

Special Topic: Stem Cell Research in China

## Preface to special topic on stem cell research in China

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The research field of stem cells and regenerative medicine is one of the most rapidly growing areas in science that have drawn much attention in recent years, and Chinese scientists have played a significant role in promoting the development of the field. Especially with the implementation of the Stem Cell and Regenerative Medicine Strategic Priority Research Program of Chinese Academy of Sciences (CAS) between 2011 and 2015, China has been changing from a follower, through a side-by-side runner, towards a leader, with enormous achievements being made in the stem cell research field during that period of time. Among others, spatial transcriptome profiling of mid-gastrulation mouse embryos provides a detailed reference for understanding the regionalization of cell fate in embryos and the mechanism of embryogenesis. The generation of mammalian haploid embryonic stem cells (ESCs) and allodiploid ESCs has provided new resources for functional genomics and reproduction and evolution studies. Obtaining functional spermatid-like cells in dish through *in vitro* meiosis has provided a new approach to studying the mechanism of meiosis and obtaining human gametes *in vitro*. Identification of the new marker for multipotent mammary stem cells has potential for the detection and treatment of breast cancer. Establishment of *in vitro* systems to expand functional muscle stem cells provides a potential method for repairing muscle injuries. Direct conversion of human fibroblasts into neuronal cells by a chemical cocktail of small molecules provides a useful and feasible method for establishing nervous system disease models for mechanism study and drug screening. In addition to basic research, Chinese scientists have also achieved a lot in promoting the clinical translation of stem cells, including establishing the clinical grade stem cell bank; carrying out clinical research of biomaterial and stem cell-based endometrial regeneration and several babies having been born therefrom; the first clinical trial with a human functional hepatocytes (hiHeps)-based bioartificial liver (BAL) system having been launched; and initiation of the first clinical trial in China using human ESCs to treat Parkinson's disease and age-related macular degeneration, respectively.

To reflect recent achievements in the field of stem cells and regenerative medicine, we dedicate this issue of *National Science Review* to stem cell research in China. We start with a Research Highlight by Yu Lan on recent progress on hematopoietic stem cell regulation. We then present a Perspective by Jianwu Dai and colleagues, who will discuss the promising role of biomate-

rial scaffolds in repairing spinal cord injury by the construction of a regenerative microenvironment within the injured cord, followed by another Perspective by Xiao-Yang Zhao and colleagues on the progress and challenges in deriving male and female gametes from pluripotent stem cells *in vitro*. A Perspective by Wei Li and Qi Zhou will discuss some new types of stem cells, namely haploid ESCs and interspecies allodiploid ESCs generated from them, as well as their applications in studying functional genomics, genome regulation, epigenetics and development biology. After that, we will present a review by Naihe Jing and colleagues, who will discuss enabling technologies including single cell sequencing and spatial transcriptomes in investigating cell lineage and cell fate determination in early embryos. Another review by Weizhi Ji and colleagues will also be presented, and the authors will discuss the promising future of combining genetically modified non-human primates (NHP) using new genome-editing technologies with the derivation of NHP pluripotent stem cells in regenerative medicine studies. Finally, an Interview with Qi Zhou by Jane Qiu will discuss the progress and future of stem cell research and regenerative medicine in China.

As the guest editor of this special topic in stem cell research in China, I would like to thank all of the authors, reviewers and the editorial staff for their dedication that makes this special topic possible. Stem cells and regenerative medicine is becoming one of the major frontier research areas globally, and there are still many scientific questions that remain unanswered, such as the mechanisms of the *in vivo* regulation of stem cells. More efforts are needed to promote the basic research and clinical translation of stem cells. China's 13th Five-Year Plan for Biotechnology has listed stem cells and regenerative medicine as one of the key research areas to be supported, and the CAS has been planning a new Strategic Priority Research Program for stem cell research. By in-depth research and extensive collaboration, we hope to keep making contributions to the development of the stem cell field, and strengthen the leading position of China in the global competition in basic and translational research of stem cells.

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