-2005*

The University of Utah and the Tibet Medical College are developing a self-sustaining perinatal care system for Tibet/Global Network for Women's and Children's Health Research. *Fiscal Years 2001-2005*

The University of Alabama at Birmingham and Nanjing University are studying involuntary migration associated with the Three Gorges Dam. *Fiscal Years 2002-2006*

The University of California at San Diego and the Zhejiang Institute of Science and Technology are examining the development of face processing expertise in children. *Fiscal Years 2004-2008*

Indiana University and East China Normal University are identifying cognitive determinants of mild mental retardation. *Fiscal Years 2004-2005*

Children's Memorial Hospital and Anhui Medical University are studying the etiology of metabolic syndrome in children. *Fiscal Years 2004-2008*

Children's Memorial Hospital of Chicago and Harbin Medical University are elucidating the precursors of metabolic syndrome in children and adolescents. *Fiscal Years 2005-2009*

The University of California at San Diego and Zhejiang Normal University are comparing children's conceptions of lying in North America and East Asia. *Fiscal Years 2005*

NIDCR: ***National Institute of Dental and Craniofacial Research***

The University of California and Peking Union Medical College Hospital are collaborating on an international research registry network for Sjogen's Syndrome. *Fiscal Years 2003-2007*

Johns Hopkins University, Peking University, and Peking Union Medical College are identifying genes that cause oral clefts. *Fiscal Years 2004-2008*

NEI: ***National Eye Institute***

The University of Nebraska and the Sichuan Provincial People's Hospital are studying protein-thiol mixed disulfide in cataractogenesis. *Fiscal Years 2003-2006*

NIA: ***National Institute on Aging***

The University of Utah and the University of Science and Technology of China are studying the degradation of the cortical function in monkeys. *Fiscal Years 2002-2007*

Indiana University and the Chinese Academy of Preventive Medicine are studying selenium levels and cognitive decline in rural elderly Chinese. *Fiscal Years 2003-2007*

Research Triangle Institute and Peking Union Medical College Hospital are examining the incidence and risk factors of dementia. *Fiscal Years 2004-2005*

Duke University and Peking University are identifying determinants of longevity in China's oldest old. *Fiscal Years 2004-2008*

NIDCD: ***National Institute of Deafness and Other Communication Disorders***

The University of Chicago and the Affiliated Hospital of Nanjing Medical University and are studying spontaneous sign systems in four cultures. Fiscal Years 2001-2005

Children's Hospital Medical Center and the Chinese PLA General Hospital are studying the molecular mechanism of aminoglycoside ototoxicity, a disease that can cause severe hearing loss. Fiscal Years 2002-2007

Ohio State University and Chinese University of Hong Kong are conducting a cross-language investigation of phonological developments. Fiscal Years 2003-2007

Ohio University and Beijing Tongren University are investigating tone development in Mandarin-speaking children with cochlear implants. Fiscal Years 2005-2007

NIMH: ***National Institute of Mental Health***

The University of California at Los Angeles and the Chinese Center for Disease Control and Prevention are assessing a public opinion leader intervention to prevent the spread of HIV. *Fiscal Years 1999-2006*

Massachusetts Mental Health Center and the Institute of Mental Health are conducting a genetic linkage study of schizophrenia. *Fiscal Years 2002-2006*

UCLA Neuropsychiatric Institute and the China Center for Disease Control and Prevention are evaluating HIV-related stigma among service providers in China. *Fiscal Years 2003-2005*

The University of Illinois and Beijing Normal University are studying the roles of self-construal in well being. *Fiscal Years 2004-2008*

The University of California at San Francisco and the Shanghai Institute of Social Sciences are identifying the cultural, social, and structural factors that contribute to the low rates of voluntary blood donation in China. *Fiscal Years 2005-2006*

The University of California at Berkeley and Peking University are investigating observed differences in East Asians and European-Americans in mental health and emotional well-being, which may be due to differences in dialectical thinking. *Fiscal Years 2005-2006*

NINDS: ***National Institute of Neurological Disorders and Stroke***

The University of California at Los Angeles and Fu Wai Hospital are assessing the role of magnesium in acute stroke. *Fiscal Years 2002-2007*

NIDDK: ***National Institutes of Diabetes and Digestive and Kidney Diseases***

Tufts University and the Chinese Academy of Preventive Medicine are studying the retinal equivalence of plant carotenoids in children. *Fiscal Years 2003-2006*

The University of Chicago and the Shanghai Diabetes Institute are part of a consortium studying Type 2 Diabetes. *Fiscal Years 2004-2008*

Vanderbilt University and Sichuan Center for Disease Control and Prevention are determining the health effects of selenium deficiency. *Fiscal Years 2005-2008*

NIAAA: ***National Institute on Alcohol Abuse and Alcoholism***

The Center for Psychiatric Rehabilitation, the Chinese Academy of Sciences, Beijing Normal University, and Hong Kong Polytechnic University are examining stigma and behavioral health in urban employers. *Fiscal Years 2003-2007*

FIC: ***Fogarty International Center***

A Fogarty International Research Collaboration Award (FIRCA) awarded to the Georgia Institute of R+ Technology and the Chinese Academy of Science to conduct a kinetic analysis of PSGL-1 molecule. *Fiscal Years 2002-2005*

Under an International Tobacco and Health Research and Capacity Building Program (Tobacco Award), to the University of California at Berkeley and Fudan University are involved in tobacco control policy analysis and intervention evaluation. *Fiscal Years 2002-2007*

Global Health Research Initiative Program for New Foreign Investigators (GRIP Award) to the University of Hong Kong to study mitotic checkpoint and genomic stability in ovarian cancer. *Fiscal Years 2002-2006*

GRIP Award to the Chinese Center for Disease Control and Prevention to conduct a childhood obesity survey. *Fiscal Years 2002-2006*

Tobacco Award to Johns Hopkins University and the Chinese Academy of Preventive Medicine to conduct epidemiology and intervention research for tobacco control. *Fiscal Years 2002-2006*

AIDS FIRCA Award to Georgetown University and Peking University First Hospital to examine two-component signaling in candidasis and aspergillosis. *Fiscal Years 2003-2005*

FIRCA Award to Wake Forest University and Peking University to study sensorimotor processes. *Fiscal Years 2003-2005*

FIRCA Award to Mount Sinai School of Medicine and Hebei Medical University to study protein kinase C-dependent inhibition of Kir channels. *Fiscal Years 2003-2005*

Stigma and Global Health Research Program (Stigma) award to West Virginia University Research Corporation and Beijing Normal University to study social stigma and mental health symptoms among migrant workers. *Fiscal Years 2003-2005*

Brain Disorders in the Developing World (Brain Disorders) award to Johns Hopkins University and Peking University to conduct epidemiological research on autism in China. *Fiscal Years 2003-2005*

Brain Disorders award to Zhejiang University to study cognitive-brain phenotyping of atypical Chinese children. *Fiscal Years 2003-2005*

AIDS FIRCA to Indiana University and Chinese Center for Disease Control and Prevention to investigate the mechanisms of host response in gonorrhea. *Fiscal Years 2004-2006*

Roswell Park Cancer Institute and Southeast University Medical School are collaborating on studies of hepatocellular carcinoma. *Fiscal Years 2004-2006*

FIRCA Award to Brigham and Women's Hospital and Fudan University to examine pathways that mediate behavioral responses to pain. *Fiscal Years 2004-2006*

GRIP Award made to Nankai University to investigate the interaction of interferon and Kaposi's sarcoma herpesvirus. *Fiscal Years 2005-2008*

Support given to Chinese scientists under the International Collaborative Genetics Research Training Program at Johns Hopkins University to build a critical mass of scientists, health professionals and academics with human genetics expertise and a sustainable research environment.

Support given to Chinese scientists under the International Training and Research in Population and Health Programs at the University of North Carolina at Chapel Hill, the University of Michigan Population Studies Center, the University of Virginia to study issues such as the reproductive processes, contraceptive development, contraceptive and reproductive evaluation, reproductive epidemiology, and social and behavioral factors that influence population dynamics.

Support given to Chinese scientists under the AIDS International Training and Research Program (AITRP) at UCLA, the University of California at Berkeley, Yale University, the University of North Carolina, Johns Hopkins University, and the University of Alabama at Birmingham to build multi-disciplinary biomedical and behavioral research capacity for the prevention of HIV/AIDS-related infections and for the integration of prevention with therapy and care for those adults and children affected by HIV/AIDS.

Support given to Chinese scientists under the International Training and Research Program in Environmental and Occupational Health (ITREOH) at the California Department of Health Services for training in areas such as cancer epidemiology, toxicology, occupational medicine, and environmental epidemiology.

Support given to Chinese scientists under the International Bioethics Education and Career Development Award Program at Peking University Health Science Center to work with collaborators from the University of Chicago, Yale University, the University of California San Francisco, and the University of Minnesota on a two-year planning program. The project will focus on development of a postdoctoral bioethics training program for participants in China who hold advanced degrees in the life sciences or medicine.

Support given to Chinese scientists under the International Maternal and Child Health Research and Training Program (IMCHRT) at the Harvard School of Public Health to increase expertise of scientists in developing countries in maternal and child health related biomedical, behavioral, and prevention research.

Under the Ecology of Infectious Disease Initiative, investigators from the University of Salford (UK), together with investigators in China, France, Ireland, Japan, and the United States, study the transmission of human alveolar echinococcosis (a highly pathogenic disease resulting from infection by a tapeworm) in farming communities in China. The project aims to develop predictive models of relative risk to humans of this and other parasitic diseases in relation to animal husbandry and land-use practices, including deforestation.

Support given to Chinese scientists under the International Clinical, Operational, and Health Services Research and Training Award for AIDS and Tuberculosis (ICOHRTA) at the University of Rochester for training in suicide research; at Stanford University for training in aging research; and Harvard University for training in mental health research.

Support given to Chinese scientists under an ICOHRTA-AIDS/TB at the Chinese Center for Disease Control and Prevention for training in integrated clinical, operational, and health services research across the full range of conditions and issues that relate to care of adult and pediatric patients with HIV/AIDS or TB (e.g., opportunistic infections, HIV malignancies, neurological and mental health consequences, behavioral issues, cardiovascular disease, hematologic conditions, blood safety issues, pulmonary manifestations, ophthalmologic manifestations, gastrointestinal conditions, drug and alcohol usage, gender-related issues and oral health manifestations).

Under the Health, Environment and Economic Development (HEED) program, Resources for the Future and the Chinese Research Academy of Environmental Sciences are utilizing an on-going project commissioned by the Asian Development Bank to implement tradable emissions permits in a heavily polluted city in China to determine whether health outcomes improve as a result. High concentrations of particulates and sulfur dioxide have been significantly implicated in premature death and serious morbidity.

NIH Support	FY 2002		FY 2003		FY 2004	
	No.	$	No.	$	No.	$
Research Grants	5	3,832,000	4	4,339,000	4	3,990,000
Research Contracts	2	271,000	2	280,000	4	714,000
Foreign Components of Domestic Awards	68	7,700,000	78	8,621,000	79	7,300,008
Visiting Program	456	14,267,000	455	15,918,000	469	16,685,000
Guest Researchers	44	0	66	0	61	0
Total		26,070,000		29,158,000		28,597,000

Revised September 2005

B Appendix B
Collaboration between the U. S. CDC and China

(by Disease)

Anemia
Researchers from NCCDPHP's Division of Nutrition and Physical Activity (DNPA) are collaborating with public health authorities in China (C-CDC) and UNICEF China to investigate the low prevalence of anemia in Ningxia Province, China. The specific aims of the project are to verify the low anemia prevalence among preschool children and non-pregnant women and to understand the potential protective factors against anemia among the population. Data collection in the field has been completed and data analysis and report preparation are underway.

Start Date: APR, 2002
Status: ongoing

Anthrax
NCID's Division of Bacterial and Mycotic Diseases has been collaborating with the Public Health Laboratory Centre in the Hong Kong Department of Health on the molecular genotyping of a Bacillus anthracis isolate from a rare case of fatal anthrax in Hong Kong. The results of multiple-locus variable-number tandem repeat analysis (MLVA) and pagA sequencing have been consistent with other B. anthracis isolates from this region.

Start Date: SEP, 2003
Status: ongoing

Antimicrobial Resistance
The WHO External Quality Assessment Schemes (EQAS) proficiency and quality control program is conducted by NCID's Division of Healthcare Quality Promotion (DHQP). DHQP staff selects and package susceptible and resistant control strains of bacteria for testing and ship them to participating international laboratories in 40 countries, including China, which then test the strains and fax results directly to DHQP for analysis. DHQP staff assesses laboratory performance and send a cumulative summary to each laboratory as well as to WHO. Accuracy of testing has improved in areas where local or regional assistance is available.

Start Date: OCT, 1996
Status: ongoing

Antimicrobial Resistance
NCID's Division of AIDS, STD, and TB Laboratory Research (DASTLR), in a collaborative study with colleagues at Sun Yat-Sen University of Medical Sciences in Guangzhou, China, began to analyze antimicrobial resistant isolates of Neisseria gonorrhea in Guangzhou. DASTLR staff currently are determining the genetic basis for ciprofloxacin resistance and performing subtyping to determine the clonality of resistant isolates.

Start Date: APR, 2003
Status: ongoing

Birth Defects

As part of an international quality assurance program, NCEH staff provides dried blood spot quality control and performance evaluation materials for screening tests for a variety of diseases to international neonatal screening laboratories, including laboratories in China. The diseases, which vary by country, include congenital hypothyroidism, phenylketonuria, galactosemia, congenital adrenal hyperplasia, maple syrup urine disease, and homocystinuria.

Start Date: JAN, 1998
Status: ongoing

Birth Defects

Scientists from NCBDDD's Division of Birth Defects and Developmental Disabilities (DBDDD) have collaborated with colleagues from Peking University (PU) since 1983, when the Shunyi Risk Approach Project began. The project revealed that neural tube defects (NTDs) affected 5 in 1,000 newborns in Northern China -- the highest known rate in the world. Since 1991, DBDDD staff has conducted a population-based prospective cohort study on the benefits of periconceptional use of folic acid (FA) in preventing NTDs. This program was the first to document that maternal use of 400 I1/4mcg of FA taken without other vitamins can reduce the prevalence of NTDs by up to 85% in high-rate areas. This collaboration also provided high-quality scientific evidence that maternal FA consumption before and during early pregnancy was safe and did not increase the likelihood for miscarriage or twinning. In addition, information from the program's follow-up of these cohorts of women and their children will enable CDC to address future concerns. The program's findings have led to important health benefits in China, the United States, and the rest of the world and support the current efforts of DHHS and the National Council on Folic Acid to increase the proportion of American women of reproductive age who consume 400 mcg of FA each day.

Start Date: MAR, 1991
Status: ongoing

Cancer

NIOSH collaborated with the Institute of Occupational Medicine in Beijing, China to investigate the mechanism of silica-induced carcinogenesis. The major focus is the effect of silica on cell growth regulation. Silica-induced cell growth arrest is being examined. Several cell cycle checkpoint proteins, such as cyclins/Cdks and growth arrest and DNA damage-inducible protein 45 (GADD45), are being studied. The role of telomerase in silica-induced normal human embryonic lung fibroblasts transformation is also being investigated. The results obtained will help NIOSH researchers understand how silica effects cell growth regulation and the mechanism of silica-induced carcinogenesis.

Start Date: MAY, 2000
Status: ongoing

Capacity Development

The Shanghai Municipal Center for Disease Control and Prevention, a China CDC-wide group, is helping China build its public health infrastructure. An NCEH staff member serves as the senior consultant to the Center and as the liaison between the U.S. CDC and the China CDC. The committee recently published Introduction to the CDC, a book written in Chinese and distributed throughout China.

Start Date: JAN, 2000
Status: ongoing

Capacity Development

NCEH's Division of Laboratory Sciences (DLS) hosted a researcher from the Chinese Ministry of Health National Reference Laboratory (NRL) for Iodine Measurements. The

researcher spent 6 weeks at DLS as a visiting researcher, spending time in the NHANES and Global Micronutrients Laboratory, Elemental Analysis Laboratory, and Newborn Screening Laboratory to learn about techniques and methods CDC use and about procedures for quality control and assurance.

Start Date: SEP, 2002
End Date: OCT, 2002
Status: complete

Capacity Development

NCID's Division of Viral Hepatitis (DVH) has provided technical assistance to and conducted workshops and training sessions for public health scientists and laboratorians from other countries, including China. Overseas, DVH personnel have led courses focusing on the epidemiology and prevention of viral hepatitis, viral hepatitis surveillance, laboratory aspects and diagnosis of viral hepatitis, injection safety, blood safety, and medical practice safety. Laboratory training events often involve "wet" (active) laboratory components and last for several days. In addition, each year DVH sponsors an average of 20 international fellows for training in viral hepatitis laboratory research; these fellows spend an average of 2 to 4 years at CDC and then return to their home countries to continue their research.

Start Date: , 1980
Status: ongoing

Capacity Development

Two leaders of the Public Health Training Network collaborated with the Chinese Satellite Telehealth Education Network (SATHEN) to conduct the second Institute on Distance Learning in Public Health. PHPPO Division of Professional Development and Evaluation (DPDE) staff members taught a 2-week course on distance learning systems development to approximately 30 public health professionals from 12 provinces. DPDE staff also toured existing distance learning centers in southern China to observe ongoing training programs.

Start Date: OCT, 2002
End Date: OCT, 2002
Status: complete

Cardiovascular Disease

In 1984, the current CDC-National Heart, Lung, and Blood Institute (NHLBI) Lipid Standardization Program (LSP) was implemented to offer combined total cholesterol (TC), triglyceride (TG), and high density lipoprotein cholesterol (HDLC) standardization services. Standardization assistance is offered to any international laboratory involved in clinical trials and investigations supported by NHLBI, other institutes of the National Institutes of Health (NIH), and WHO -- including laboratories in China. The goal of the LSP is to improve the laboratory measurement of cholesterol and related lipids so that they are measured with the accuracy and precision needed for detection, treatment, and prevention of cardiovascular disease.

Start Date: JAN, 1984
Status: ongoing

Cardiovascular Disease

NCEH's Division of Laboratory Sciences provides support to seven international members of the Cholesterol Reference Method Laboratory Network (CRMLN): the Netherlands, Japan, United Kingdom, Canada, Italy, Argentina, and China. Support includes providing reference materials used to assess performance of reference methods and designated comparison methods, quality control materials for assessing performance, and regular reports of performance status.

Start Date: MAR, 1989
Status: ongoing

Diabetes

NCEH's Division of Laboratory Sciences is collaborating with the multinational Immunology of Diabetes Society to improve autoantibody assays predictive of type 1 diabetes. Forty-nine key laboratories in 17 countries, including laboratories in China, have registered with the Diabetes Autoantibody Standardization Program (DASP) for the DASP 2003 workshop.

Start Date: OCT, 1999
Status: ongoing

Emergency Response

At the request of WHO's Beijing Office and China's Ministry of Health, staff from NCHSTP's Division of STD Prevention (DSTDP) helped to respond to the SARS epidemic in Beijing by assisting in epidemiologic evaluations and studies. A family of studies and evaluations was designed and carried out to collect valuable data in Beijing, where the world's largest outbreak of SARS occurred in 2003. Through these studies, research capacity at Beijing Health Bureau was built and enhanced. The information derived from these studies and evaluations will be used in developing control measures if SARS were to reappear in Beijing or elsewhere.

Start Date: JUN, 2003
End Date: JUL, 2003
Status: complete

Environmental Health

Researchers from NCEH's Division of Laboratory Sciences (DLS) are collaborating with the National Cancer Institute on a pilot project to investigate the organochlorine (OC) levels in people with hepatocellular carcinoma. DLS's role is to measure the OC levels in serum specimens from China. The data are being evaluated to determine whether a larger study is warranted.

Start Date: JUL, 2001
End Date: MAR, 2003
Status: complete

Epidemiology Service and Training

In October 2001, the China CDC (C-CDC) and Ministry of Health (MOH) established the nation's first field epidemiology and training program, the China FETP (C-FETP). The C-FETP was established with assistance from CDC and other international health organizations, including UNICEF and WHO, to strengthen China's disease surveillance, applied epidemiology, and response capacity for its 1.3 billion people. Because of the enormous challenge of developing such capacity nationwide, C-FETP asked WHO's Division of International Health (DIH) to assign a senior consultant epidemiologist to Beijing to collaborate on developing the program during its critical formative years and to provide high-priority technical assistance. With WHO's help, the C-FETP has trained two cohorts (22 field epidemiologists) since its founding in October 2001. The first cohort of 10 epidemiologists graduated in September 2003. They have been assigned to senior provincial epidemiology positions, where they are also serving as mentors and recruiters for future FETP cohorts. The second cohort of epidemiologists has been assigned to a variety of provincial and national field epidemiology positions to complete requirements for a Fall 2004 graduation. A third cohort of 12 epidemiologists is being recruited and will start the program in October 2003. The "service-in-training" provided by the first and second C-FETP cohorts has already encompassed dozens of investigations and provided important recommendations for strengthening disease surveillance, response, and prevention in infectious diseases, environmental health and injuries, both nationally and locally, as well as producing a variety of international scientific presentations and publications. C-FETP contributions have been crucial for implementing China's SARS investigation and control

activities in Southern China and Beijing, for which C-FETP has won the highest official and scientific praise.

Start Date: OCT, 2001
Status: ongoing

Food Safety

NCID's Division of Bacterial and Mycotic Diseases (DBMD) is collaborating with public health institutions in the Asia Pacific region, including institutions in China, to establish a PulseNet-compatible regional network (PulseNet Asia Pacific) for molecular subtyping of food borne pathogenic bacteria and the routine exchange of DNA "fingerprint" patterns of food borne pathogens and associated epidemiologic information. This will facilitate early recognition of international food borne disease outbreaks and investigation of these outbreaks. A steering committee (Dr. Kai-Man Kim (Hong Kong,), Chairman) was convened and an action plan for implementation was developed. The first PulseNet Asia Pacific Workshop on standardized PulseNet DNA "fingerprinting" and analysis will be held in Hong Kong from April 15 to 19, 2004.

Start Date: DEC, 2002
Status: ongoing

Gastroenteritis

NCID's Division of Viral and Rickettsial Diseases (DVRD) examined specimens from non-human primates using electron microscopy techniques for diagnosis of infectious agent. DVRD determined that the infections were caused by several viruses, including adenovirus, coronavirus, and small round viruses.

Start Date: SEP, 2003
End Date: SEP, 2003
Status: complete

Hepatitis

Laboratory personnel from NCID's Division of Viral Hepatitis are trying to determine whether there are correlations between different HBV mutants and the development of fulminant hepatitis and liver damage. The core and S genes are being amplified for sequence analysis from paraffin-embedded liver tissues of patients in China with fulminant hepatitis.

Start Date: OCT, 2001
End Date: SEP, 2003
Status: complete

Hepatitis

NCID's Division of Viral Hepatitis (DVH) supported hepatitis prevention activities in the People's Republic of China by detailing a medical officer to the U.S. Embassy in Beijing to work with staff in the China CDC. Collaborative activities have included developing an application to the Global Alliance for Vaccines and Immunization (GAVI)/The Vaccine Fund for funding to support routine infant hepatitis B immunization activities; implementing a national survey of knowledge, attitudes, and practices of village health care; executing a nationwide coverage survey to determine the status of hepatitis B immunization in China; implementing a survey of clinicians and the general public in urban areas in China regarding hepatitis B knowledge; and supporting efforts by WHO's Southeast Asia Regional Office to introduce hepatitis B vaccine into countries in the region. Other activities have involved the use of hepatitis B vaccine off the cold chain, the study of risk factors associated with delayed birth doses of hepatitis B vaccine; surveillance for liver cancer; and a review of the disease burden of chronic liver disease.

Start Date: SEP, 1999
Status: ongoing

HIV/STD Prevention

NCID's Division of AIDS, STD, and TB Laboratory Research (DASTLR) in collaboration with NCHSTP's Global AIDS Program provides technical assistance as well as long-term consultation on public health laboratory infrastructure development and laboratory elements of HIV/STD prevention programs in China. These efforts focus on diagnostics, testing and monitoring algorithms, laboratory systems, and quality assurance measures. DASTLR staff work directly with Ministry of Health and CDC field staff to develop comprehensive laboratory support for prevention initiatives in China.

Start Date: OCT, 2000
Status: ongoing

HIV/STD Prevention

In consultation with partners at both central and provincial levels, the China-us cooperation framework for HIV prevention and care was completed in March 2003. Global AIDS Program (GAP) China serves as an integral part of the national program and will assist in the planning and implementation of China Comprehensive AIDS RESponse (CARES), including the Global Fund to Prevent AIDS, TB, and Malaria-funded component, at three levels: national, provincial, and county. The six GAP-assisted provinces are at different stages of the HIV epidemic due to different modes of transmission. They include provinces with high-intensity epidemic areas (Henan and Xinjiang); provinces with moderate-level epidemic (Anhui and Guizhou); and provinces with low-level epidemic (Heilongjiang, Inner Mongolia, and Tibet). The GAP program strategy is designed to support a comprehensive approach to HIV prevention and care by integrating key strategic components in project areas of China CARES with GAP China assistance (e.g., community and political mobilization, surveillance, care and treatment, voluntary HIV counseling and testing, and risk-reduction measures). GAP China also develops the capacity of provincial program managers for planning and project management and assists the project provinces and counties in the planning of overall China CARE and GAP-assisted activities. In FY 2003, GAP China staff served as members of the committee for the planning and implementation of the first national HIV survey for high-risk groups, built on the existing sentinel surveillance system. As a result, a plan was developed for provincial sentinel surveillance systems, accelerating the planning of the GAP-assisted surveillance component. GAP China conducted province-specific low-risk group surveillance using existing HIV testing data from hospital admissions, blood banks, maternal and child health services, and military recruitment.

Start Date: OCT, 2002
Status: ongoing

Immunization

NIP's Global Immunization Division supports strengthening global childhood immunization programs through direct support to countries, through partners (such as WHO and UNICEF), and through participation in the Global Alliance for Vaccines and Immunization (GAVI). GAVI was initiated in 2000 with the primary goals of introducing new vaccines (e.g., hepatitis B, Haemophilus influenzae type b, and yellow fever), improving immunization coverage, and improving injection safety (for immunization) in the poorest countries -- those with per capita GNP of under $1,000. Funds exceeding $1.2 billion have been made available to countries beginning in 2000 for these purposes, continuing for 5 years. CDC is one of many partners contributing to this effort, which is led by UNICEF, WHO, the Bill and Melinda Gates Foundation, the World Bank, and others. Since January 2001, NIP has participated on GAVI's Board, Implementation Task Force, and Research and Development Task Force. During 2003, a collaborative project to improve routine immunization and reduce measles morbidity was initiated in China.

Start Date: JAN, 2000
Status: ongoing

Influenza

A mid-term influenza surveillance project assessment and influenza laboratory review was conducted in FY 2003 as part of NCID's long-standing support for influenza surveillance in China. WHO and the Chinese Ministry of Health (MOH) organized the mission to review influenza surveillance activities in four Chinese provinces with the following objectives: (1) to review the function of the influenza surveillance network; (2) to review laboratory procedures, staffing, and supplies; and (3) based on the findings at provincial levels, to prepare a report and make recommendations to WHO and the MOH.

Start Date: JAN, 1988
Status: ongoing

Influenza

NCID's Division of Viral and Rickettsial Diseases, in collaboration with WHO and the Chinese Ministry of Health, supported a workshop on the development of influenza immunization guidelines in Beijing. The purpose of the workshop was three-fold: (1) to exchange information with international partners on vaccine strain recommendation procedures, immunization policies, and influenza surveillance; (2) to develop draft influenza vaccine guidelines for China; and (3) to identify data required to improve guidelines in the future.

Start Date: NOV, 2002
Status: ongoing

Influenza

In September 2003, the WHO Collaborating Center for Surveillance, Epidemiology and Control of Influenza in the Influenza Branch of NCID's Division of Viral and Rickettsial Diseases (DVRD) shipped out 241 kits for global influenza laboratory surveillance to U.S. state health departments, foreign national influenza centers, including centers in China, and other collaborating institutions. CDC provides a kit containing reagents for identification of influenza specimens for global influenza surveillance. This information is essential for the identification of variants and the timely inclusion of new variants into the influenza vaccine. DVRD also distributed kits for the identification of A(H5) and A(H7) viruses, due to the emergence of these novel subtypes in humans.

Start Date: JAN, 1991
Status: ongoing

Influenza

NCID's Division of Viral and Rickettsial Diseases, in collaboration with WHO, organized the First International Influenza Epidemiology and Surveillance Course, held in Atlanta in November 2002. Course objectives included providing the skills and knowledge necessary to improve national and international influenza disease surveillance and fostering a global community of epidemiologists and disease control staff dedicated to the control and prevention of influenza. By providing training on monitoring illness patterns and the health impact related to influenza, more countries will have data necessary for understanding the toll of influenza and for formulating national influenza control and prevention policies, including the prioritization and allocation of limited health resources.

Start Date: MAR, 2001
End Date: NOV, 2002
Status: complete

Laboratory Diagnostics

The Model Performance Evaluation Program for HIV-1 antibody testing is an ongoing external assessment program provided by PHPPO's Division of Laboratory Systems (DLS) that is available to laboratories worldwide. Twice a year, six referenced survey specimens are shipped to laboratories in China for HIV-1 antibody testing. After each site tests the

specimen panel, its results are sent to DLS. DLS staff analyzes the results and provide a summary report of the aggregate performance by method type and reagent manufacturer. The results for individual laboratories or laboratories by country are not evaluated, but each participating laboratory can compare its performance against the whole to identify potential problems and make improvements or changes in its testing process, as needed.

Start Date: JUN, 1986
Status: ongoing

Laboratory Standardization

Ensuring the Quality of Iodine Procedures (EQUIP) is a CDC standardization program designed to provide urinary iodine laboratories with an independent assessment of their analytical performance. The program, which is operated jointly by NCEH and NCCDPHP, will help laboratories monitor the degree of variability and bias in their urinary iodine assays. Information received from the program can then be used to eliminate bias and/or precision problems in the assay system; confirm the quality of analysis; and increase each laboratory's confidence level. Currently, 42 laboratories in 31 countries, including China, participate in the EQUIP program.

Start Date: JUL, 2001
Status: ongoing

Malaria

A staff member from NCID's Division of Parasitic Diseases (DPD) served as special advisor to the Mekong Region Information, Education and Communication Project (Mekong IEC). This project provides assistance to several countries in the Mekong River region, including China, Vietnam, Cambodia, Laos, Thailand, and Myanmar. DPD's contribution included participating in a mid-project review and refining activities for the project's second year, providing technical assistance in reviewing research proposals that would complement the Mekong IEC activities, and assisting in the development of a funding proposal for a second phase of the project.

Start Date: SEP, 2002
Status: ongoing

Measles

During FY 2003, NIP's Global Immunization Division worked in partnership with WHO, UNICEF, the United Nations Foundation, the American Red Cross, and individual Ministries of Health to accelerate global measles mortality reduction and regional elimination goals. To support these goals, NIP provides a variety of staffing, funding, research, technical support, and vaccination activities. NIP supported China by providing technical and financial support to the Ministry of Health to begin planning and implementing a measles elimination strategy, sustain China's polio-free status, and improve routine immunization coverage in Guizhou Province (whose population is 38 million).

Start Date: OCT, 1998
Status: ongoing

Micronutrient Malnutrition

NCCDPHP's Division of Nutrition and Physical Activity is collaborating with public health authorities in China and UNICEF China to support a flour fortification project in areas of western China. This project will test the effectiveness of two iron fortificants (iron-DTA and elemental iron) in the prevention of iron deficiency. Baseline data have been collected and are currently being analyzed.

Start Date: MAR, 2002
Status: ongoing

Micronutrient Malnutrition

NCCDPHP's Division of Nutrition and Physical Activity (DNPA) is collaborating with NCBDDD and researchers at Beijing University to conduct a study in China on the impact of iron/folic acid versus multi-micronutrient folic acid supplements during pregnancy on neonatal mortality, morbidity, and complications during pregnancy, labor, and delivery. DNPA researchers will conduct a double-blinded, randomized controlled trial with three study groups randomized by individual in five counties. The primary objective is to determine which micronutrient combination has the highest protective impact on pregnancy outcomes, neonatal morbidity and mortality, and complications.

Start Date: JUN, 2002
Status: ongoing

Noncommunicable Disease Prevention and Control

Through an assignee to WHO, NCCDPHP's Division of Adult and Community Health guides the work of the Mega Country Health Promotion Network. The Network was established to mobilize the world's most populous countries, including China, to address the transition of the global burden of disease from communicable to noncommunicable conditions and to promote health in a collaborative effort. Priority areas to be addressed through the Network have been identified by Mega country representatives. These include: school health as a key setting for primary disease prevention; key risk factors of chronic diseases (including tobacco, diet and nutrition, and physical activity) as an integrated approach to the field of chronic diseases; and behavioral risk factor surveillance as a tool for strengthening the evidence base for chronic diseases. Data collection on key behavioral risk factors began in 1996 as a part of a World Bank project. Data are collected on a quarterly basis each year in eight municipalities of China: Beijing, Chengdu, Liuzhou, Luoyang, Shanghai, Tianjin, and Weihai, with a sample size of 2,400 per year in each municipality. In 2003, work also began on a data action report among the Mega countries to document how data collected on three key risk factors -- tobacco use, diet/nutrition, and physical activity -- are being used in the most populous countries to implement health policies and programs.

CIO: NCCDPHP
Start Date: MAR, 1996
Status: ongoing

Occupational Safety and Health

In China, Ministry of Health officials estimate that more than 526,000 coal workers have contracted pneumoconiosis and 119,000 of them have died of the disease, according to statistics from 1949 to 1996. In the United States, NIOSH has recommended that coal miners undergo serial lung function monitoring to allow early detection of lung injury. However, a recent study of recruits to coal mining has suggested that the temporal changes in lung function may not be linear. Rather, new miners appear to suffer initial severe declines, followed by some reduction in the rate of decline. Understanding this pattern is important in the interpretation of screening spirometry. Owing to the relatively long interval between medical examinations in previous studies, it is not possible to obtain more reliable information on this phenomenon from existing data sets. The current collaboration with researchers at the Tongji Medical University involves examining lung function changes prospectively in underground Chinese coal miners. The study is assessing how the lung function of new coal miners changes in the short term (within 3 years) after they enter coal mining and the relationship of these changes to dust exposure. It aims to help Chinese investigators understand current underground environmental conditions and lung function changes experienced by Chinese coal miners and to generate information that will be useful to U.S. occupational health personnel in the performance and interpretation of recommended lung function screening for workers in dusty trades. The study team

obtained a baseline medical history and spirometry results from 449 participants from three coal mines and one technical school. Follow-up medical surveys were then performed on 15 occasions between 1995 and 1999. Environmental monitoring, including the collection of total and personal respirable dust samples, was also performed. The investigators are currently analyzing and reporting the results at international meetings and in peer-reviewed publications.

Start Date: OCT, 1995
Status: ongoing

Plague

NCID's Division of Vector-Borne Infectious Diseases (DVBID) is continuing collaborative efforts with Chinese scientists studying plague. The sequence of the newly emerged 6-kb plasmid was published and a study to understand its role in Yersinia pestis isolates was started. A senior scientist from the Chinese Academy of Preventive Medicine (Beijing) examined the six unique genes encoded by the 6-kb plasmid. In conjunction with scientists from the Yunnan Institute of Epidemic Disease Control and Research (YIEDCR), DVBID scientists are trying to identify a source of the 6-kb plasmid and track its spread. At YIEDCR, DVBID provided training on setting up their molecular laboratory, biosafety, and performing the competitive enzyme-linked immunosorbent assay (ELISA) test. DVBID's current efforts include continuing to analyze the genetic variance in Chinese Y. pestis isolates, detecting the pathogenic mechanisms, and completing the transfer of technology for multiplex and rapid PCR (polymerase chain reaction) testing.

Start Date: SEP, 1997
Status: ongoing

Respirator Protection

The Chinese State Food and Drug Administration (SFDA) is developing standards and test methods for personal protective equipment that can be used by healthcare workers. Because of SARS outbreak in 2003, the Chinese SFDA took measures to accelerate development of standards and test methods for personal protective equipment. In order to rapidly gather information to support the development effort, representatives from the Chinese Liaoning Test Center visited the NIOSH National Personal Protective Technology Laboratory (NPPTL). During the visit, members of the delegation toured the laboratory's respirator certification test facility to witness respirator certification testing and attended a presentation on technical research areas and the respirator certification program.

Start Date: SEP, 2003
End Date: SEP, 2003
Status: complete

Rubella and Congenital Rubella Syndrome

NIP staff conducted a study in Jiaxing City, China among a birth cohort enrolled in the Child Health Care (CHC) System through August 31, 2000. The study's purpose is to assess the feasibility of screening and diagnosing congenital rubella syndrome (CRS) cases where rubella vaccination is not routine and where the burden of disease is thought to be greater than in the United States. This study is supplemental to an existing CDC birth defects study. Surveillance tools developed from the NCEH collaboration will be modified and used to enhance CRS case finding. Ongoing activities include obtaining final specimens for laboratory testing and analyzing data.

Start Date: MAR, 2000
Status: ongoing

School Health

Through WHO, NCCDPHP's Division of Adolescent and School Health (DASH) provides technical support and recommendations for improving coordinated school health and HIV

prevention programs to national school groups in the world's 11 most populous countries (known as the Mega countries) and in nine Global AIDS Program (GAP) countries.

Start Date: NOV, 1998
Status: ongoing

Severe Acute Respiratory Syndrome (SARS)

A Preventive Medicine Resident (PMR) traveled to Beijing, China to work on the Severe Acute Respiratory Syndrome (SARS) epidemic. The resident helped eight provincial SARS teams assess the morbidity and mortality associated with SARS and made presentations to visiting WHO officials. These presentations resulted in the lifting of travel advisories for their provinces. The PMR also traveled to Shanxi province, where 448 probable cases and 24 deaths had occurred in 2003. The PMR met with regional and local people in government, China Centers for Disease Control, hospitals, and fever clinics to evaluate the surveillance system, community controls, communication and education, clinical management and infection control practices, and laboratory capacity related to the SARS outbreak. The findings were presented to the regional and local communities. These meetings provided vital information to key stakeholders regarding the spread of the outbreak. Consequently, successful intervention and control measures were designed and implemented. As a final product, the PMR presented the findings from the above activities to China Ministry of Health and WHO.

Start Date: JUN, 2003
End Date: JUN, 2003
Status: complete

Severe Acute Respiratory Syndrome (SARS)

Working through the Ministry of Health in China, PHPPO's Division of Professional Development and Evaluation delivered master video production tapes for rapid translation into Chinese. These programs were then re-broadcast within China and distributed as CD-ROMs to all health departments in China's 23 provinces. It is estimated that 1.8 million Chinese health professionals have received critical SARS information through translated CDC Public Health Training Network (PHTN) programs and CD-ROMs.

Start Date: APR, 2003
End Date: JUN, 2003
Status: complete

Silicosis

Researchers from NIOSH's Health Effects Laboratory Division and Division of Respiratory Disease Studies are working with Chinese colleagues to study respirable silica dust surface properties that may be responsible for anomalous differences in silicosis disease risks seen in a Chinese medical registry for metal miners and pottery workers. The researchers found that lung fibrosis risk for a given level of exposure to respirable silica dust differed by workplace types or locations, with no discernable basis for the differences. Analyses of Chinese workplace dusts, using a NIOSH-patented method for respirable particle surface elemental analysis, have found that coating respirable silica particle surface by a thin sub-micrometer layer of clay may be a factor in lung fibrosis disease risk. This had been indicated in an earlier NIOSH study of the "coal rank anomaly" regional differences in coal worker lung fibrosis risk seen in the United States and Europe. Now, a NIOSH and Tongji Medical College epidemiology study of some 25,000 workers, coupled with analyses of the surfaces of samples of respirable silica particles from the workplaces, indicates that such surface occlusion is associated with anomalous differences in the risk of silicosis between Chinese metal miners and pottery workers. Initial study results were reviewed at an international symposium on monitoring and evaluation of silica dust hazards was held in Wuhan, China at the Huazhong University-Tongji Medical College in November 2001.

Full results were presented at the third International Symposium on Silica, Silicosis, Cancer and Other Diseases, held in Italy in October 2002. Tongji Medical College is planning a second international symposium on silicosis in 2005.

Start Date: JUL, 1998
Status: ongoing

Silicosis

NIOSH's Health Effects Laboratory Division is collaborating with the Institute of Occupational Medicine, Department of Biochemistry in Beijing, China on research involving the elucidation of molecular events that occur in cells exposed to silica or other particles. Silica-induced events measured include oxidant production, phosphorylation of protein tyrosine, and activation of the transcription factor NFkB. NFkB activation is dependent upon tyrosine protein kinase, which in turn is dependent on the production of nitric oxide and reactive oxygen species by silica-exposed macrophage. Other studies include autopsy studies of occupational and environmental changes in lungs and molecular events leading to carcinogenesis. Another area of research activity involves identification of biomarkers of occupational disease and inhibitors of disease development.

Start Date: JAN, 1998
Status: ongoing

Surveillance

WHO and NCCDPHP's Division of Adolescent and School Health, in collaboration with UNICEF, UNESCO, and UNAIDS, launched the Global School-based Student Health Survey (GSHS) in 2003 after 2 years of development. The purpose of the GSHS is to help countries develop priorities, establish programs, and advocate for resources for school health programs and policies; make comparisons across countries on the prevalence of health behaviors and protective factors; and establish trends in the prevalence of health behaviors by country. The GSHS is a school-based survey conducted primarily among 13- to 15-year-old students using a standardized sampling and data collection methodology and core questionnaire modules that measure student demographics; alcohol and other drug use; dietary behaviors; hygiene; mental health; physical activity; protective factors; sexual behaviors that contribute to HIV infection, other STI, and unintended pregnancy; tobacco use; and violence and unintentional injuries. Surveys have been completed in Swaziland and Uganda and survey implementation workshops were held in 2003 in 21 countries, including China.

Start Date: MAR, 2003
Status: ongoing

Syphilis

The Syphilis Serology Reference Laboratory in NCHSTP's Division of STD Prevention (DSTDP), serves as the reference laboratory for the syphilis portion of the WHO STD Diagnostics Initiative which is looking as the utility of rapid diagnostic tests for use in the field. The project was started in 2003 with 8 laboratories world-wide participating. In 2003 DSTDP served as the reference laboratory for 4 of the 8 laboratories, including laboratories in China, Russia, and Haiti.

Start Date: JAN, 1991
Status: ongoing

Syphilis

Scientists in the Syphilis Serology Reference Laboratory in NCHSTP's Division of STD Prevention provided syphilis serology proficiency testing samples for 76 laboratories in 57 countries, including China. CDC administers the program, with WHO enrolling participants. CDC is responsible for preparing samples, sending them to the enrolled

laboratories, grading results, and providing summary reports for three shipments per year. This program has been in place since 1988 and is a function of the WHO Collaborating Center for Reference and Research in Syphilis Serology.

Start Date: JAN, 1991
Status: ongoing

Tobacco Control

NCCDPHP's Office on Smoking and Health (OSH) and NCEH's Division of Laboratory Sciences (DLS) conducted an International Cigarette Study to compare Marlboro cigarettes sold in the United States with Marlboro cigarettes and popular local brands sold in 27 other countries in FY 01 and 02. Investigations conducted by DLS staff included measuring the potent carcinogens in cigarette tobacco; evaluating tar, nicotine, and carbon monoxide levels, several classes of chemicals (including selected flavor compounds), and volatile organic components; and analyzing mainstream tobacco smoke for tobacco-specific nitrosamines. In 2003, NCEH staff published a paper summarizing results of the study: Ashley DL, Beeson MD, Johnson DR, McCraw JM, Richter P, Pirkle JL, Pechacek T, Song S, Watson CH. Tobacco-specific nitrosamines in tobacco from U.S. brand and non-U.S. brand cigarettes, Nicotine and Tobacco Research 5:323-331, 2003.

Start Date: AUG, 2000
Status: ongoing

Training

Led by a Steering Committee consisting of WHO, CDC, the Danish Institute for Food and Veterinary Research, Institut Pasteur International Network, Health Canada, and the Netherlands' Animal Sciences Group, WHO Global Salm-Surv is an international network of over 800 individuals involved in food-borne diseases. The network's long-term mission is to reduce food borne disease globally by enhancing laboratory-based surveillance and outbreak detection and response techniques. WHO Global Salm-Surv conducted eight training courses in FY 03 to help strengthen the skills of microbiologists and epidemiologists in laboratory-based surveillance and outbreak detection and response techniques. The courses promoted interaction with regional Field Epidemiology Training Programs. Each course had approximately 20 to 30 participants, with a total of approximately 200 people trained from 75 nations, including China.

Start Date: OCT, 2000
Status: ongoing

Vaccine Preventable Diseases

NCID's Division of Viral Hepatitis is working with the China CDC and the Seattle-based Program for Appropriate Technology in Health (PATH) to develop a study assessing the feasibility of administering hepatitis B vaccine to infants born at home using a pre-filled injection device that has been stored outside the cold chain.

Start Date: , 2003
Status: ongoing

Violence

Nick's Division of Violence Prevention is collaborating with the Beijing Suicide Research and Prevention Center and the Chinese National Center for Chronic and Noncommunicable Disease Prevention (one Division of the Chinese CDC) on the development of a National Suicide Prevention Plan. CDC staff are serving on the Expert Advisory Panel.

Start Date: NOV, 2002
Status: ongoing

C Appendix C Directory of Biomedical Research Organizations in China

Government Owned Organizations:

Organization	Functions	Contact/website
Chinese Academy of Sciences (CAS)	CAS was founded in Beijing on November 1, 1949 on the basis of the former Academia Silica (Central Academy of Sciences) and Peiping Academy of Sciences. CAS is a leading academic institution and comprehensive research and development center in natural science, technological science and high-tech innovation in China. Under CAS there are five Academic Divisions, 108 scientific research institutes, over 200 science and technology enterprises, and more than 20 supporting units including one university, one graduate school and five documentation and information centers. They are distributed over various parts of the country. 12 branches of CAS were established in Shanghai, Nanjing, Hefei, Changchun, Shenyang, Wuhan, Guangzhou, Chengdu, Kunming, Xi'an, Lanzhou and Xinjiang. CAS has a total staff of over 58,000, of whom 39,000 are scientific personnel according to 2000 figures. CAS institutes in life science and biotechnology are listed below.	http://english.cas.cn/Eng2003/page/home.asp Address: 52 Saline Rd., Beijing China Postcode: 100864 Tel: 86 10 68597289 Fax: 86 10 68512458
Institute of Genetics and Developmental Biology (IGDB), CAS	Research directions/centers: Plant Genomics, Developmental Biology, Human and Animal Genetics and Agricultural Resources. In addition, the Institute has a core facility for Molecular Biology, an Experimental Animal Core Facility and an Experimental Station for Crop Plants.	http://www.genetics.ac.cn/xywwz/main.html 917 Bldg, Datum Road, 100101 Beijing, China Tel: 86 10 6488 9776 E-mail: yphuang@genetics.ac.cn
Institute of Biophysics (IBP), CAS	IBP is founded in 1958 with research fields in structural and molecular biology, systems biology, and brain and cognitive science.	http://www.ibp.ac.cn/e/index.html 15 Datun Road, 100101 Beijing, China Tel: +86-10-64889869 Fax: +86-10-64867566 Email: secretary@sun5.ibp.ac.cn
Institute of Microbiology, CAS (IMCAS)	Performs a wide spectrum of basic and applied research on microbial resources, microbial ecology, fermentation, microbial enzymology, molecular virology, and molecular microbial genetics. The IMCAS consists of three research centers (the Center for Microbial Resources, the Center for Molecular Microbiology, and the Center for Microbial Biotechnology), and one supporting center (the Center for Technology and Information).	http://www.im.ac.cn/en/new/index.php Zhongguancun Bei 1 Tiao, No. 13, Haidian District, Beijing 100080, China Tel: 86-10-62565880 Fax: 86-10-62560912 office@sun.im.ac.cn

Institute of Psychology, CAS (IPCAS)	IPCAS focuses on basic research areas, cross-disciplinary studies of psychology in both natural and social sciences, and applied psychological research.	http://www.psych.ac.cn/ Jian 15 Datun Road, Chaoyang district, Beijing 100101, China Tel: 86 10 64879520 E-mail: renjc@psych.ac.cn
Institute of Zoology (IOZ), CAS	Research at IOZ is organized into 5 themes: conservation of rare and endangered animals, control and management of pest animals, reproductive biology, developmental biology and aging, zoological systematic and evolutionary biology, and prevention and control of animal-borne infectious diseases.	http://www.ioz.ac.cn/english/index_e.asp 25 Beisihuanxi Road, Haidian, Beijing, 100080, China Tel: +86-10-62552219 Fax: +86-10-62565689 Email: ioz@ioz.ac.cn
Institute of Botany, CAS (IBCAS)	The Institute of Botany, Chinese Academy of Sciences is an integrative research center of basic plant science in China. Its predecessors were the former Fan Memorial Institute of Biology and the Institute of Beijing Academy of Sciences set up in 1928 and 1929 respectively. The two institutes were merged into the Institute of Plant Taxonomy , CAS in 1950. In 1953, the Institute bears its present name and it has its history of 76 years.	http://english.ibcas.ac.cn/ Xiangshan Nanxincun No. 20, Beijing 100093, China
Shanghai Institutes for Biological Sciences (SIBS), CAS	Details under Shanghai section.	
Institute of Hydrobiology (IHB), CAS	The institute has been mainly devoted to the studies on the life phenomena of aquatic organisms in correlation with their water environments. Four research orientations, including freshwater ecology, aquatic biodiversity and resource conservation, fishery biotechnology and water environment engineering have been advanced.	http://159.226.163.238/english/default.aspx 7 Donghu South Road, 430072 Wuhan, Hubei, China Tel: +86-27-87883482 Fax: +86-27-87875132 Email: ihb@ihb.ac.cn
Wuhan Institute of Virology, CAS	Founded in 1956, WIV is the only institute in China that focuses on researches on general viruses. The scientific mission of WIV is to conduct research and development in virology, environmental and agricultural related microbiology and biotechnology. Its research fields include the identification and classification of viruses, molecular virology, basic and applied research on insect viruses, animal viruses especially aquaculture-animal viruses and plant pathogens, microbial pesticides, environmental microbiology, biosensors, DNA-chips and molecular enzyme engineering.	http://www.whiov.ac.cn/englishpag/eng.htm 44 Xiao Hongshang Zhong Qu, Wuchang, Wuhan 430071, Hubei Province, China
Wuhan Botanical Garden (Wuhan Institute of Botany), CAS	The Institute was founded in 1956. Based on climatologically and geographically distinct flora in central China., WIB conducts research in multiple disciplines including plant taxonomy, geobotany, plant ecology, plant genetics and resource botany according to its endemic flora. Its main research fields include plant conservation genetics and sustainable utilization of plant genetic resources, aquatic plant biology and function improvement and adjustment of water area ecosystems, agroforest ecosystems and high efficiency ecological agriculture.	http://www.whiob.ac.cn/english/default.htm Moshan, Wuhan 430074, Hubei Province, China Tel: 86 27 87510290

South China Institute of Botany, CAS	Institute is engaged in the research on the biodiversity conservation in tropics and subtropics, restoration and rehabilitation of degraded ecosystem, rational exploitation and utilization of plant resources. Its main task is to elucidate certain important theoretical arguments in botany and ecology, to solve some practical problems, which are critical and in urgent needs for the economic development of the country.	http://www.scib.ac.cn/ Leyiju Botanic Graden, Guangzhou, Guangdong province, China Tel: 86 20-37252711 Fax: 86 20-37252831
Chengdu Institute of Biology	The institute focuses on exploring, using and efficiently protecting bio-resources for sustainable development. Its research field covers chemistry of natural products; restoration and rehabilitation of degraded ecological systems and agricultural biotechnology.	http://www.cib.ac.cn 9 Renmin Nan Lu, Chengdu 610041, Sichuan Province, China Tel: 86 28-85220920 Fax: 86 28-85222753
Kunming Institute of Botany (KIB)	Although KIB was founded in 1950, its predecessor, Yunnan Provincial Institute of Agricultural and Forestry Botany, was established 1938. The Institute focuses its interdisciplinary efforts on research into the biodiversity and bioresources of the unique subtropical broad-leaved forests and those of the Himalayan sub-alpine vegetation. Its mission is to introduce better management of the Earths environment by increasing knowledge and understanding of the plant and fungal kingdoms.	http://www.kib.ac.cn/KIBEnglish/ General Office: Tel: 86 871-5223080 [ganfy]@mail.kib.ac.cn
Xishuangbanna Tropical Botanical Garden (XTBG)	Founded in 1959, the Garden is the Institute is now a major part of the 'Bioresources and Biodiversity Conservation Base' in southwest China. It focuses its efforts on Yunnan province as well as southwest China and southeast Asia, carrying out research on conservation biology, forest ecology and resource botany, characterized by the research of tropical rainforest management, rare and endangered plant conservation, agroforestry system in tropical mountainous regions, the exploitation, introduction, acclimatization and extension of new resource plants, and ethnic forest culture.	http://en.xtbg.ac.cn/ Menglun, Mengla, Yunnan 650223, China
Kunming Institute of Zoology (KIZ)	Founded 1959, the KIZ is located in southwest China's Yunnan province, a place rich in diversity of both ecosystems and species due to its diversified geological, geomorphologic, and climatic conditions. The main interests of the Institute are wildlife conservation and sustainable utilization of animal resources and the related theoretical basics of biology. The scientific activities at KIZ are involved in the subjects of systematic zoology, genetics and evolution, primate biology, toxicology, conservation biology and entomology.	http://www.kiz.ac.cn/ehomepage/index.htm 32 Jiaochang Donglu Kunming,Yunnan 650223, China Tel: +86 871 5190390 Fax: +86 871 5191823
China National Biotech corporation (CNBC)	The China National Biotech Corporation (CNBC) changed its name from the China National Biological Products Corporation with the approval of the State Industry and Commerce Administration Bureau in 2003. CNBC is the largest bioengineering corporation engaged in the R & D, manufacturing and marketing of biological products in China. The CNBC consists of the China National Scientific Instruments and Materials Import/Export Corporation and six biological product research institutes formerly under the Ministry of Health located in Beijing, Changchun, Chengdu, Lanzhou, Shanghai and Wuhan plus the Beijing Tiantan Biological Products Co., Ltd., which is a publicly listed company. CNBC employs nearly 10,000 people, of which over 4,000 are scientists and technicians.	http://www.cnbpc.com.cn/english.htm

	CNBC is mainly dedicated to develop bio-techniques and produce biological products. It has a total of 53 facilities received State GMP Certificate. The business activities cover bacterial vaccines, viral vaccines, toxoid, antitoxin, blood products, immunodiagnostic kits, biotechnological reagents , medical experimental animal, various cultural media, bio-technique transfer , technical training & technical service.	
Changchun Institute of Biological Products	Products include vaccine, toxoid, antitoxin, blood products, immunodiagnostic kits and monoclonal antibodies. Export to Japan, Vietnam, Korea, India, Pakistan, U.S.A and Canada.	http://www.ccibp.com/ (in Chinese) 137 Xian Rd, Changchun, Jilin 130062, China Tel: 86 431-7925931 Fax: 86 431-7912435
Shanghai Institute of Biological Products (SIBP)	SIBP carries out research and development on products in cellular and molecular biology, microbiology and immunology, hematology, bacteriology and epidemiology.	http://www.siobp.com/index_e.htm 1262 Yanan (west) Rd, 200052 Shanghai Tel: 86 21 62803189 Fax: 86 21 62801807 Email: shsys@online.sh.cn
Lanzhou Institute of Biological Products	Research and manufacture of vaccine, toxoid, antitoxin, blood products, immunodiagnostic kits and other health care products.	http://www.vacmic.com/index1.htm (in Chinese) 178 Yanchang Road, Lanzhou, Gansu 730046, China Tel: 86 931-8340311 Fax: 86 931-8367199
Chengdu Institute of Biological Products	Facilities for blood products and DNA recombinant technology with GMP certificate. Export of blood products to U.S.	http://www.ronsen.com/ Wai Dong Bao Jiang Qiao ,Chengdu, Sichuan 610063, China Tel: 86 28-4419831 Fax: 86 28-4419060
Wuhan Institute of Biological Products	Facilities for blood products and DNA recombinant technology.	http://www.btbp.com.cn/ 9 Linjiang Street, Wuhan, Hubei 430060, China Tel: 86 27-88843615 Fax: 86 27-88842261
Beijing Institute of Biological Products	Facilities for blood products and DNA recombinant technology.	http://www.nvsi.biz/ Sanjianfang Chaoyang District, Beijing 100024, China Tel: 86 10-65762911 Fax: 86 10-65762404
Beijing Tiantan Biological Products Co. Ltd. (BTBP)	BTBP has 1,169 employees including 186 researchers and engineers. BTBP is mainly engaged in R&D, production and marketing of biological products such as vaccines, blood products, diagnostic reagents and media.	http://btbp.com.cn/content/e684/index_chi.html 4 Sanjianfang, Chaoyang District, Beijing 100024, China Tel: 86-10-65762911 Fax: 86-10-65792747 E-mail: xxzx@btbp.com.cn

Shanghai-Based Organizations

Organization	Functions	Ownership	Contact/website
Shanghai Institutes for Biological Sciences (SIBS), Chinese Academy of Sciences (CAS)	Shanghai Institutes for Biological Sciences (SIBS) affiliated to the CAS is a national R&D organization for conducting comprehensive studies on life sciences in China. Founded in July of 1999, it amasses the multi-disciplinary build-up from the eight former biological research institutes under the jurisdiction of the CAS Shanghai Branch and aims at the frontiers of life sciences and biotechnology focusing on human health and biomedical research. Note: All TT related activity is centralized through SIBS Office of Technology Transfer.	Government	http://www.sibs.ac.cn/eindex.htm 320 Yue Yang Road, Shanghai 200031, China Tel: 86-21-54920000 Fax: 86-21-54920078 Or contact: Yingjie Wu at SIBS OTT Tel: 86 21 5492 0142 Fax: 86 21 5492 0145 Email: yjwu@sibs.ac.cn
Member institutes & facilities:			
a). Shanghai Institute of Biochemistry and Cell Biology (SIBCB)	SIBCB is founded in May 2000 from a consolidation of two former CAS institutes in Shanghai: the former Shanghai Institute of Biochemistry with a history of more than 40 years and the Shanghai Institute of Cell Biology. It is specialized in the following three basic research areas: polypeptide, protein and proteomics; nucleic acid, gene, chromosome and genomics as well as molecular and cell biology, immunology and development biology.	Government	http://www.sibcb.ac.cn/eindex.asp 320 Yue Yang Road, Shanghai 200031, China Tel: 86-21-54920000 Fax: 86-21-54920011
b). Institute of Neurosciences (ION)	ION is founded in 1999 and has become a major center in China for basic research in neurobiology. Its focuses are concentrated on the following fields: neural development, neural plasticity, information processing within the central nervous system.	Government	http://www.ion.ac.cn 320 Yue Yang Road, Shanghai 200031, China Tel: 86-21-54921729 Fax: 86-21-54921735
c). Shanghai Institute of Materia Medica (SIMM)	Established in 1932, SIMM is the oldest of its kind in the country and the sole entity at the CAS specializing in drug discovery and development. The disciplines covered by SIMM include chemistry of natural products, medicinal chemistry, combinatorial chemistry, drug screening, pharmacology, pharmacokinetics, toxicology and computer-aided drug design, proteomics and bioinformatics.	Government	http://www.simm.ac.cn/english/index-e.htm 555 Zu Chong Zhi Road, Shanghai 201203, China Tel: 86-21-50806600 Fax: 86-21-50807088
d). Shanghai Institute of Plant Physiology and Ecology (SIPP)	SIPP is a research center erected on the incorporated framework of the former Shanghai Institute of Plant Physiology, a time-honored R&D entity of more than half a century old, with the former Shanghai Institute of Entomology. It is the birthplace of China's modern studies of phytophysiology and phytochemistry as well as one of trail-blazers in the insect research throughout the country. Its research priorities are now concentrated on the following fields: functional genomics, molecular physiology, phytochemistry, environmental biology, molecular ecology, genetic engineering and biotechnology. Government	Government	http://www.sipp.ac.cn 300 Feng Lin Road, Shanghai 200032, China Tel: 86-21-64042090 Fax: 86-21-64042385

e). National Center for Gene Research (NCGR)	In 1992, the National Center for Gene Research (NCGR) was established jointly by the Ministry of Science and Technology, the Chinese Academy of Sciences (CAS) and the Shanghai local government, to provide a major focus in China for mapping and sequencing the rice genome, and genomes of other organisms. Research Fields include Rice structural and functional genomics bioinfomatics.	Government	http://www.ncgr.ac.cn/english/ep5.htm 500 Caobao Road, 200233 Shanghai, China Tel: 86-21-54971303 Fax: 86-21-64825775
f). Health Science Center (HSC)	HSC is jointly established by SIBS and Shanghai Second Medical University. It is a research base of duality, featuring basic research of medical biology and practice of clinical medicine. Its main research orientations cover immunology, medical genetics, disease-related genomics, cell and development biology, pharmacogenomics, model organisms, physiology and toxicology.	Government	http://www.hsc.ac.cn 225 South Chong Qing Road, Shanghai 200025, China Tel: 86-21-63852643 Fax: 86-21-63852655
g). Institute of Nutritional Science	The research programs will center upon the following: (1) exploration of the role(s) and the mechanism(s) of action of nutrients; (2) the effect of diet and nutrients on genome, proteome and metabolome, i.e. nutrigenomics; (3) the effect of genetic variations on the interaction between diseases and diet or nutrient requirements, i.e. nutrigenetics; (4) nutritional epidemiology, assessment and surveillance; (5) social and behavioral nutrition; and (6) molecular mechanisms of nutrition-related diseases such as obesity, cardiovascular diseases, diabetes, aging, mental disorders, stress, cancer and osteoporosis.	Government	http://www.nutrition.ac.cn/eintroduction.html 319 Yue Yang Road, Shanghai 200031, China Tel: 86-21-54920290 Fax: 86-21-54920291
h). Inforamtion Center for Life Science	Information Support Unit of SIBS, provides library, IT and bioinformatics services.	Government	http://www.sicls.ac.cn/eindex.htm 319 Yue Yang Road, Shanghai 200031, China Tel: 86-21-64336650 Fax: 86-21-64375762 http://www.casb.cn/ (only in Chinese)
i). Shanghai CASB Biotechnology CO., Ltd.	Reorganized and transformed from Shanghai Biotechnology Center into a company. Working field: gene expression regulation, gene expression study in animal model, recombinant DNA technology.	Government	http://www.casb.cn/ (only in Chinese) 500 Cao Bao Road, Shanghai 200233, China Tel: 86-21-64700892 Fax: 86-21-64700244
k). Shanghai Laboratory Animal Center (SLAC)	SLAC is the Shanghai branch of the National Rodent Laboratory Animal Resources. Its FY 2004 sales reached 700,000 animals.	Government	http://www.slaccas.ac.cn (only in Chinese) South Ding Pu River Bridge, Song Jiang District, Shanghai, China 2001615 Tel: 86-21-57639577 Fax: 86-21-57639280 http://www.shanghaipasteur.ac.cn/aboutus.html

l). Institut Pasteur of Shanghai	The Institut Pasteur of Shanghai was set up by the joint efforts of the Chinese Academy of Sciences, Shanghai Municipal Government and Institut Pasteur as non-profit making research institution within the system of CAS. It is one of the members of the Shanghai Institutes for Biological Sciences (SIBS) of CAS. The purpose is to develop and promote research, training and public health activities in respect of infectious diseases, especially in the field of virology, immunology, epidemiology and vaccinology, as well as an exploration of the active principles of Chinese traditional medicine.	Government	http://www.shanghaipasteur.ac.cn/aboutus.html 225 South Chongqing Road Shanghai 200025, China Tel: 86-21-63852693 E-mail: ips@sibs.ac.cn

Other Shanghai Organizations

Shanghai Pharmaceutical (Group) Co., Ltd.	SPGC is one of the first Chinese pharmaceutical companies that gave birth to the Chinese pharmaceutical industry. SPGC regards antibiotics, prescription drugs, traditional Chinese medicine & OTC, API and medicine distribution & retail as the core business. Its products are sold throughout China and to more than 30 countries abroad. SPGC currently owns the Central Research Institute and over 10 national level and municipal level R&D centers with several research institutes.	Private	http://www.pharm-sh.com.cn/eng/corporate/Corporate.asp Group Headquarters Shanghai Pharmaceutical (Group) Co., Ltd 200 Tai Cang Road, Shanghai 200020, China Tel: +86-21-63730908*5016 Fax: +86-21-63748398 For business units contacts: http://www.pharm-sh.com.cn/eng/corporate/contact_us.asp
Shanghai Genomics	■ develop novel therapeutic products in fibrosis, infectious disease, cancer areas and new biomaterial for drug release. ■ technology platform includes signaling pathway mapping, gene expression profile studies, protein expression and purification, animal modeling, medicinal chemistry, and bioinformatics.	Private	http://www.shanghaigenomics.com/english/gongsi.htm 647 Song Tao Road, Building #1 Zhangjiang Hi-Tech Park, Pudong New Area Shanghai 201203, China Tel: 86-21-50802786 Fax: 86-21-50802783 Investor & Business Development Contact person: Dr. Sam Yi E-mail: bd@shanghaigenomics.com
Chinese National Human Genome Center at Shanghai	■ coordinate the major human genome projects in various frontier areas in Shanghai, ■ provide high quality service for research institutions and biotech/pharmaceutical companies at home and abroad, ■ and serve as an incubator of genomic industry in China.	Government	http://www.chgc.sh.cn/ 351 Guo Shou Jing Road, Bldg. 1, 4F, Zhang-jiang Hi-Tech Park, Pudong, Shanghai, 201203,P.R.China Tel: +86-021-50801919, 50801923 Fax: +86-021-50801922 web@chgc.sh.cn Director: Zhu Chen (Member of Chinese Academy of Sciences)
Shanghai Biochip Co., Ltd. (SBC)& Shanghai Engineering Center for Biochip	Develop expression genechips, protein chips, tissue and cell chips, large scale SNP detection, biochips in clinic diagnosis and bioinformatics.	Government	http://www.shbiochip.com/english/Company.asp 646,Songtao Road, Zhangjiang Hi-Tech Park, Pudong, Shanghai 201203, China Tel: 86-021-50802121 Fax: 86-021-50800934

Elixigen (Shanghai) Co., Ltd	■ supplier of human and animal cell systems worldwide ■ Research and Development department is working to provide precise cell systems for research labs in the pharmaceutical and biotechnology industries ■ sales office in U.S.A and Japan	Private	http://www.elixigen.com/e_about.asp" http://www.elixigen.com/e_about.asp Laboratories: 351 Guoshoujing Road Shanghai Pudong Zhangjian High-Tech Zone Office: 371 Yanqiao Road, Suite 201 Shanghai, China, Pudong Yoyo Industry Zone Phone/ Fax: 86-21-58703411
GL Biochem (Shanghai) Ltd	■ research, development, manufacture and marketing of diverse biochemicals and fine chemicals, especially peptide, peptide reagents and related products.	Private	http://www.glschina.com/en/profile.htm http://www.glschina.com/en/profile.htm 351 Guo Shoujing Road, Shanghai 201203, China Tel: 86-21-50801805/ 50800521 Fax: 86-21-64189186/ 64391063 Email: glsync@online.sh.cn; glsync2@hotmail.com
MicroPort Medical (Shanghai) Corp, Ltd	MicroPort Medical (Shanghai) Corp, Ltd. was founded in 1998 by a group of oversea scientists and engineers. The business focus of the corporate is in the area of interventional and minimally invasive medical devices, including angiographic catheters, guiding catheters, PTCA balloon dilatation catheters, coronary stent, and Abdominal Aortic Aneurysms (AAA) stent graft. The company is also engaged intensively in developing drug eluting stent, and various micro catheters and stents to treat brain diseases.	Private	http://www.microportmedical.com/english/index.htm 501 Newton Road, ZhangJiang Hi-tech Park, Shanghai 201203, China Tel:+86-021-38954600 Fax:+86-021-50801305 MicroPort International Sales and Marketing Office MicroPort Medical BV. Kellenseweg 8,4004 JD, Tiel, The Netherlands Tel:+31-344-636250 Fax:+31-344-636259 Email:cs@microport-int.com
The National Center for Drug Screening (associated with the Shanghai Institute of Materia Medica)	The National Center for Drug Screening (associated with the Shanghai Institute of Materia Medica) was jointly invested by the Ministry of Science and Technology, the Chinese Academy of Sciences and the Shanghai Municipality Government. At present, it is the only national center specializing in screening for new drugs. The main functions of the center include: providing compound screening services; offering drug screening technology platforms and technical consultation; setting up various screening models; studying high-throughput screening technologies and constructing national compound libraries. The center's screening and research emphasis is directed towards tumor, nervous system diseases, gerontological diseases and diabetes.	Government	http://www.screen.org.cn/news/Eng.HTM The National Center for Drug Screening No. 189, Guo Shou Jing Road, Zhangjiang High-Tech Park Pudong New District, Shanghai 201203, China Telephone: 86 21 5080 1313 Facsimile: 86 21 5080 0721 E-mail: center@mail.shcnc.ac.cn
Shanghai Institute of Pharmaceutical Industry (SIPI)	Shanghai Institute of Pharmaceutical Industry (SIPI) was inaugurated in 1957, and now is the largest and strongest comprehensive research and development entity in the pharmaceutical industry system of China. Formerly, it was under the direct leadership of the State Drug Administration, and now is affiliated to the Central Enterprise Work Commission.	Government	http://www.sipi.com.cn/gjjzx/english/pages/about.htm 1320 Beijing Xi Road, Shanghai, China Tel:021-62479808*510 Fax:021-62791715 Email: office@sipi.com.cn, keyan@sipi.com.cn

	SIPI covers the whole spectrum of pharmacy, including chemical synthetic drugs, pharmaceutical preparations, biochemical and microbiological drugs, bio-tech drugs and products, Chinese medicinal herbals and modern preparations of Chinese traditional medicine, drug analysis, pharmacology, toxicology, and pharmaceutical equipment.		
Shanghai Academy of Agricultural Sciences (SAAS)	Established in 1960, SAAS has now 12 institutes with research focuses such as crop seed production, ecology, plant protection, gardening, vegetable, edible fungi, veterinary science and agricultural informatics.	Government	http://www.saas.sh.cn/ Chinese only 2901 Beizhai Road, Shanghai 201106 Tel: 021- 62208442 Fax: 021-62206698 E-mail: saas@saas.sh.cn
Shanghai University of Traditional Chinese Medicine (SHUTCM)	Found in 1956, SHUTCM is both an education and a research institution of TCM in the areas of surgery, pharmacology and internal medicine.	Academic/ Government	http://www.shutcm.com/structure/index Chinese only 1200 Cai Lun Road, 201203 Shanghai Tel: 5132 2222 Email: xiaoban@shutcm.com
WuXi PharmaTech	Founded in early 2001, WuXi PharmaTech is China's first and leading chemistry-based pharmaceutical R&D firm. Widely considered to be the finest and best-equipped private R&D facility in China, WuXi PharmaTech seeks to accelerate the movement of our customers' products through the discovery and development pipeline by offering world-class combinatorial, medicinal and synthetic chemistry, computer-aided drug design, and providing a broad spectrum of integrated development services from milligram to metric ton scaled active pharmaceutical ingredients, intermediates and raw materials. In collaboration with our customers, we also aim to help fill the fast-growing demand in China for western style medicines.	Private	http://www.pharmatechs.com/ www.pharmatechs-us.com 288 Fu Te ZhongLu, Bldg 1, WaiGaoQiao Free Trade Zone, Shanghai 200131, China Tel: +86-21-50461111 Fax: +86-21-50461000 CEO: Dr. Ge Li Administration & Investor Relations: Mr. Tao Lin: HYPERLINK "mailto: lintao@pharmatechs.com" lintao@pharmatechs.com Customer Service: Mr. Bo Feng: fengbo@pharmatechs.com PR Contact: Mr. Shengxu Zhao: zhao_ shengxu@pharmatechs.com
Crimson Pharma	Crimson is a private pharmaceutical company that acquires, develops and commercializes innovative therapeutics to address unmet medical and economic needs in the Asian market. Crimson focuses on acquiring the regional rights to pharmaceutical compounds and technologies with significant pre-clinical, clinical or market data, and adds value by accelerating their time-to-market through efficient clinical and regulatory development in China. Founded in 2002, Crimson is headquartered in Hong Kong and also operates in the United States and China. The Company has established a brand new, 10,000 square ft. development center in Shanghai that houses a full pre-clinical suite with organic synthesis, formulation development, as well as analytical and QC release laboratories.	Private	http://www.crimsonpharma.com/web/en/company/about_us.htm China Office: 328 Bibo Road, Block C, 4th Floor Zhang Jiang Hi-Tech Park Shanghai 201203, China T: +86 21-5080-5146 F: +86 21-5080-5148 Business development contact: Vivian Lao, Vice President vivian.lao@crimsonpharma.com

Shanghai Sunway Biotech Co., Ltd	Shanghai Sunway Biotech Co., Ltd., founded in 1995, is an innovative biopharmaceutical company concentrated on developing and manufacturing anticancer gene-therapy biopharmaceuticals based on its oncolytic viral technology platform.	Private	http://www.sunwaybio.com.cn/NewWeb01/english.htm 1150 Guiqiao Rd., Jinqiao Export Processing Zone, Pudong, Shanghai 201206, China Tel: +86 21 50310270 Fax: +86 21 58999488 E-mail: sunwaybio@sunwaybio.com.cn
MolCell Biopharmaceuticals	The mission: To develop better computational tools and to provide the best professional services of computer-assisted drug design and computational biology for biopharma & biotech enterprises to accelerate their R & D programs efficiently and cost-effectively.	Private	http://www.molcell.com/ Contact: Ge, Junhui Floor 5, 151 Keyuan Rd. Zhangjiang High-tech Park, Pudong Shanghai 201203, P.R. China Phone: +86-21-5027 0850 info@molcell.com
Shanghai Fuchun Zhongnan Biotech Co. Ltd	Founded in 2002. R&D in biopharmaceuticals (e.g. therapeutic antibody), diagnostics (five in clinical trial). Provide service for cloning and protein purification. Sales of antibodies, nucleotide purification kit, etc. Broad domestic and foreign collaboration partners in academia and industry.	Private	http://www.biochinan.com/ (Chinese only) Contact: Jian Ni, Ph.D. & M.D., President and CEO Room 501, No.1011 Halley Rd. ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Tel: China 86-21-59766219 (O), 13818096617 (C), Fax: 86-21-59766219 Tel: U.S.A 301-916-0466 (O), 301-792-6166 (C), Fax: 301-916-8385, E-Fax: 2403630201 jiannihome@yahoo.com, jianni@biochinan.com
Shanghai Green Biomaterials Co. Ltd	Founded in 1998. Development and manufacture of chitin containing hygienic products.	Private	http://www.shgcgf.com/ (Chinese only) 351 Guo Shou Jing Road, 4F ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Contact: Wei Zhang (Sales) Tel:86-021-62729008 Fax:86-021-62729007 Cell:13706167386 E-mail: shgcsw@126.com
IgCon Therapeuticals Co. Ltd	Sino-American joint venture (Genetastix, U.S.), develops humanized antibodies for therapeutic and diagnostic purposes. Broad international collaboration.	Private	http://www.igcon.com/ Rm 320, 563B Song Tao Road, ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Tel: 8621 5080 3839 Fax: 8621 5080 3837 Business development: business@igcon.com

Shanghai Innovative Research Center of Traditional Medicine (SIRCTM)	Established in 2000, this center dedicated to TCM modernization research. Several laboratories have been set up for plant chemistry, organic synthesis, toxicology, Chinese herb genomics, drug design and TCM informatics.	Government	http://www.sirc-tcm.sh.cn/ (Chinese only) 439 Chung Xiao Road, #1 Bldg ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Tel: 86 215080 1717, 8621 5027 2399 sirc120@sirc-tcm.sh.cn
Shanghai Pharm Valley Corp.	The commercial arm of Shanghai Innovative Research Center of Traditional Medicine. R&D, manufacture and sales of purified herbal drug active components, health food, and drug intermediates and medical related software.	Government	http://www.shpv.com 563 Song Tao Road, B Bldg, 2F ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Tel: 86-21-50801998 Fax: 86-21-50805243 shpv@shpv.com
Shanghai Julong Pharmaceutical R&D Co. Ltd.	Founded in 2000, mainly engaged in R&D of new drugs, chemical intermediates, as well as technical transfer and the manufacture of rare chemical products. The research field covers chemical drugs, plant drugs and chemical reagents, and most skilled in organic synthesis.	Private	http://www.kisschem.com/en-aboutus.htm Old Humin Road NO.1901, Shanghai 201108, China Tel: 86-21-6497 9654, 86-21-6497 9672 Fax:86-21-6497 9694 Contact: Xiaolong Yang (cell: 8613921092068) Xiangqun Liu (cell: 86 13817821051) E-mail: julong@kisschem.com dragon@kisschem.com
Shanghai Kelun Bio-Tech Co.,Ltd	Founded in 2003, R&D focuses on anti-bacteria and anti-viral drugs.	Private	http://www.kbt.cn/ 328 Bi Bo Road, B Bldg, Rm 110 ZhangJiang Hi-Tech Park, Pudong New Area Shanghai 201203 China Tel: 86 21-5080778-3, -2, -1 Fax: 8621-50807780 Email: kbt@kbt.cn
Shanghai Fudan-Zhangjiang Bio-pharmaceutical Co., Ltd	The four platforms established are: (1)Genetic Engineering Drugs Platform (2)Photodynamic Therapy Drugs Platform (3)New Drug Screening and Evaluation Platform (4)Medical Diagnostic Products Platform.	Private	http://www.fd-zj.com/en/gsjs/gsgs.htm 308 Cailun Rd., ZhangJiang Hi-Tech Park, Shanghai 201203, China Tel: +86 21 58953355 Fax: +86 21 58553990 E-mail: fd-zj@fd-zj.com
Shanghai LeadDiscovery Pharmaceutical Co., Ltd	Established in November 2002; dedicates to designing, screening, synthesizing of lead compound for the novel drugs and providing relevant services. The company is also engaged in developing, producing and selling of pharmaceutical raw materials medicine and intermediates.	Private	http://www.leaddiscovery.com.cn/en/index.htm 5F,1043 HaLei Road, Zhangjiang Hi-tech Park, Pudong New Area, Shanghai 201203, China Tel: 86-21-51320099, 51320020 Fax: 86-21-51320060 Email: sales@leaddiscovery.com.cn

Shanghai Medicilon Biotech Co., Ltd.	Sino-USA joint venture. Shanghai Medicilon Inc. offers drug discovery and development services ranging from protein production, biological assays, and chemistry services to pharmacokinetic and bioanalytical services.	Private	http://www.medicilon.com/introduction-shmdx.html 1011 Halei Road, Suite 502, Zhangjiang, Hi-tech Park, Shanghai 201203, China Tel: + 86 21 51320237 FAX: +86 21 51320222 E-mail:clchen@medicilon.com, cmao@medicilon.com
Shanghai Newgenco Bioscience Co., Ltd.	The company is presently focusing on the development of drug candidates and dietary supplements for the treatment of diabetes mellitus, high blood lipid, high blood pressure and other cardiovascular diseases.	Private	http://www.newgenco.com.cn/en/aboutus.htm 518 Bibo Road, A316, Zhangjiang, Hi-tech Park, Shanghai 201203, China Tel: 86 21-50802940, 50272739 Fax: 86 21-50272759 E-mail: mkt@newgenco.com.cn
Shanghai Lion Biomedical Sci&Tech Co. Ltd.	R&D, manufacture and sales of digital medical devices. Private	Private	http://www.lionmedical.com/index1.aspx (Chinese only) 498 Guo Shoujing Road, Pudong Software Park 12302-5, Zhang Jiang Hi-Tech Park Shanghai 201203, China Tel:+86 21-38953681 Fax: +86 21-38953676 lion@lionmedical.com
Sym-Bio Biotechnology Co., Ltd.	Focus on advanced TRF (time-resolved fluorescence) instruments and the relative reagent kit for scientific research and clinical working.	Private	http://www.sym-bio.com.cn/english/index.htm 351 Guo Shoujing Road, Bldg 2, Rm501-502, ZhangJiang Hi-Tech Park, Shanghai, 201203, China Tel: +86-21-5080 5261 /5262 /5263 Fax: +86-21-50800393 info@sym-bio.com
TenGen BioTech	TenGen BioTech has established a series of unique bio-platforms for early stage drug and vaccine development. TenGen BioTech has through drug-screening technology developed therapeutic drugs for cancer and hepatic diseases from natural herbs with very limited side effect.	Private	http://www.tengen-biomed.com/page-english/e-company.htm Shanghai TenGen Biomedical Co., Ltd. (Office) West 5G, 318 North Chongqing Road, Shanghai, 200003, China Tel: +86-21-33100664 Fax: +86-21-63590887 info@tengen-biomed.com
Tauto Biotech Co., Ltd..	Development of natural medicines from natural plants and animals primarily by application of techniques like HSCCC and liquid phase chromatography. Active pharmaceutical ingredients have been successfully extracted with high purity from natural plants. The company has manufactured a series of new-type patented HSCCC equipment, and can provide science research institutes with the most advanced technology and equipment for isolation and purification, and also develop new products based on customer's request.	Private	http://www.tautobiotech.com/Frameset_E.htm Room1311, Hearing Mansion, 1279 Pudong Road, Shanghai 200122, China Tel: 86-21- 58779812, 58821768 Fax: 86-21-50546686 E-mail: tauto@szonline.net marketing@tautobiotech.com, tech@tautobiotech.com

Shanghai Upper Bio-tech Pharma Co., Ltd.	Founded in 1999. R&D and sales of the reagents for rapid diagnostics in the biomedicine field.	Private	http://www.poct.com.cn/ General Manager: Jason Xu 3F, C Bldg, 328 Bi Bo RD. Shanghai 201203, China Tel: +86 21 50800960, 50800476, 50800960 Direct: +86 21 38953398 Fax: +86 21 50801522 market@uppergold.com
Shanghai Weibang Qiaoyuan Pharm. Tech Co., Ltd.	Founded in 2003 as a joint venture of two Chinese domestic pharmaceutical companies to focus on using collagenase as treatment, mainly as injection for disc repair.	Private	http://www.cccc.sh.cn/d_q/aboutus.htm#menuhref (Chinese only) Tel: +8621 55965646, 65629999-1102 Fax: +8621 65021438 cccc@cccc.sh.cn
Shanghai Wenda Biotech, Inc.	Devoted to research, develop and manufacture active ingredients from botanical and biopharmaceutical intermediate for biopharmaceutics, food additives, nutritional supplement and cosmetic.	Private	http://www.21wenda.com/wenda_en.htm 518 Bibo Road, Bldg A, Zhangjiang High-tech Park, Shanghai 201203, China Fax: 86-21-50802089 50802090 Fax: 86-21-38953580 info@21wenda.com
Shanghai Youseen New Medicine Exploration Co., Ltd.	TCM modernization, purification of active ingredient of Chinese herbs for drugs as well as nutrition and cosmetic supplements. The pipeline includes drugs for cardiovascular, liver, urinary diseases and anti-viral, anti-bacterial medicaments.	Private	http://www.youseen.com/ (Chinese) 351 Guo Shoujing Road, Bldg 2, 4F Zhangjiang High-tech Park, Shanghai 201203, China Ms. Yu Tel: +86 21 50801298-815 E-mail: yuli@youseen.com Mr. Zhang Tel: +86 21 50801298-812 E-mail: sale@youseen.com Fax: 86 21 50801298-813
Shanghai Zhaoguang Bioengineering Design Institute Co., Ltd.	The company is focused on industrial application of enzymes for polysaccharide production.	Private	http://www.zhaoguang.com.cn 351 Guo Shoujing Road, Zhangjiang High-tech Park, Shanghai 201203, China Tel: +86 21 68561199, 50801666 Fax: +86 21 68568768, 50801999 E-mail: wzg@zhaoguang.com.cn
Shanghai Guardian Medical Instrument Co., Ltd.	Shanghai Guardian Medical Instrument Co., Ltd. is specializes in developing and manufacturing innovative adhesives and bandages. Guardian sets its target on serving for overseas customers in medical, sports, veterinary and first aid markets. Various kinds of cohesive elastic bandages and adhesive elastic bandages are produced. The R&D center also develops market-specific products. Current major geographic markets are Europe, North America, Japan and other developed regions. Private	Private	http://www.guardee.com/eng/aboutus.htm 20th Floor, Shanghai International Pharmaceutical Trade & Exhibition Tower,1399 Jinqiao Road, Pudong, Shanghai 201206, China Tel: 86-21-58547462, 86-21-58547463 Fax: 86-21-58547467 E-mail: Export@guardee.com

Shanghai GeneCore BioTechnologies Co., Ltd	Established in 1997, acquired by Vita Genomics Inc (Taiwan). GeneCore conducts research and service in genomics and proteomics. Platform technologies include high throughput SNP genotyping, mutated gene analysis, proteomics, quantitative PCR, genome library search and bioinformatics.	Private	http://www.genecore.com/english/about/index.htm 200 Tian LinRoad, 3F Shanghai 200233, China Tel: 86 21 6495 6278 Fax: 86 21 6485 9746 E-mail: genecore@online.sh.cn
Shanghai Celstar Bio-pharmaceutical	Products include human tumor necrosis factor for injection, fetal bovine serum, HBV vaccine.	Private	http://www.celstar.com.cn/english/gsjj.htm 1 Juli Road, Zhangjiang High-tech Park, Shanghai 201203, China
Weihai Sinogen Pharmaceutical Co., Ltd. (Sinogen)	Sinogen is a Sino-Foreign Joint Venture company registered in China in December 1995. Manufactures Hepatocyte Growth Factors (pHGF) intravenous injection to treat severe hepatitis. Sinogen is also developing drugs for heart and kidney diseases.	Private	Sales Headquarter: Address: 23 B Zhaofeng International Trade Center, 369 Jiangsu road, Shanghai 200050, China Tel: 86 21-5240-0573 or 86 21-5240-0574 or 86 21-5240-0575 Fax: 86 21-5240-0576 E-mail: market@sinogen.com.cn

Beijing Organizations

The MEBO International Group	The MEBO International Group, founded by Professor Xu Rongxiang in 1987, is a pioneer and successful practitioner in the research and application of regenerative medicine. The research has provided the market with innovative technologies and products that fulfills the promise of regeneration and repair of human organs in vivo and in situ. The MEBO group has been harnessing the power of stem cells for a wide spectrum of clinical applications, which includes using tissue repair and organ regeneration in the treatment of aged skin, diseased skin, such as diabetic ulcers and baldness, various traumatic wounds, and diseases involving mucous membrane in internal organs such as ulcers.	Private	http://www.mebo.com/en/mebo/overview.asp China office, Room 5301 33 East Chang An Ave. Beijing 100004, China Tel: +86 10 6527 7731, +86 10 6527 9212 Fax: +86 10 6512 4361 Email: info@mebo.com 505 Los Altos Ave. Arcadia, California 91007 USA Tel: +1 626 8218617 Fax: +1 626 4468528 Email: international@mebo.com
Starvax, Inc.	Starvax Inc. is a product oriented company developing novel drugs for the treatment and prevention of infectious disease and cancer, with a focus on the Asia-Pacific , especially the Chinese market.	Private	http://www.starvax.com/english/about%20us/01.htm Suite A 206 Biotechnology and Medicine Incubator Building, No. 55 Life Road, Changping District, 102206 Beijing, China Ms. Wenping Wang Tel: +86-10-80728606/07/08/09 ext. 201 Fax: +86-10-80728610 wpwang@starvax.com

Beijing Medical University United Biological Engineering Co. **a) Beijing Biopharmaceutical H-Tech Incubator** **b) Beijing Medical University United Pharmaceuticals** **c) Beijing Biopharmaceutical Technology Exchange Service Center Co., Ltd** **d) Beijing Zhongguancun Life Science Park Incubator Co., Ltd.**	Since 1994, the company researches and develops biopharmaceutical, herbal medicine and health products. It also manufactures and sales these products as well as provides technology transfer and consulting services. Following are its subsidiaries: Provides services from venture capital, equipment to staff, as well as technical support. R&D, manufacture and sales of biological products, pharmaceuticals, health products and medical equipment. Specialized technology exchange service center for biopharmaceutical branch. Special incubator for biopharmaceutical start-ups.	State-owned	http://www.bio-incubator.com/ (Chinese) Tel: 86 10-82801730 Fax: 86 10-62050175 E-mail: bmuupc@sun.bjmu.edu.cn
Peking University School of Oncology/ Beijing Institute for Cancer Research/ Beijing Cancer Hospital	Academic research focuses on breast and stomach cancers. Long term collaborator of the U.S. National Cancer Institute.	Academic	http://www.bicr.bjmu.edu.cn/english.htm (more info in Chinese) Beijing Xisi No. 1Honglouchang Road , Bejing, China
Beijing Genomics Institute, Chinese Academy of Sciences (Precursor Beijing Huada Genomics Research Center)	Involved in the Human Genome Project which China was responsible for 1%. Focus on genome research from human to rice and other species.	Academic	http://www.genomics.org.cn/bgi_new/english/index.htm Beijing Airport Industrial Zone B-6, Beijing 101300, China Tel: 86-010-80481184 Tax: 86-010-80498676

Other Cities' Organizations

Shenzhen SiBiono GeneTech Co.,Ltd.	Shenzhen SiBiono GeneTech Co.,Ltd. is a pioneer in developing gene therapy in China. As the first professional company in gene therapy in China, SiBiono has achieved great success. In October 2003, The recombinant human Ad-p53 Injection, trademarked as Gendicine, developed independently by Sibiono successfully obtained the Drug License, Production Approval and GMP Certificate from the China State Food & Drug Administration (SFDA). It is the first commercialized gene therapy product ever approved in the world. Two major technology platforms of Viral Vector Gene Delivery System and Non-Viral Vector Gene Delivery System have been developed focusing on cancer and cardiovascular diseases.	Private	Shenzhen Sibiono GeneTech Co., Ltd. Langshan Rd. Shenzhen Hi-Tech Industrial Park (North) Shenzhen 518057, China Fax: 86-755-26968808 www.sibiono.com sbn@sibiono.com Contact: Zhaohui Peng, Ph.D., CEO. zhpeng@sibiono.com

Sanjiu Medical and Pharmaceutical Co., Ltd.	The company is engaged in medical R&D, production, sales and healthcare services, according to its strategy "modernizing traditional Chinese medicine, industrializing Chinese medical treatment, globalizing health service".	Private	http://www.999.com.cn/english/ 1028 Bei Huan Avenue Shenzhen, Guangduo Province, China
TASLY Group	Founded in 1994, located in Beichen hi-tech Park, Tianjin, TASLY is a well-known modern Traditional Chinese Medicine (TCM) pharmaceutical enterprise which does scientific research & development, production and marketing.	Private	http://www.tasly.com.cn/en/About_Tasly.htm http://www.tasly.com.cn/en/About_Tasly_Organization.htm Tasly Modern TCM Garden, Beichen Hi-Tech Park, Tianjin 300402, China TEL: +86-22-2673 6808, 26736617 FAX: +86 22 26736618 EMAIL: info@tasly.com
GeneScience Pharmaceutical Inc.	Founded in 1994, GeneScience is one of the largest biopharmaceutical companies in China now. It has three products on the market and more than ten products on the development pipeline. In 2002, GeneScience's recombinant human growth hormone (rhGH, Jintropin) captured a major share of China's growth hormone market.	Private	http://www.gensci-china.com/english.htm 72 Tianhe Street, High-tech Development Zone, Changchun, Jilin 130012, China Tel: +86-431-5100414, +86-431-5100402 Fax: +86 431 5100625 Email: genlei@gensci-china.com
Shenzhen Kangtai Biological Products Co., Ltd. (SKBC)	Founded in 1988, SKBC has introduced the Recombinant Hepatitis-B Vaccine (Yeast) production line as well as the seed, production technology, quality standard and control methods from Merck & Co.	Private	http://www.biokangtai.com/ 6 Kefa Road, Nanshan District Science Technology Park, 518057 Shenzhen, China Tel: 86-755-26988688 Fax: 86-755-26988600 Email: HYPERLINK "mailto:office@biokangtai.com" office@biokangtai.com
Hutchison Medipharma (Shanghai)	Established in 2002, now mainly engages in research and development, production and sales of plant and herbal medicines, and aims to modernize, industrialize and internationalize the sector. Aims to use advanced technology to develop new medicines with independent intellectual property rights from traditional Chinese herbal medicines, to cure tumor, immunity and metabolic diseases.	Private	No website found Du Ying, general manager of Hutchison Medipharma

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