Preface

The book *Genetics of Stem Cells* is a compilation of expert reviews in the stem cell and development field. This is a very rewarding experience for me to work with talented colleagues. As a volume editor, I want to acknowledge the publisher team: Sarah Latham, Mary Ann Zimmerman, Mohamed Ashiq Ibrahim Nazeer, Lisa Tickner, and Michael Conn; they are the unsung heroes of this book.

The pluripotent embryonic stem cells (ESC) have limitations in immunological incompatibility and the ethical problem associated with destroying a human embryo. To circumvent these limitations of ESC, scientists have approached many alternatives such as somatic cell nuclear transfer, cell fusion, or direct reprogramming. With recent advancements, adult somatic cells can now be reverted into induced pluripotent stem cells (iPS). In the first and the third chapters, Dr. Yoon, Dr. Rajasingh, and collaborators describe the current knowledge about the somatic cell reprogramming by means of integrating and nonviral methods. In the second chapter, Dr. Kishore and collaborators highlight the epigenetic mechanisms of induced pluripotent and review the protocols of cardiovascular lineage differentiation of iPS cells. Dr. Lin's lab first reported miR-302-induced iPSCs (mirPSCs). In the fourth chapter, he introduces his experience in the mirPSCs and related epigenetic mechanisms.

Urodeles has extraordinary regenerative capacity of heart, however, such ability has been largely lost in mammalian heart. In the fifth chapter, Dr. Messina and collaborators extensively review the regeneration and its mechanisms starting with the lesson learned from lower vertebrates and then focus on recent advancements and novel insights concerning regeneration in the adult mammalian heart, including the discovery of resident cardiac progenitor cells. The studies of microRNA-mediated gene regulatory network are hot now. In the sixth chapter, Dr. Hasegawa and collaborators review the role of microRNA-mediated myocardial cell differentiation. Wnt and Notch signaling pathways play a variety of important roles in stem cell differentiation and survival. In the seventh chapter, Dr. Dawn and collaborators provide an overview of canonical and noncanonical Wnt signaling and highlight the role of Wnt11 in cardiac differentiation. Recently, microRNA has been reported to cross-talk with Notch signaling pathway in stem/progenitor cell differentiation. In the eighth chapter, Dr. Tang and collaborators review the cross-talk between Notch signaling pathway and microRNA in determining cell fate.

Both bone marrow stem cells and cardiac progenitor cells have been used in clinical trial recently. In the ninth chapter, Dr. Zhang and collaborators discuss heart repair using bone marrow-derived cells or heart-derived cells. The major barrier for clinical stem cell therapy is the severely poor survival of donor cells in ischemic myocardium because over 90% of stem cells are lost within 1 week after cell transplantation. Enhancing the survival of engrafted stem cell survival in host tissue is important for successful progenitor cell therapy for patients. In the tenth chapter, Dr. Xu and collaborators review the role of GATA4, a cardiac early transcriptional factor, in improving bone marrow cell capacity for heart repair. In the eleventh chapter, Dr. Qin and collaborators review the c-kit marker, SDF-1/CXCR4 signaling, and integrin on progenitor cell homing and retention. In the twelfth chapter, Dr. Wang and collaborators introduce their experience in using genetically manipulated cell path for repairing infarcted heart. In the fourteenth chapter, Dr. Fan provide an overview of heat shock proteins, a multifaceted gene involved in stem cell survival, proliferation, and differentiation ageing. In the fifteenth chapter, Dr. Haider and Dr. Ashraf introduce their experience in developing and optimizing the protocols to enhance donor stem cell survival posttransplantation with special focus on preconditioning approach.

Like the famous Trojan horse, the gene modified cell has to gain entrance inside the host's walls and survive to deliver its transgene products. Using cellular, molecular, and gene manipulation techniques, the transplanted cell can be protected in a hostile environment from immune rejection, inflammation, hypoxia, and apoptosis. In the thirteenth chapter, Dr. Phillips and Dr. Tang discuss methods to deliver and construct gene cassettes with viral and nonviral delivery, siRNA, and conditional Cre/Lox P. The constitutive overexpression of therapeutic gene has a risk of unwanted side effects; to overcome this problem, Dr. Phillips and Dr. Tang introduce a novel tissue-specific, hypoxia, or glucose-inducible vigilant vector system for treating heart disease, diabetes, and hemophilia.

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