Press Release

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January 2007

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AchemAsia 2007
7th International Exhibition-Congress on Chemical Engineering and Biotechnology

Beijing / PR China, 14 - 18 May 2007

Trend Report No. 8: China's Biotechnology Industry

China's Biotechnology Industry on the Upswing

- **7th AchemAsia in May 2007 in Bejing will bring together chemical processing and biotechnology experts from all over the world**
- **High level exhibition, congress and partnering event for industrial biotechnology**

The Chinese biotech industry is rapidly growing and innovative R&D in many sectors is gaining ground globally. China is already strong in many biotechnology sectors. It has become a powerful force in the global biopharmaceutical market and it is expected that China will become a serious competitor for Europe and the United States. In the field of plant genetic engineering it is already a global leader. It is also seen to be becoming one of the world's largest producers and users of biofuels due to its abundant agricultural resources and rapid financial growth.
Biotechnology could become the fastest growing industry in China over the next years as it is to be put high on the country's mid- and long-term scientific and technological development strategy for 2006 through 2020. The ever increasing trend of producing new innovative products and away from imitating foreign products is confirmed by the high number of patents filed and granted.
AchemAsia 2007 from 14-18 May 2007 in Beijing with its special focus on industrial biotechnology will bring together experts from science and industry to present and discuss the latest developments in biotechnology processing and equipment, biosafety, IP and licensing and all related sectors.

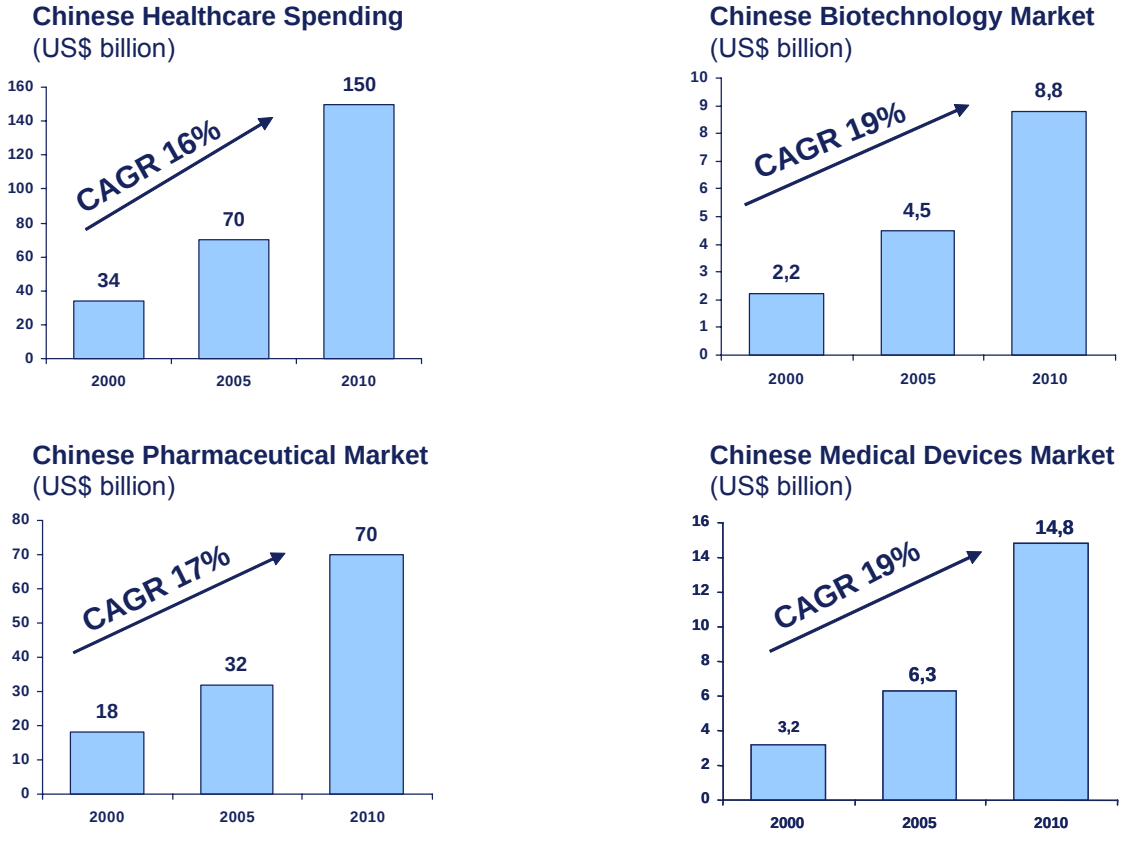
China's biotech growth began in the 1980's and over the past 20 years, biotech in China has emerged from just a few researchers at a small number of institutes to an integrated industry. Due to the increasing importance of biotechnology to China, the Chinese government is heavily promoting this industry through increased programme funding of research, the encouragement of foreign investments, improvement of IP rights, creation of high-tech zones and tax incentives.

The number of biotech facilities has considerably grown since the 1980's. China currently has around 200 research centres focused on biotechnology and is already at an international level in some areas of research (e.g. gene research of some important diseases, stem cell research and gene mapping). Many new biotech companies are formed each year and there are now well over 500 private biotech companies in China, over 300 of which are in the medical biotechnology area[a]. A majority of the companies are situated in the dedicated investment zones and development zones (e.g. there are around 20 biotech parks located in Beijing, Shanghai, Guagzhou and Shenzen).

Medicinal (Red) Biotechnology

China is one of the leaders in the development of biogenerics and its biopharmaceutical industry is continuing its impressive growth rate. It is expected that China's healthcare and biotech industry will show strong growth in the future (Fig. 1). According to government statistics, China's biological product market surpassed US$ 2.5 billion in 2004 and is growing in excess of 13% per year.

China's biopharmaceutical sector has gone from solely imitating products to the development of new innovative products. Since 1993, when the first genetically engineered drug (recombinant human interferon α1b) was introduced to the market, more than 20 recombinant pharmaceuticals, such as insulin and granulocyte colony stimulating factor (GCSF) have been commercialized. In 2002, 8 of the world's top 10 selling biopharmaceutical drugs were produced in China.



Source: BCG, Burrill, E&Y, Frost & Sullivan, Goldman Sachs, IMS, World Bank

Fig. 1: China's healthcare and biotech markets

[a] Life Science Partnering China Europe, 18.-19. Spetember 2006, Beijing, VR China.

China's biopharmaceutical market is primarily generic, and most players are smaller domestic companies that compete on price. Most of them have excess manufacturing capacity and are seen as good candidates for partnership or acquisition.

But China is also very active in the field of innovative biopharmaceuticals (Fig. 2). It is reported that in 2004 there were approximately 140 drugs in China's biopharma pipeline, 60 of which are biologics, including 19 antibodies and 11 vaccines. New drug development is focused on gene therapy and antibodies.

Sector	Type	Application	Producer
Vaccines	Recombinant hepatitis B surface antigen	Hepatitis B	Shenzhen Kangtai Biological Products
	Recombinant live oral vaccine	Shigella dysentery	Lanzhou Institute of Vaccines and Biological Products
Therapeutics	Recombinant interferon α1b	Ulcerative keratitis / Hepatitis B and C	Changchun Research Institute of Biotechnology Shanghai Research Institute of Biotechnology
	Recombinant human interleukin-2	Various uses, including cancer	Shenzen Neptunus Interlong Biology Technique Holdings
	Recombinant epidermal growth factor	Skin injuries	Shanghai Dajiang Group
	Recombinant granulocyte colony-stimulating factor	Neutropenia	Amoytop Biotechnology (Fujian)
	Recombinant erythropoietin-α	Anemia	Shenyang Sunshine Pharmaceutical (Beijing)
	Recombinant human somatotropin	Dwarfism	Changchun Jinsai Pharmaceutical
	Recombinant streptokinase	Cardiovascular	China Tonghua Herbal Link
	Recombinant Ad-p53 gene therapy	Head and neck squamous cell carcinoma	Shenzhen SiBono GenTech
Diagnostics	Enzyme-linked immunosorbent assays	Hepatitis C virus and human immunodeficiency virus	Shanghai Huaguan Biochip

Source: Nature Biotechnology 22, DC13 - DC18 (2004)

Fig. 2: China's biopharma products (selection)

Due to their high compliance, trials can be performed at international standards in China. The approval process is similar to that in the United States and includes three phases of clinical trials. It takes 5-8 years in China compared to an average of 8-10 years in the United States. With these high standards it is hoped to increase local demand, as Chinese consumers perceive only Western drugs being developed at international standards. One advantage for local biotech companies over international companies are the low costs for developing drugs in China. These are estimated at around US$ 120 million compared to the costs for developing drugs in the United States at US$ 800 million - 1 billion.

Plant (Green) Biotechnology

China is a global leader in the field of plant genetic engineering and has become the fourth largest grower of genetically modified (GM) crops. It ranks second to the United States in terms of investment in crop biotechnology and is continually increasing its investments in agricultural biotech research. China's biotech development strategy for the 11th Five-Year Plan (2006-10) is to include efforts to develop the biotechnological seeding of major crops. It is estimated that the Chinese government is currently investing around US$ 500 million in agricultural biotechnology. With regard to rice crop expenditure, China is the world's highest biotechnology research spender with an annual expenditure of US$ 115 million. China is to also increase its investment in safety monitoring of GM crops as a more comprehensive and accurate safety evaluation is required for the further commercialisation of these crops.

The number of plant biotechnology researchers in China has become one of the highest in the developing world. The research focuses on all applications including tissue culture, genetic engineering, marker-assisted selection, microbiology, genomics, and other related areas. More than 50 plant species and more than 120 functional genes used in plant genetic engineering have been identified. One of the few commercially deployed transgenic trees, the Bt poplar (transformed with the Bacillus thuringensis gene Cry1Ac) has been developed to help with environmental protection in parts of China that have difficult physical and climatic conditions and where pests are a serious problem.

Chinese farmers have grown insect-resistant Bt cotton since 1996 and today almost 70% of China's cotton comes from GM plants. China accounts for the world's largest acreage in pest-resistant Bt cotton. Four types of Chinese-developed GM rice (three to prevent insect damage and one to resist bacterial blight) are awaiting commercialisation approval. Field-testing of two biotech rice varieties in the provinces of Hubei and Fujian showed yield increases of around 4-8% and pesticide reduction of around 80%, resulting in an overall increase in net income by US$ 80-100 per hectare. Field trials are ongoing for other major crops such as potato, soybean, cucumber, papaya, maize, and tobacco.

In order not to become dependent on foreign companies for cotton or grain seed, the Chinese government, while allowing joint ventures with foreign companies such as Monsanto, has supported setting up Chinese biotech companies (such as Weiming and Biocentury) that develop GM seeds and supply them more inexpensively.

In response to public concern, China is now strictly regulating GM crops. In 2002, China's first biotech law was enforced which guarantees proper evaluation of GM foods and crops for potential risks. It also outlines an essential framework appertaining to the import of transgenic substances. In 2000, the Seed Law came into effect, which stipulates that all new cultivars (both conventional and transgenic species) must be strictly ratified and registered before distribution. The law must be observed in each trial stage of GM crops, before they are issued permits for commercialisation.

Industrial (White) Biotechnology

Driven by future fuel shortage (petrol deficit is estimated to reach 200 million tons by 2020), air pollution (increasing car ownership) and growing rural development, China's government launched a bioethanol national programme in 2000 aimed to promote the production of ethanol. Due to government support over the past years, bioethanol is already blended into all fuel sold in around 9 provinces. The government is targeting a 10% blend of biofuels by 2020 which, with the predicted growth in vehicle sales, would mean a demand of around 23 million tons of biofuel. Five major Chinese bioethanol manufacturers now have capacity to produce over 1.5 million tons a year, the largest of which, Jilin Plant (commissioned in 2003), has an annual production capacity of 600,000 tons. More than 80% of bioethanol is made from grains (e.g. corn, cassava, rice), 10% from sugar, 6% from paper pulp waste residue, and the rest from ethylene by synthetic process. Current estimations see an annual production capacity of liquid biofuels (bioethanol & biodiesel) of 11 million tons by 2010.

China's plastic consumption in 2005 was 25-30 million tons of which 5.5 million tons were used for packaging. It is estimated that the total plastic consumption will reach 80 million tons by 2010. With this in mind, the Chinese government is also encouraging and promoting the production and use of biodegradable plastics. In March 2005, the Chinese government launched its polylactic acid (PLA) plan - it is estimated that the demand for PLA will reach 8-10 million tons by 2020. China already has pilot reactors producing polyhydroxyalcanoates (PHA) plastic from plant and bacterial waste.

Progress has also been made in basic research. Chinese researchers from the Chinese Academy of Sciences Guangzhou Institute have used nanotechnology to turn carbon dioxide waste into biodegradable plastics - three patents have been secured. China's Ministry of Science and Technology has launched a programme to study microbial genomics with the goal of improving organisms for oil extraction. If successful, this would lead to the extraction of an additional 6-10% oil from reserves by 2010. The new oil extraction technology is based on the theory that in the oil strata, there exist a large number of microbes that work to separate heavy components and other impurities while producing acidic materials, solvents, macromolecular polymers and gas, which propels oil to move out of the terrain, thus making it easier for oil extraction. Researchers have sequenced the genomes of two species of microbes that are able to metabolise heavy components and other impurities in the oil while producing gas that propels the oil out of the earth to ease extraction.

Other current research activities include bioremediation of organic polluted environments and bioaugmentation of wastewater treatment, screening of novel enzymes (laccase, xylanase, phytase etc.) of industrial applications from non-extremophiles and extremophiles as well as fermentative production of amino acids and alcohols (like ethanol, xylitol, arabitol).

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(This report was made available as AchemAsia Trendreport 2007 by Dr. Gunter Festel, Festel Capital, Hünenberg, Switzerland, www.festel.com.)