

Preface

The cloning of the sheep Dolly in 1996, demonstrating for the first time that it was possible to reprogram a differentiated mammalian cell to a pluripotent state, opened a new and very promising field of research in regenerative medicine. Although the technology of nuclear transfer from a somatic cell to an enucleated egg was banned for human reproductive cloning, it looked very promising for therapeutic cloning and research purposes. However, in practice, it was shown that this technology was extremely challenging and the results were very disappointing and frustrating. The groundbreaking discovery of induced pluripotent stem cells (iPSCs) in mice by Dr. Yamanaka's group in 2006 came as a surprising alternative to therapeutic cloning approach for reprogramming differentiated cells to an embryonic stem cell (ESC)-like state. The report of the first human iPSCs just a year later was received with high enthusiasm by the scientific community, since most technical and ethical issues involving access to human ESCs could then be circumvented, promoting therapeutic applications. Since then, iPSC research became a fast-growing field that quickly dominated most of the scientific publication in stem cell biology. Interestingly, progress in iPSC research has been pushed by scientists interested in the mechanisms of pluripotency (re)programming, maintenance of the pluripotent state, differentiation to defined cell types, and consequences of genetic/epigenetic abnormalities to cell ontogeny and function. While applications of iPSCs in cell therapy are envisioned but still in a premature stage of development, the use of iPSCs as tools to study human genetic diseases boomed in the last few years. With the contribution of experts in the field, this book provides to readers a glimpse of this effervescent scenario, emphasizing the concept of “patients in a petri dish” model. Chapters 1 and 2 provide excellent examples of how iPSCs have been used to model inherited disorders affecting brain and heart function, as well as advantages and limitations compared to other experimental models. Chapters 3 and 4 present the perspectives that iPSCs bring to better understand and treat severe forms of neurodegenerative disorders for which there are no effective therapy available. Applications of iPSC technologies to address common diseases that are

leading cause of mortality and morbidity worldwide are covered in Chaps. 5 and 6. Finally, Chaps. 7 and 8 discuss how stem cells in general, not only iPSCs, have been instrumental in the study of common neurodevelopmental disorders as well as complex multifactorial diseases such as cancer. Readers will find in the forthcoming text enlightening issues of this rapidly developing field of research within the broader context of regenerative medicine.

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Stem Cells in Modeling Human Genetic Diseases

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2015, XII, 147 p. 16 illus., 15 illus. in color., Hardcover

ISBN: 978-3-319-18313-8