Preface

Most cells within an organism are committed to fulfilling a single function within the body. Of the estimated trillion cells in our body, only a small number can self-renew and produce a diverse range of specialized cell types. These are the stem cells, which are responsible for maintaining tissue homeostasis. When such maintenance fails, degeneration of specific cell types can take place and results in several degenerative diseases. On the other hand, when stem cells and their descendants overproliferate, tumors can develop, resulting in cancer. Stem cells provide an opportunity to study the growth and differentiation of individual cells into tissues. Understanding these processes could provide insights into the causes of birth defects, genetic abnormalities, and other disease conditions. Stem cells can be transplanted into the body to treat several diseases or injuries.

Stem cells are found in almost all organisms from the early stages of development to the end of life. There are several types of stem cells that have been reported. All of them may prove useful for medical research; however, each of the different types has both promise and limitations. Embryonic stem cells, which can be derived from a very early stage in development, have the potential to produce all of the body's cell types. Adult stem cells, which are found in certain tissues, may be limited to producing only certain types of specialized cells. However, recent studies suggest that adult stem cells might be more flexible than previously thought, and might be able to produce a wider variety of cell types. Stem cells have recently attracted significant attention largely due to their potential therapeutic use in regenerative medicine and for developing anticancer therapies to eliminate cancer stem cells. Understanding the mechanisms regulating stem cell proliferation and differentiation is a very hot topic in developmental biology and stem cell medicine. However, the mechanism of stem cell self-renewal and differentiation remains elusive, because proliferation and differentiation occur simultaneously and are difficult to analyze. Recent studies on reprogramming the adult somatic cells to become as embryonic stem cells (induced pluripotent stem cells) through the introduction of embryonic genes also attracted significant attention because these cells can be useful tools for drug development and modeling of diseases, as well as in transplantation medicine.

To understand the potential therapeutic use of stem cells, first we have to learn how to identify, isolate, and characterize the somatic stem cells from different tissues and organs. The *Somatic Stem Cells: Methods and Protocols* is intended to present selected genetic, molecular, and cellular techniques used in somatic stem cell research and its clinical application. The chapters are mainly focused on the isolation, characterization, purity, plasticity, and clinical uses of somatic stem cells from a variety of human and animal tissues. Chapters include information that will assist researchers in identification, characterizing and studying different types of stem cells, and their differentiation potential. Composed in the highly successful *Methods in Molecular Biology series* format, each chapter contains a brief introduction, step-by-step methods, a list of necessary materials, and a notes section which shares tips on troubleshooting to avoid known pitfalls. I hope that *Somatic Stem Cells: Methods and Protocols* provides fundamental techniques to cell and molecular biologists, developmental

biologists, tissue engineers, geneticists, clinicians, and students and postdoctoral working in the various disciplines of stem cell research and its potential application in regenerative medicine.

I would like to thank Prof. John M. Walker and the staff at Humana+Springer for their invitation, editorial guidance, and assistance throughout preparation of the book for publication. I also would like to express my sincere appreciation and gratitude to the contributors for sharing their precious laboratory expertise with the stem cell community. Last but not least my family members for their continued support.

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