the Wnt pathway by use of BIO can sustain the undifferentiated status in both human and mouse ES cells, based on evaluation of expression of *Oct-3/4, Rex-1* and *Nanog*, marker genes for pluripotency [27]. Removal of the compound from culture medium leads to restoration of multi-lineage differentiation program of human and mouse ES cells, suggesting inactivation of GSK3 by BIO is reversible.

Cheng's group compared a panel of human and mouse fibroblasts with capacities for supporting the prolonged growth of human ES cells, to search for growth factors required for hESC survival, proliferation, and self-renewal [17]. Their experiments suggest that supportive feeder cells secrete factors required for human ES cell survival/proliferation and also capable of blocking spontaneous differentiation thereby achieving self-renewal. By examining the effects of blocking or adding recombinant Wnt proteins into hESC culture, they found that recombinant Wnt3a induced human ES cell proliferation and also differentiation in the absence of feeder cell-derived factors. After treatment of Wnt3a for 4-5 days, human ES cells, while exhibiting an undifferentiated phenotype, fail to form undifferentiated hESC colonies. Results of a reporter assay indicate a low level of the beta-catenin-mediated transcriptional activation in the canonical Wnt pathway in undifferentiated hESCs, although upregulated during differentiation. Based on these observations, Cheng and colleagues proposed a model to explain the seemingly paradoxical roles of Wnt signaling in human ES cells [17]. Wnt, in combination with supportive feeder cells or conditioned medium, CM (containing antidifferentiation factors), supports self-renewing proliferation of undifferentiated human ES cells. However, in the absence of the "antidifferentiation factors", Wnt promotes ES cell proliferation and differentiation.

Ding's group launched a cell-based screen of chemical libraries to search for small molecules that promote self-renewal of ES cells [26]. This search led to identification of a previously uncharacterized heterocycle, SC1, that supports propagation of mouse ES cells in an undifferentiated status in the absence of feeder cells, serum, and LIF. Long-term SC1-expanded murine ES cells maintain the differentiation capacity into all three primary germ layer cells in vitro. Biochemical analysis suggests that SC1 stimulates self-renewal of mouse ES cells through suppression of RasGAP and Erk1 activities [26]. Ding's group also developed a simple chemically defined medium (CDM) that supports efficient self-renewal of human ES cells cultured on a Matrigel-coated surface over multiple passages [28]. hESCs maintained under such conditions express multiple hESC-specific markers, display the characteristic hESC morphology, maintain a normal karyotype in vitro, and form teratomas in vivo. This study also identified growth factors that direct monolayer differentiation of human ES cells toward neural, definitive endoderm/pancreatic and early cardiac muscle cell lineages in the CDM conditions [28].

In conclusion, elucidation of intracellular signaling pathways involved in decisions on self-renewal and differentiation of ES cells is a most critical issue in the field of stem cell biology. Toward this goal, combined use of genetic and chemical biology techniques is a most elegant approach.

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Stem Cell Research in China

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About the author: Guo-Tong Xu, MD, PhD, graduated from Harbin Medical University with a bachelor degree in 1982. He later received a MD degree from Peking Union Medical College, Chinese Academy of Medical Sciences, and a PhD in pharmacology from University of North Texas Health Science Center (UNTHSC), USA. After trained in Alcon Lab. and NEI/NIH, he was appointed as a Research Assistant Professor at UNTHSC. He returned to China in 1997, and served as the Director of Sino-American Rainbow EyeCare Center in Nanjing (1997-1999), the China Country Director of ORBIS International (1999-2001), and Special Professor in Shanghai Key Laboratory of Developmental Biology, Shanghai Second Medical University (2001-2003). In 2003, he jointed the Institute of Health Sciences, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences (CAS), and Shanghai Jiaotong University School of Medicine, and became a Principal Investigator, Professor and vice Director in 2005. In 2006, his lab jointed the Key Laboratory of Stem Cell Biology of CAS. Recently, he was appointed as the Executive Vice President of Tongji University Medical School. Dr. Xu's research focuses on aging and metabolic eye diseases, including the development of new drugs and new therapies for diabetic retinopathy (DR) and age-related macular degeneration (AMD). He is now in charge of the establishment and development of a network of Stem Cell Banks in China. Dr. Xu served as the Secretary General and Chair of the Organizing Committee of the 2007 Shanghai International Symposium of Stem Cell Research. (Email: gtxu@sibs.ac.cn)

Background

Stem cells, in simple terms, are the cells capable of self-renewing and differentiating. By such definition, stem cells provide virtually unlimited sources for biomedical research and treatment of diseases through regenerative medicine. Stem cell research aspires the cure of many devastating illnesses such as Alzheimer's disease, Parkinson's disease and diabetes. It has the potential to revolutionize regenerative medicine which is currently limited by donor tissues and organs. Stem cells have provided experimental systems for studying early human development and mechanisms of genetic diseases. Stem cells are also becoming useful tools for drug discovery and development. It is therefore not surprising that stem cell research has been one of the hottest areas in life sciences. Progresses in stem cell research have been ranked among the major scientific breakthroughs in the past few years by top scientific journals.

The public interest in stem cell research goes beyond the scope of the science itself. China is a country where the general public is fascinated by stem cells and therapeutic cloning, and overwhelmingly supports stem cell research. In our history, one of the earliest concepts of cloning can be seen in the "Monkey King" published more than 400 hundred years ago. About 45 years ago, Professor Dizhou Tong, a Chinese embryologist at Institute of Oceanography, Chinese Academy of Science (CAS), cloned a fish by injecting a somatic cell of the Asian carp into an enucleated oocyte of the same species [1]. Ten years later, Tong generated an interspecies hybrid fish by inserting a European carp nucleus into an Asia carp egg [2]. In the 1980s, Dr. Daopei Lu at People's Hospital of Peking University performed the first syngeneic bone marrow transplantation in China [3]. The hematopoietic stem cell from bone marrow was the first stem cell type being used for treating human diseases. These early examples signify the curiosity and fascination of Chinese people and their scientists in cloning and stem cell research.

In the past two decades, with the tremendous economic growth in China, the government significantly increased its supports to scientific research and technology development. Stimulated by the breakthroughs in mammalian cloning and human embryonic stem cells, Chinese government has provided generous support and ethical guidelines to regulate stem cell research. This encouraging environment has attracted many Chinese scientists abroad to return and establish research capabilities in stem cell research. Since several reviews on stem cell research in China have been published recently [4-6], this article will primarily introduce the key stem cell players in China and their current works. We've learned and followed the progress of these scientists through organizing major research projects in China, academic exchanges and international stem cell research symposiums since 2001, and we hope that such information is valuable to the readers.

Stem cell researchers in various cities

The two 973 (basic research) projects for stem cell research initiated in 2001 represent a milestone in the development of stem cell

research in China. Under this program, two stem cell research centers were established: Peking University Stem Cell Research Center led by Dr. Lingsong Li, and the Center for Developmental Biology, Xinhua Hospital, Shanghai Jiaotong University School of Medicine headed by Dr. Huizhen Sheng. Back then, there were only a small number of scientists in China working in this field. The number of participants to the ISSCR (International Society for Stem Cell Research) annual meetings from China was only 1 or 2 in the years from 2001 to 2005. Those two 973 projects and several other projects like the 863 projects and the others supported by provincial and city governments have trained and developed many stem cell researchers. The number of researchers in the stem cell field has increased dramatically with 61 attendees in 2007 ISSCR meeting, including two oral presentations.

In November 2007, Shanghai International Symposium on Stem Cell Research was held successfully, jointly organized by Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, ISSCR, Shanghai Jiaotong University School of Medicine, Institute of Biomedical Sciences of Fudan University, Peking University Stem Cell Research Center and Guangzhou Institute of Health and BioMedicine. There were over 500 participants including more than 400 local Chinese scientists. Through the evaluation process by the scientific committee, 24 scientists from main-land China were selected as speakers at the symposium. They are from Beijing (6), Tianjin (2), Shanghai (13), Guangzhou (1), Kunming (1) and Changsha (1). These data, as well as the data from other activities, basically shows the number and the distribution of the stem cell scientists in China: about 500-600 scientists in about 100-200 labs, mainly in Beijing and Shanghai, and also in Guangzhou, Changsha and Kunming.

Stem Cell Research in Beijing and Tianjin

Stem cell scientists in Beijing and Tianjin mostly focus their works on somatic stem cell with several competitive embryonic stem cell projects. For example, Dr. Qi Zhou's team in Beijing Institute of Zoology, Chinese Academy of Sciences (CAS), established robust platforms for somatic nuclear transplantation, therapeutic clone and embryonic stem cell study. They have established several cloned animal models and cell models (including over 70 pantheon stem cell lines and mouse embryonic stem cell lines). Recently, collaborating with Dr. Weizhi Ji of Kunming Institute of Zoology, Chinese Academy of Sciences, they have made major achievements in macaque nuclear transplantation and induced differentiation of embryonic stem cell. Dr. Zhou's team is recognized to have contributed significantly to the enhancement of methods to generate SCNT blastocysts from the rhesus macaque [7], a key precedent to the recent description of the isolation of primate nuclear transfer-embryonic stem cell lines [8].

In Peking University, there are several active stem cell laboratories. Dr. Lingsong Li, head of the Stem Cell Research Center of Peking University, focuses on the comparative study of gene and protein expression pattern in embryonic stem cell and different tissue stem cell, in order to understand the regulating mechanism of embryonic stem cell differentiation. They have also explored new cell therapies for degenerative disease such as diabetes and Parkinson's disease. They have succeeded in repairing cornea injury with stem cell technique in a rabbit model [9, 10]. Their recent study on Pax6-Sox2 in regulation of maturation of both brain neural stem cell and pancreatic β cells was presented in a plenary session on the 5th ISSCR annual meeting [11]. Currently, the center has 5 groups. Dr. Chunyan Zhou, returned from the UK, also established her laboratory in Peking University Medical School. Her team has made considerable progress in the practice and mechanistic study of cell therapy (autologous MSC transplantation) for myocardial injury [12]. In addition to research, the center is also establishing a somatic stem cell bank, collecting somatic stem cells of different tissues and organs.

In another laboratory in Peking University, headed by Dr. Hongkui Deng, the main research areas include the directed differentiation of embryonic stem cell and the mechanism. They have successfully established a highly efficient induction system for differentiation of hES cells to liver cells. These liver cells can produce secreted proteins, and be infected by HCV [13]. In addition, they also induced the differentiation of hESC to functional pancreatic βcells which can secrete insulin and C-peptide. Furthermore, when diabetic mice were transplanted with these βcells, their serum glucose returned to normal level [14, 15]. They also found P53 can regulate spontaneous apoptosis of human embryonic stem cells by P53 transcription independence apoptosis signal pathway, and control the proliferation and differentiation of hESC [16]. In collaboration with Jinwei Xiong in Harvard University, they found Lycat plays an essential role in regulation ESC differentiation to hematopoiesis and endothelium [17].

There are also several strong stem cell research teams in Beijing outside the CAS and Peking University systems. Dr. Alex Yu Zhang of XuanWu hospital, Capital Medical University, is one of them. He returned back to China in 2001 and established a cell therapy center focusing on stem cell therapy for Parkinson's disease and Diabetes. In the study of cell therapy for diabetes, they have successfully isolated and cultured pancreatic progenitor cells from non-human primate diabetic animal, and differentiated those progenitor cells into insulin-secretion cells. Now, they are moving forward to test stem cell auto-transplantation in non-human primate diabetic animal model [18].

Another major stem cell research team is directed by Dr. Xuetao Pei, head of Institute of Blood Transfusion of Academy of Military Medicine. This team has explored the plasticity of adult stem cell differentiation towards to several tissues. His team focused on adult stem cell like bone mesenchymal stem cells and hematopoietic stem cells. They have established protocols for direct differentiation of MSC to blood, neuron, cardiac muscle, liver, and pancreatic cells [19, 20]. In 2007 Shanghai International Symposium on Stem Cell Research, Dr. Pei reported his work on stem cell approaches in regeneration therapy for liver diseases, including a cocktail protocol with MSC- or hESC-derived hepatocyte and other growth factors. The experimental therapy improved liver function in acute liver failure model in rat.

Dr. Robert Chunhua Zhao and his team in Center of Excellence in Tissue Engineering of Chinese Academy of Medical Sciences have been working on MSC biology, HSC growth and development, immune regulating mechanism of stem cell [21]. In collaboration with the National Institute for the Control of Pharmaceutical and Biological Products, Zhao's team worked out a procedure for Flk1+CD31-CD34- stem cell culture and assessment. The Flk1+CD31-CD34- stem cell clinical protocol was approved by the State Food and Drug Administration (SFDA) of China in 2004. They are running the first SFDA-approved stem cell therapy for patients with leukaemia and other severe diseases in China. The trial demonstrated that cotransplantation of HLA-identical sibling culture-expanded Flk1+CD31-CD34- stem cells with an HLA-identical sibling hematopoietic stem cell (HSC) transplant is feasible and appears to be safe, without immediate or late stem cell-associated toxicities. The number of patients included in phase I clinical trials did not allow a demonstration of the effectiveness of the treatment. However, based on the result of the phase I trial, his team was granted phase II clinical trail license from SFDA on April 21, 2006.

The Institute of Hematology of Chinese Academy of Medical Sciences in Tianjin has explored research and application of cord blood stem cell. They built probably the first or the largest cord blood bank in China. Dr. Zhongchao Han contributed significantly to this work. Recently, the institute is recruiting Dr. Tao Cheng, an expert in stem cell biology research, as its executive deputy director.

Stem Cell Research in Shanghai

Stem cell research in Shanghai is focused more on embryonic stem cells. The stem cell research groups are mainly in the Key Laboratory of Stem Cell Biology (KLSCB) of CAS, Shanghai Jiaotong University, Fudan University and Second Military Medical University. Among them, Key Laboratory of Stem Cell Biology of CAS is the strongest with 11 laboratories based in two institutes in SIBS (Shanghai Institutes for Biological Sciences) family: Institute of Health Science (IHS) and Institute of Biochemistry and Cell Biology.

Dr Ying Jin, who is the director of KLSCB and a Principal Investigator (PI) of IHS, has been focusing her research on molecular regulation of embryonic stem cell and establishment of human embryo stem cell lines. Jin's group have established several human and mouse embryonic stem cell lines [22,23], and studied imprinted gene expression in human embryonic stem cells. Her work demonstrated that the imprinted gene expression in hES cells following long term culture and differentiation remained the same as their parental cells [24]. Meanwhile, she has established a technology platform for studying protein-protein interaction in embryonic stem cells, focusing on transcription factor Oct4 [25, 26, 27]. On the 2007 Shanghai International Symposium for Stem Cell Research, she presented her recent work on nucleolar protein LYAR in mouse ESCs.

Another PI in KLSCB, Dr. Xin Wang who recently joined Institute of Biochemistry and Cell Biology (IBCB) of SIBS, focuses his research on the stem cell differentiation into functional liver cells and induction of liver cell reprogramming. The lab headed by Dr. Naihe Jing, also a PI in KLSCB and IBCB, has studied the mechanism of maintaining neural stem cells (NSC) in early stage in animal embryonic development for many years. His recent paper published in Development Cell (2007) represents their achievement [28].

In order to improve the efficiency of the directional differentiation and explore the potential application of stem cells in treating ischemic heart disease and heart failure, Dr. Huang-Tian Yang, PI of KLSCB and IHS, led her group to investigate induced differentiation of stem cells into cardiac muscle cells. Their results showed that the 3-4 passages of MSC can be induced into cardiac muscle-like cells to certain degree, and the differentiation potential and proliferation capability were in inverse correlation [29]. They also obtained clues that the Ca2+ regulated signal pathway is involved in such differentiation [30, 31]. Another PI in KLSCB and IHS, Dr. Tingxi Liu, concentrates his research on identifying tumor suppression gene of hematopoietic embryonic stem cell (HES). Collaborating with the scientist in the US, they discovered that a leukaemia stem cell tumor suppression gene on chromosome 5q, which has been sought after for many years. This paper was published in Nature Medicine [32]. Dr. Liu also built a zebrafish research technology platform to support the research in stem cells, development and diseases. Other platforms are also been built inside SIBS or in Shanghai as well as in other places. The one that is the most relevant to stem cell research perhaps is the national stem cell bank network. Several PIs in KLSCB, Dr. Guo-Tong Xu, Dr. Xiaoyan Ding and Dr. Lei Xiao, are leading the effort, while conducting their own research activities. They will focus on embryonic stem cells, providing cell materials and technical supports on NTSC, iPS, gene modification and so on.

Another team led by Dr. Lihe Guo, a PI in the Insti-

tute of Biochemistry and Cell Biology, made progress in treating neuronal injury with amniotic member cell (AMC) transplantation in a monkey model of neural cord injury. His work demonstrated that AMC might be similar to ESC in its pluripotency to certain extend. In collaboration with Suzhou University School of Medicine, his team collected AMCs, transfected with Neural Nutrition Factor gene, and then transplanted them into injured right neural cord of a monkey. Two months later, the monkey recovered completely, resumed normal walking. We are looking forward to reading his scientific report soon about this work.

Another stem cell research team in Shanghai is within Shanghai Jiaotong University (SJTU) system, with several PIs mainly in its medical school, formerly Shanghai Second Medical University, which was one of the pioneers in stem cell research in China. In 2001, Dr. Huizhen Sheng started to build the Center for Development Biology there. Dr. Sheng is the first scientist who established a "human-rabbit cybrid" using nuclear transfer technique, and obtained recombinant embryos [33]. Dr. Yilin Cao, head of the National Tissue Engineering Centre in Shanghai and the Tissue Engineering Centre of the Ninth Shanghai Hospital, leads a strong team in applying stem cell research. In the past decade, they focused on the construction of artificial tissues through the combination of stem cells and bioengineering approaches. Some tissues generated this way, e.g., bone [34], have been successful in clinical trials. In addition, Dr. Cao's lab has also established a human embryonic stem cell line and has made meaningful progress in understanding the interaction between stem cells and biomaterials [35]. The Ninth Hospital made a commitment to the study of blood tumor stem cells, including reverse differentiation of leukemia cell to normal blood cells, as well as the mechanism of leukemia stem cells survival and self-renewal. The stem cell research lab in the College of Pharmaceutical Sciences of SJTU led by Dr. Wei Han has engaged in adult stem cells research, focusing on isolation and culture technology used for amplification of human cord blood stem cells and bone marrow-derived mesenchymal stem cells [36].

In Shanghai Institute of Medical Genetics, SJTU, a team led by Professor Shuzhen Huang and Dr. Fanyi Zeng focuses on in vivo stem cell biology study. Employing the technique of intrauterine transplantation, they transplanted human HSC and constructed the first human/goat chimera, where human stem cells survived in goat for a long time. They studied the plasticity and mechanism of the differentiation of human stem cells into various tissue cells inside the chimera. They also analyzed the human derived gene transcription spectrum with DNA microarray. In addition, they also constructed ganciclovir-induced HSV-tk transgenic mice model for liver injury study, proved that HSCs intrauterine transplantation may be an effective method for repairing liver injury [37].

In May 2007, the above-mentioned research laboratories in SJTU system were organized together to form the Shanghai Stem Cell Institute. Dr. Ying Jin was appointed as the director. At the same time, SJTU make great efforts to attract overseas Chinese scholars to join the Institute. Dr. Li-Xin Feng is one of the PIs recently recruited from the United States under such effort. Dr. Feng is an expert in embryonic germ cells research which is a weak area in China.

Fudan University has also recruited several scientists in stem cell research field. Dr. Qiqun Tang of the Institute of Biomedicine is one of them. Dr. Tang is accomplished in the area of adipose-derived stem cells, and published several papers in journals like PNAS. He has established a model in which multipotent stem cells can be differentiated to preadipocyte based on the research of the mechanism of 3T3-L1 preadipocyte differentiation. Dr. Suchun Zhang, recruited by the Medical school of Fudan University, is an expert in neural stem cells. He studies directed differentiation of human embryonic stem cell to neurons. His research aims to illustrate development of neurons and to facilitate the treatment of neuronal diseases by studying genetic and epigenetic during directed differentiation. Such "new blood" enhances stem cell research capability in Fudan University.

In clinical stem cell research field, Dr. Jianhong Zhu of Huashan Hospital, Fudan University, tested effect of autologous neuronal stem cell transplantation in repairing patients with open brain trauma. He first separated neural stem cells/progenitors from cracked brain tissue of the patients, and grown them in the culture system. After transplanted with these cells, these patients recovered faster and better than those in the control group. This work was published in the New England Journal of Medicine [38]. Currently, his team is tracing the transplanted stem cells with nano-particles as markers. In Zhongshan Hospital, another hospital affiliated with Fudan University, Dr. Junbo Ge has been focusing on the treatment of cardiac diseases with bone marrow stem cells (MSCs). Since 2003, Dr. Ge and his collaborator, Dr. Yunzeng Zou, have treated about 200 patients with heart failure. The clinical observation demonstrated that autologous MSCs transplantation can significantly improve blood supply to the ischemic heart tissue and improve heart functions. No severe side-effect such as arrhythmia was observed [39].

In the Second Military Medical University, Dr. Houqi Liu's team in the Center of Developmental Biology mainly studies morphological characteristics and molecular mechanisms of organ development and tumorigenesis. Their work includes cell line establishment and differentiation potential of hESC [40]. They have made some significant progress in the understanding of roles of genes, microenvironment and polar molecules in the development of follicluls from human MSCs. In liver stem cell study, Dr. Yiping Hu leads his lab, also in the Second Military Medical University, proved the existence of liver stem cell in adult liver [41]. He also identified a stem cell line from the livers of Retrosine-treated mice, which can differentiate into hepatocytes and gallbladder cells. Such cells were able to repopulate the damaged liver [42].

Stem Cell Research in Guangzhou

The research of Dr. Duanqing Pei's team in Guangzhou Institute of Biomedicine and Health (GIBH), CAS, focuses on the regulation mechanism of ESC self-renewal, especially on Oct4 and Nanog [43]. Recently, Dr. Pei's team started to work on induced pluripotent stem cells (iPS) [44].

Another stem cell scientist in Guangzhou is Dr. Peng (Andy) Xiang of Center for Stem Cell Biology and Tissue Engineering, Sun Yat-Sen University. His lab is working on hES cell line establishment [45] and transgenic/knockout mice. They have also established the Apodemus-Mus chimeras, the knowledge may be helpful to produce human organs in animals someday [46]. In National Key Laboratory of Ophthalmology, Sun Yat-Sen University, Dr. Jian Ge's team made progress in many aspects on ophthalmic stem cell research, including: induced differentiation of ESC and monkey marrow stem cell to corneal epithelial cell and retinal ganglion cells [47].

Professor Xiaofang Sun of the Third Affliated Hospital of Guangzhou Medical College is a physician with 20-year clinical experience in IVF. She and her co-workers have established several hES cell lines in the past years. These cell lines will be important tools for studying the relative diseases [48].

Stem Cell Research in Other Cities

In the Reproduction and Stem Cell Engineering Institute of Central South University, Professor Guang-Xiu Lu's leads one of the earliest stem cell teams in China, which is also IVF center-based stem cell lab. They mainly focus on various hES cell lines, including parthenogenetic stem cell lines establishment [49]. They also work on vascular endothelial progenitor cells derived from cord blood to ischemic tissue.

In addition to the active stem cell research in the above-mentioned 4-5 cities, more and more scientists in China have recently begun to study stem cells. A few examples are given below. In Kunming Institute of Zoology, CAS, Dr. Wei-Zhi Ji and colleagues have developed a series of monkey feeder cells for cultivation of monkey ES cells. Such information is of help for developing suitable feeder cells for human ES cells. In Qingdao, a team led by a physician scientist, Professor Li-Xin Xie, carried out clinical studies, for example, limbal stem cell transplantation for the treatment of corneal injury. Professor Zhongying Dou of Northwest Agriculture and Forestry University in Yangling, Xi'an, is an experienced scientist in animal cloning and his team began to study stem cells. Professor Jianyuan Li at Shandong Provincial Stem Cell Engineering Technology Research Center in Yantai has been working on the establishment of "human-rabbit cybrid" and reconstructed embryo and stem cell lines. In recent year, scientists from a few other stem cell research institutions begin to attend domestic academic activities. Those institutions and scientists include Dalian Stem Cell and Tissue Engineering R&D Center, Hubei Provincial Key Lab of Embryonic Stem Cell Research in Shiyan, Dr. Xueguang Zhang in Suzhou University who focuses on hemotopoietic stem cell study, Dr. Zhixu He, who used to be a team member in Dr. Huizhen Sheng's lab and participated the establishment of the "human-rabbit cybrid" embryo, is relocated to Guiyang and established the Stem Cell and Tissue Engineering Center in Guangyang Medical College.

Summary and Future Perspective

Over the past 6 - 7 years, stem cell research in China has advanced significantly. Some well-trained returnee scientists are leading major research teams that have started to show their achievements among the international stem cell community. However, stem cell research in China still only has a scale comparable to that of a state or a major university in the US. There is a long way to go to catch up with the research capabilities and achievements in the developed countries. Nonetheless, progress made by Chinese scientists has built an infrastructure for further advancement. As in other fields, Chinese scientists are poised to make unique contributions. I have been asked several times to predict what and when Chinese stem cell scientists will make major breakthroughs. This reminds me that soon after Dolly the sheep was born in 1997, an international stem cell expert predicted that "embryonic stem cell approach with nuclear transfer technology will benefit patients in about ten years" when asked. The truth is that it is impossible to predict scientific breakthroughs because they are not exactly something we able to plan. Nevertheless, I believe that if scientists keep up their current efforts, pluripotent stem cells will one day be used to treat grievous illnesses. And as long as the Chinese government and the people continue their supports, the day that Chinese scientists make major contributions to stem cell research will come.

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