

# Handbook of Experimental Pharmacology

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## *Volume 180*

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# Bone Marrow-Derived Progenitors

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With 18 Figures and 6 Tables

ISSN 0171-2004

ISBN 978-3-540-68975-1 Springer Berlin Heidelberg New York

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Editor: Simon Rallison, London  
Desk Editor: Susanne Dathe, Heidelberg  
Cover design: *design & production* GmbH, Heidelberg, Germany  
Typesetting and production: LE-TeX Jelonek, Schmidt & Vöckler GbR, Leipzig, Germany  
Printed on acid-free paper 27/3100-YL - 5 4 3 2 1 0

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## Preface

There is excitement generated almost daily about the possible uses of stem cells to treat human disease. The ability of stem cells to acquire different desired phenotypes has opened the door for a new discipline: regenerative medicine. Much of the interest for this purpose is generated by embryonic stem cells, but their use is still controversial for moral as well as scientific reasons. Less controversial and readily available are the adult bone marrow-derived progenitors, including hematopoietic stem cells, endothelial progenitors, and mesenchymal stem cells, which are the subjects of this book. These cells can be isolated by simple procedures directly from the bone marrow or from peripheral blood after being stimulated, i.e., mobilized. By reaching sites of damage through the circulation or even after local administration, these cells can overcome the hurdles of delivery approaches that limit the success of gene therapy. Adult bone marrow-derived cells have been shown to regenerate diseased hepatocytes and contribute to neurons, blood vessels, and skeletal and cardiac muscle cells. The increasing amount of new data, sometimes with conflicting results, is making us appreciate the molecular complexity of cell differentiation and potential mechanisms of action involved in these cell-mediated processes. It is becoming increasingly important to understand the biology of these cells to potentially improve their therapeutic efficiency and to facilitate their proper therapeutic use. Examining the cell-mediated processes can ultimately lead to the discovery of pathways and molecular mechanisms of organ repair, which can be further utilized in drug development. With patients' growing attention to the most recent research developments, there is increasing medical need for a better understanding—developed through rationally designed, randomized clinical trials that will move these strategies quickly and carefully toward medical reality—to parallel the increased enthusiasm.

In this volume of the series *Handbook of Experimental Pharmacology* published by Springer, we hope to achieve the ambitious goal of providing a comprehensive overview of the currently available information related to the therapeutic utility of adult bone marrow-derived cells. Chapters in Part I focus on basic principles, including a general introduction to the different bone marrow-derived cell types, mechanisms contributing to their development and localization in the bone marrow niche, mechanisms leading to their mobilization, the current understanding about their immune plasticity, the effect

of aging, and the potential enhancement of their survival or function using cell-gene combinations. Part II is dedicated to therapeutically relevant pre-clinical experiences and the most recent clinical experiences with these cells for cardiac diseases, neurodegenerative disorders, liver diseases, and diabetes. The potential role of bone marrow-derived cells in tumorigenesis and their potential contribution to tumor angiogenesis are also discussed. Although their exact role in cancer pathology remains to be better understood, harnessing the ability of these cells to deliver antitumor agents provides an additional therapeutic opportunity, which is introduced within the therapeutic section.

Each chapter is written or co-authored by accomplished scientists, leading experts in their field, ensuring the delivery of up-to-date information regarding our current understanding of bone marrow-derived progenitor cell biology and its applications to specific disease indications. The editors focused their efforts on providing a balanced overview of the recent developments in the field without major interference with the content and style of the individual chapters. In some instances reiteration of basic principles in the different chapters may appear redundant when looking at the volume as a whole, but it is necessary to allow each chapter to serve as a self-standing overview of the chosen principle.

The editors thank the authors of the chapters for their excellent contributions, and Springer for its highly professional work and timely publication of the book. We would like to express our specific gratitude to Susanne Dathe from Springer for her patience and guidance throughout the development of this book. We also appreciate the interest and support of the HEP Editorial Board, specifically acknowledging Gabor M. Rubanyi among the board members for his enthusiastic support and encouragement from the very beginning of this project.

Ridgefield and Frankfurt am Main,  
March 2007

Katalin Kauser  
Andreas-Michael Zeiher

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