

Stem Cell Research

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The curiosity in understanding the developmental biology from nature and to solve the unmet medical needs have made the stem cell researches blooming in last two decades. The establishment of embryonic stem cells (ESC) initiated a new tide of research although the hematopoietic stem cells (HSC) have been successfully used for decades in bone marrow transplantation. The studies of ESC help to answer many important questions in developmental biology. However, the clinical application of ESC faced several difficulties due to the ethic issue, tumorigenicity and immunologic rejection. Two clinical trials utilizing ESC were granted for spinal cord injury and macular degeneration by the USA FDA without any final results yet. The somatic nucleus transfer was then proposed to overcome the immunologic rejection.

The development of induced pluripotent stem cells (iPSC) in 2006 opened a new horizon in stem cell researches. It breaks the barrier of plasticity of well differentiated adult cells and is easier to set up than somatic nuclear transfer. The success in iPSC researches provide the new tools for disease modeling, and the screening and safety assurance of drug development. Tumorigenicity is always a big concern in the clinical cell therapy of iPSC but the first human trial to treat macular degeneration was started in Japan since last year. Following the iPSC research, trans-differentiation between adult cells, interspecies iPSC transfer, organogenesis, and germ cell development etc. are possible in recent 5 years. In these review, these new stem cell researches and future applications in regeneration medicine will be discussed.