

Preface

The enormous interest in stem cell biology has led to new research in both basic science and biomedical applications, with significant progress being reported during the past few years. Basic science experiments are focused on exploring stem cell characteristics and potential through experimental manipulations aimed at determining new possibilities for future clinical applications. Biomedical applications include growth of stem cells for tissue engineering and tissue repair, with major success using skin cells as stem cell resources for tissue-specific applications. These efforts have been highly rewarding and have led to promising new applications in regenerative medicine for treatment of organ damage, disorders, and diseases, such as heart disease, muscle diseases, and various others. Induced pluripotent stem cells (iPSCs), adult stem cells and peri-natal stem cells have been utilized to generate multiple cell types including hematopoietic, osteogenic, chondrogenic, adipogenic, endothelial, myogenic, neural, and lung cells that can be utilized for the regeneration of the blood and immune system, bone, cartilage, heart muscle, neural and lung tissue. Using iPSCs to create patient-specific cell lines for autologous cell therapies has generated enormous enthusiasm for translational potential and new cell-based therapies.

Furthermore, new knowledge about cancer stem cells has resulted in new approaches for cancer therapy when it was recognized that this small population of cells within tumors could be the cause for enhanced drug resistance and for recurrence of tumors that had been in remission. Significant new information on cancer stem cells has generated new ideas for targeted tumor treatment strategies.

New journals have been created to specifically address stem cell research and several books have been dedicated to various aspects of stem cell biology; yet, based on the rapid progress in the field, new books are in demand to address new aspects of this exciting and expanding area in the life sciences.

Cell and Molecular Biology and Imaging of Stem Cells features chapters written by experts in their specific areas of research who have been invited for their significant contributions to stem cell biology and imaging of stem cells. Topics include stem cells from the amniotic fluid and placenta, biomaterials as artificial niches for pluripotent stem cell engineering, low-intensity ultrasound in stem cells and tissue engineering, mammalian neo-oogenesis from ovarian stem cells *in vivo* and *in vitro*, Oct4-EGFP transgenic pigs as a new tool for visualization of pluripotent and reprogrammed cells, regulation of adult intestinal stem cells through thyroid hormone-induced tissue interactions during amphibian metamorphosis, stem cell therapy for veterinary orthopedic lesions, sex steroid combinations in regenerative medicine for brain and heart diseases (the vascular system cell niche and a clinical proposal), hair follicle stem cells, the potential of using induced

pluripotent stem cells in skin diseases, mitochondrial differentiation in early embryo cells and pluripotent stem cells, the role of centrosomes in cancer stem cell functions.

It has been a great pleasure to edit this book on new aspects of stem cell biology and I am most grateful to all contributors for their outstanding chapters and for sharing their unique and specific expertise with the stem cell community. I would like to express my sincere thanks to all for their most valuable contributions and I hope that this book will stimulate further advances in stem cell research to deepen our understanding toward biomedical applications and regenerative medicine.

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