Editor
Massimiliano Gnecchi
Department of Molecular Medicine
Unit of Cardiology
University of Pavia
Pavia, Italy

Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology
Fondazione IRCCS Policlinico San Matteo
Pavia, Italy

Laboratory of Experimental Cardiology for Cell and Molecular Therapy
Fondazione IRCCS Policlinico San Matteo
Pavia, Italy

Department of Medicine
University of Cape Town
Cape Town, South Africa

ISSN 1064-3745 ISSN 1940-6029 (electronic)
Methods in Molecular Biology
DOI 10.1007/978-1-4939-3584-0

Library of Congress Control Number: 2016936658

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Humana Press imprint is published by Springer Nature
The registered company is Springer Science+Business Media LLC New York
Preface

Mesenchymal stem cells (MSC) are adult cells with the capacity for self-renewal and multilineage differentiation. Initially described in the bone marrow, MSC are also present in other organs and tissues. From a therapeutic perspective, because of their straightforward preparation and hypothetical immunologic privilege, MSC emerged as an extremely promising therapeutic agent for tissue regeneration and repair. Currently, there are a significant number of clinical trials underway exploring the use of MSC for the treatment of various diseases including bone defects, graft-versus-host disease, myocardial infarction and heart failure, stroke, Crohn’s disease, and wound repair. At the same time, there are still unresolved issues associated with MSC related to their isolation, culture and expansion, phenotypic definition, multipotential differentiation, and mechanisms of action. While researchers should ideally share and use proven methods and protocols to ultimately enable the comparison of results obtained by independent investigators, current MSC research is often considered nonhomogeneous, with different labs using different protocols and definitions.

The present volume aims to outline the current status of the field and to emphasize the need for clearly established and reproducible protocols to better define the identity, function, and use of MSC in cell therapy. In particular, in the first part of the book, a series of state-of-the-art reviews gives the reader a summary on the use of MSC for the treatment of various diseases. Then, in the following three parts, numerous chapters illustrate methods on isolation and characterization of MSC, expansion of MSC for clinical use, and production and definition of the MSC secretome. These protocols include practical advice from researchers who have personalized their methodologies. These insightful tips should dramatically reduce the time and costs involved in setting up MSC protocols in individual labs.

The volume mainly addresses PhD students and postdocs since they are the investigators actively operating in the field of cell and molecular biology, proteomics, and transcriptomics or in the development of clinically compliant manufacturing of therapeutic MSC or their derivatives. However, the state-of-the-art review chapters would be of extreme interest also for more senior investigators.

Pavia, Italy

Massimiliano Gneccchi
Acknowledgments

I would like to personally thank all of the authors who contributed to this volume for sharing their invaluable knowledge and expertise in this dynamic field of Mesenchymal Stem Cell Applications.

Most of all, I extend a heartfelt thanks to Laurene Kelly, M.Sc., for managing all the correspondence with the authors. Ms. Kelly directly interfaced with each author for approval of her editorial improvements producing a uniform and user friendly volume.

Massimiliano Gncachi
Contents

Preface .................................................................................................................. v
Contributors .......................................................................................................... xiii

PART I  OVERVIEW OF MESENCHYMAL STEM CELLS FOR CELL THERAPY

1 Mesenchymal Stromal Cells in Hematopoietic Stem Cell Transplantation . . . 3
   Maria Ester Bernardo and Franco Locatelli
2 Bone Tissue Engineering: Past–Present–Future ............................................. 21
   Rodolfo Quarto and Paolo Giannoni
3 Mesenchymal Stem Cells for Osteochondral Tissue Engineering ............... 35
   Johnathan Ng, Jonathan Bernhard, and Gordana Vunjak-Novakovic
4 Mesenchymal Stem Cells in Cardiology ......................................................... 55
   Ian A. White, Cristina Sanina, Wayne Balkan, and Joshua M. Hare
5 Mesenchymal Stem Cells in Kidney Repair .................................................. 89
   Marina Morigi, Cinzia Rota, and Giuseppe Remuzzi
6 Mesenchymal Stem Cells in Lipogems, a Reverse Story: from Clinical
   Practice to Basic Science .............................................................................. 109
   Carlo Tremolada, Camillo Ricordi, Arnold I. Caplan, and Carlo Ventura
7 Paracrine Mechanisms of Mesenchymal Stem Cells in Tissue Repair .......... 123
   Massimiliano Gnecchi, Patrizia Danieli, Giuseppe Malpasso, and Maria Chiara Ciuffreda

PART II  ISOLATION AND CHARACTERIZATION OF MESENCHYMAL STEM CELLS

8 Protocols for in vitro Differentiation of Human Mesenchymal
   Stem Cells into Osteogenic, Chondrogenic and Adipogenic Lineages ............ 149
   Maria Chiara Ciuffreda, Giuseppe Malpasso, Paola Musarò,
   Valentina Turco, and Massimiliano Gnecchi
9 Colony Forming Unit Assays ........................................................................... 159
   Patrice Penfornis and Radhika Pochampally
10 Methods and Strategies for Lineage Tracing of Mesenchymal
    Progenitor Cells .......................................................................................... 171
    R. Wilder Scott and T. Michael Underhill
11 Isolation of Mouse Bone Marrow Mesenchymal Stem Cells ....................... 205
    Siddaraju V. Boregowda, Veena Krishnappa, and Donald G. Phinney
12 Isolation of Pig Bone Marrow-Derived Mesenchymal Stem Cells ............... 225
    Dries A.M. Feyen, Frederike van den Akker, Willy Noort,
    Steven A.J. Chamuleau, Pieter A. Doevendans, and Joost P.G. Sluijter
PART III MESENCHYMAL STEM CELLS FOR CLINICAL USE

13 Isolation, Culture, and Phenotypic Characterization of Mesenchymal Stromal Cells from the Amniotic Membrane of the Human Term Placenta ......................................................... 233
   Marta Magatti, Stefano Pianta, Antonietta Silini, and Ornella Parolini

14 Isolation, Culture, and Characterization of Human Umbilical Cord Blood-Derived Mesenchymal Stromal Cells ......................... 245
   Karen Bieback and Philipp Netsch

15 Isolation, Expansion, and Immortalization of Human Adipose-Derived Mesenchymal Stromal Cells from Biopsies and Liposuction Specimens .......................................................... 259
   Luigi Balducci and Giulio Alessandri

16 Optimization of Mesenchymal Stem Cells to Increase Their Therapeutic Potential .................................................. 275
   Minh Quan Vu, Shant Der Sarkissian, Melanie Borie, Pierre-Olivier Bessette, and Nicolas Noiseux

17 Directed Differentiation of Human-Induced Pluripotent Stem Cells to Mesenchymal Stem Cells ........................................ 289
   Qizhou Lian, Yuelin Zhang, Xiaoting Liang, Fei Gao, and Hung-Fat Tse

18 Isolation and Manufacture of Clinical-Grade Bone Marrow-Derived Human Mesenchymal Stromal Cells ........................ 301
   Renuka P. Miller and Patrick J. Hanley

19 Quality Control Assays for Clinical-Grade Human Mesenchymal Stromal Cells: Methods for ATMP Release ......................... 313
   Marina Radrizzani, Sabrina Soncin, Viviana Lo Cicero, Gabriella Andriolo, Sara Bolis, and Lucia Turchetto

20 Quality Control Assays for Clinical-Grade Human Mesenchymal Stromal Cells: Validation Strategy ........................................ 339
   Marina Radrizzani, Sabrina Soncin, Sara Bolis, Viviana Lo Cicero, Gabriella Andriolo, and Lucia Turchetto

21 Cryopreservation and Revival of Human Mesenchymal Stromal Cells ........................................... 357
   Mandana Haack-Sorensen, Annette Ekblond, and Jens Kastrup

22 Clinical-Grade Manufacturing of Therapeutic Human Mesenchymal Stem/Stromal Cells in Microcarrier-Based Culture Systems .......... 375
   Ana Fernandes-Platzgummer, Joana G. Carmelo, Cláudia Lobato da Silva, and Joaquim M.S. Cabral

23 GMP-Compliant Expansion of Clinical-Grade Human Mesenchymal Stromal/Stem Cells Using a Closed Hollow Fiber Bioreactor .......... 389
   Christina Barckhausen, Brent Rice, Stefano Baila, Luc Sensebé, Hubert Schrezenmeier, Philipp Nold, Holger Hackstein, and Markus Thomas Rojewski
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Engineering Small-Scale and Scaffold-Based Bone Organs via Endochondral Ossification Using Adult Progenitor Cells.</td>
<td>Celeste Scotti, Beatrice Tonnarelli, Adam Papadimitropoulos, Elia Piccinini, Atanas Todorov, Matteo Centola, Andrea Barbero, and Ivan Martin</td>
<td>413</td>
</tr>
<tr>
<td>25</td>
<td>Fabrication of Elasticity-Tunable Gelatinous Gel for Mesenchymal Stem Cell Culture</td>
<td>Thasaneeya Kuboki and Satoru Kidoaki</td>
<td>425</td>
</tr>
<tr>
<td>26</td>
<td>Testing the Paracrine Properties of Human Mesenchymal Stem Cells Using Conditioned Medium</td>
<td>Patrizia Danieli, Giuseppe Malpasso, Maria Chiara Ciuffreda, and Massimiliano Gnocchi</td>
<td>445</td>
</tr>
<tr>
<td>27</td>
<td>Tips on How to Collect and Administer the Mesenchymal Stem Cell Secretome for Central Nervous System Applications</td>
<td>F.G. Teixeira, S.C. Serra, and A.J. Salgado</td>
<td>457</td>
</tr>
<tr>
<td>28</td>
<td>Soluble Factors from Human Fetal Bone Marrow-Derived Mesenchymal Stem Cells: Preparation of Conditioned Medium and Its Effect on Tumor Cells.</td>
<td>Jerry K.Y. Chan and Paula Lam</td>
<td>467</td>
</tr>
<tr>
<td>29</td>
<td>Isolation and Characterization of Exosome from Human Embryonic Stem Cell-Derived C-Myc-Immortalized Mesenchymal Stem Cells</td>
<td>Ruenn Chai Lai, Ronne Wee Yeh Yeo, Jayanthi Padmanabhan, Andre Choo, Dominique P.V. de Kleijn, and Sai Kiang Lim</td>
<td>477</td>
</tr>
<tr>
<td>30</td>
<td>Transcriptomic Analysis of Adult Renal Derived Mesenchymal Stem-Like Cells.</td>
<td>Jose Gomez, Jeffrey Schmeckpeper, and Maria Mirotsou</td>
<td>495</td>
</tr>
<tr>
<td>31</td>
<td>Proteomic Analysis of Mesenchymal Stem Cells.</td>
<td>Vitor Marcel Faça, Maristela Delgado Orellana, Lewis Joel Greene, and Dimas Tadeu Covas</td>
<td>509</td>
</tr>
<tr>
<td>32</td>
<td>Unraveling Mesenchymal Stem Cells’ Dynamic Secretome Through Nontargeted Proteomics Profiling</td>
<td>Sandra I. Anjo, Ana S. Lourenço, Matilde N. Melo, Cátia Santa, and Bruno Manadas</td>
<td>521</td>
</tr>
<tr>
<td>33</td>
<td>Identification of Factors Produced and Secreted by Mesenchymal Stromal Cells with the SILAC Method</td>
<td>Beatriz Rocha, Valentina Calamia, Francisco J. Blanco, and Cristina Ruiz-Romero</td>
<td>551</td>
</tr>
</tbody>
</table>

Index.                                                                 | 567  |
Contributors

GIULIO ALESSANDRI • Department of Cerebrovascular Diseases, Fondazione IRCCS Neurological Institute Carlo Besta, Milan, Italy
GABRIELLA ANDRIOLI • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland
SANDRA I. ANJO • CNC – Center for Neuroscience and Cell Biology, University of Coimbra, Coimbra, Portugal; Faculty of Sciences and Technology, University of Coimbra, Coimbra, Portugal
STEFANO BAILA • TerumoBCT, Zaventem, Belgium
LUIGI BALDUCCI • Medestea Research and Production Laboratories, Consorzio CARSO, Bari, Italy
WAYNE BALKAN • Interdisciplinary Stem Cell Institute, University of Miami Miller School of Medicine, Miami, FL, USA
ANDREA BARBERO • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland
CHRISTINA BARCKHAUSEN • Department of Hematology, Oncology and Immunology, University Hospital Giessen and Marburg, Philipps-University Marburg, Marburg, Germany
MARTA ESTER BERNARDO • Dipartimento di Emato-Oncologia e Medicina Trasfusionale, IRCCS Ospedale Pediatrico Bambino Gesù, Rome, Italy
JONATHAN BERNHARD • Department of Biomedical Engineering, Columbia University, New York, NY, USA
PIERRE-OLIVIER BESSETTE • Faculté de Médecine, Université de Montréal, Montréal, Canada
KAREN BIEBACK • Medical Faculty Mannheim, Institute of Transfusion Medicine and Immunology, Heidelberg University, Heidelberg, Germany; German Red Cross Blood Service Baden-Württemberg – Hessen, Mannheim, Germany
FRANCISCO J. BLANCO • Rheumatology Division, ProteoRed-PRB2/ISCIII Proteomics Group, INIBIC – Hospital Universitario de A Coruña, A Coruña, Spain; RIER-RED de Inflamación y Enfermedades Reumáticas, INIBIC-CHUAC, A Coruña, Spain; Servicio de Reumatología, Unidad de Investigación, INIBIC-CHU A Coruña, A Coruña, Spain
SARA BOLIS • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland
SIDDARAJU V. BOREGOWDA • Department of Molecular Therapeutics, The Scripps Research Institute, Jupiter, FL, USA
MÉLANIE BORIE • Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CRCHUM), Montreal, QC, Canada
JOAQUIM M.S. CABRAL • Department of Bioengineering and iBB - Institute for Bioengineering and Biosciences, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal
VALENTINA CALAMIA • Rheumatology Division, ProteoRed-PRB2/ISCIII Proteomics Group, INIBIC – Hospital Universitario de A Coruña, A Coruña, Spain
ARNOLD I. CAPLAN • Skeletal Research Center, Case Western Reserve University, Cleveland, OH, USA
JOANA G. CARMELO • Department of Bioengineering and iBB - Institute for Bioengineering and Biosciences, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal
MATTEO CENTOLO • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland
STEVEN A.J. CHAMULEAU • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands
JERRY K.Y. CHAN • Experimental Fetal Medicine Group, Department of Obstetrics and Gynaecology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore; Department of Reproductive Medicine, KK Women’s and Children’s Hospital, Singapore, Singapore; Cancer and Stem Cell Biology Program, Duke-NUS Graduate Medical School, Singapore, Singapore
ANDRE CHOO • Agency for Science Technology and Research, Bioprocessing Technology Institute, Singapore, Singapore; Division of Bioengineering, Faculty of Engineering, National University of Singapore, Singapore, Singapore
MARIA CHIARA CIUFFREDA • Department of Molecular Medicine, Unit of Cardiology, University of Pavia, Pavia, Italy; Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
DIMAS TADEU COVAS • Hemocentro de Ribeirão Preto, Centro de Terapia Celular, Faculadade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil
PATRIZIA DANIELI • Department of Molecular Medicine, Unit of Cardiology, University of Pavia, Pavia, Italy; Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
CLAUDIA LOBATO DA SILVA • Department of Bioengineering and iBB - Institute for Bioengineering and Biosciences, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal
DOMINIQUE P.V. DE KLEIJN • Department of Surgery, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore; Cardiovascular Research Institute, National University Health System, Singapore, Singapore; Experimental Cardiology, University Medical Center, Utrecht, The Netherlands; Interuniversity Cardiology Institute of the Netherlands, Utrecht, The Netherlands
SHANT DER SARKISSIAN • Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CRCHUM) Montreal, QC, Canada; Faculté de Médecine, Université de Montréal, Montreal, QC, Canada
PIETER A. DOEVENDANS • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands; Interuniversity Cardiology Institute of the Netherlands (ICIN), Utrecht, The Netherlands
ANNETTE EKBLOND • Cardiology Stem Cell Centre, The Heart Centre, Rigshospitalet Copenhagen University Hospital, Copenhagen, Denmark
VITOR MARCEL FAÇA • Departamento de Bioquímica e Imunologia, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil; Hemocentro de Ribeirão Preto, Centro de Terapia Celular, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil

ANA FERNANDES-PLATZGUMMER • Department of Bioengineering and iBB - Institute for Bioengineering and Biosciences, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal

DRIES A.M. FEVER • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands

FEI GAO • Department of Ophthalmology, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China

PAOLO GIANNONI • Stem Cell Laboratory, Department of Experimental Medicine, University of Genova, Genoa, Italy

MASSIMILIANO GNÉCCHI • Department of Molecular Medicine, Unit of Cardiology, University of Pavia, Pavia, Italy; Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Department of Medicine, University of Cape Town, Cape Town, South Africa

JOSE GOMEZ • Division of Cardiology, Department of Medicine, Duke University Medical Center & Duke Cardiovascular Research Center, Durham, NC, USA

LEWIS JOEL GREENE • Hemocentro de Ribeirão Preto, Centro de Terapia Celular, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil

MANDANA HAACK-ØRENSEN • Cardiology Stem Cell Centre, The Heart Centre, Rigshospitalet Copenhagen University Hospital, Copenhagen, Denmark

HOLGER HÄCKSTEIN • Institute for Clinical Immunology and Transfusion Medicine, University Hospital Giessen and Marburg, Justus-Liebig-University Giessen, Giessen, Germany

PATRICK J. HANLEY • Program for Cell Enhancement and Technologies for Immunotherapy, Center for Cancer and Immunology Research, Washington, DC, USA; Children’s National Health System, Washington, DC, USA; Division of Blood and Marrow Transplantation, Washington, DC, USA; Sheikh Zayed Institute for Pediatric Surgical Innovation, Washington, DC, USA; The George Washington University, Washington, DC, USA

JOSHUA M. HARE • Interdisciplinary Stem Cell Institute, University of Miami Miller School of Medicine, Miami, FL, USA

JENS KASTRUP • Cardiology Stem Cell Centre, The Heart Centre, Rigshospitalet Copenhagen University Hospital, Copenhagen, Denmark

SATORU KIDOAKI • Laboratory of Biomedical and Biophysical Chemistry, Institute for Materials Chemistry and Engineering, Kyushu University, Fukuoka, Japan

VEENA KRISHNAPPA • Department of Molecular Therapeutics, The Scripps Research Institute, Jupiter, FL, USA

THASANEeya KUBOKI • Laboratory of Biomedical and Biophysical Chemistry, Institute for Materials Chemistry and Engineering, Kyushu University, Fukuoka, Japan

RUENN CHAI LAI • Agency for Science Technology and Research, Institute of Medical Biology, Singapore, Singapore
PAULA LAM • Cancer and Stem Cell Biology Program, Duke-NUS Graduate Medical School, Singapore, Singapore; Department of Physiology, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore; Laboratory of Cancer Gene Therapy, Division of Cellular and Molecular Research, National Cancer Centre, Humphrey Oei Institute of Cancer Research, Singapore, Singapore

QIZHOU LIAN • Cardiology Division, Department of Medicine, University of Hong Kong, Hong Kong, China; Research Centre of Heart, Brain, Hormone, and Healthy Aging, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China; Department of Ophthalmology, Li Ka Shing Faculty of Medicine, University of China, Hong Kong, China

XIAOTING LIANG • Cardiology Division, Department of Medicine, University of Hong Kong, Hong Kong, China

SAI KIANG LIM • Agency for Science Technology and Research, Institute of Medical Biology, Singapore, Singapore; Department of Surgery, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore

FRANCO LOCATELLI • Dipartimento di Emato-Oncologia e Medicina Trasfusionale, IRCCS Ospedale Pediatrico Bambino Gesù, Roma, Italy; Dipartimento di Scienze Pediatriche, Università degli Studi di Pavia, Pavia, Italy

VIVIANA LO CICERO • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland

ANA S. LOURENÇO • Faculty of Sciences and Technology, University of Coimbra, Coimbra, Portugal; Biocant - Biotechnology Innovation Center, Cantanhede, Portugal

MARTA MAGATTI • Centro di Ricerca E. Menni, Fondazione Poliambulanza-Istituto Ospedaliero, Brescia, Italy

GIUSEPPE MALPASSO • Department of Molecular Medicine, Unit of Cardiology, University of Pavia, Pavia, Italy; Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy

BRUNO MANADAS • CNC – Center for Neuroscience and Cell Biology, University of Coimbra, Coimbra, Portugal; Biocant - Biotechnology Innovation Center, Cantanhede, Portugal

IVAN MARTIN • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland

MATILDE N. MELO • CNC – Center for Neuroscience and Cell Biology, University of Coimbra, Coimbra, Portugal

RENUKA P. MILLER • Program for Cell Enhancement and Technologies for Immunotherapy, Center for Cancer and Immunology Research, Washington, DC, USA; Children’s National Health System, Washington, DC, USA

MARIA MIROTSOU • Division of Cardiology, Department of Medicine, Duke University Medical Center & Duke Cardiovascular Research Center, Durham, NC, USA

MARINA MORIGI • IRCCS – Istituto di Ricerche Farmacologiche Mario Negri, Centro Anna Maria Astori, Bergamo, Italy

PAOLA MUSARÒ • Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
PHILIPP NETSCH • Medical Faculty Mannheim, Institute of Transfusion Medicine and Immunology, Heidelberg University, Heidelberg, Germany; German Red Cross Blood Service Baden-Württemberg – Hessen, Mannheim, Germany

JOHNATHAN NG • Department of Biomedical Engineering, Columbia University, New York, NY, USA

NICOLAS NOISEUX • Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CRCHUM) Montreal, QC, Canada; Faculté de Médecine, Université de Montréal, Montreal, QC, Canada; Division of Cardiac Surgery, Centre Hospitalier de l’Université de Montréal (CHUM), Montreal, QC, Canada

PHILIPP NOLD • Department of Hematology, Oncology and Immunology, University Hospital Giessen and Marburg, Philipps-University, Marburg, Germany

WILLY NOORT • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands; Department of Cell Biology, University Medical Center Utrecht, Utrecht, The Netherlands

MARISTELA DELGADO ORELLANA • Hemoctro de Ribeirão Preto, Centro de Terapia Celular, Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, Ribeirão Preto, SP, Brazil

JAYANTI PADMANABHAN • Agency for Science Technology and Research, Bioprocessing Technology Institute, Singapore, Singapore

ADAM PAPADIMITRPOULOS • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland

ORNELLA PAROLINI • Centro di Ricerca E. Menni, Fondazione Poliambulanza-Istituto Ospedaliero, Brescia, Italy

PATRICE PENFORSN • Cancer Institute, University of Mississippi Medical Center, Jackson, MS, USA

DONALD G. PHINNEY • Department of Molecular Therapeutics, The Scripps Research Institute, Jupiter, FL, USA

STEFANO PIASTA • Centro di Ricerca E. Menni, Fondazione Poliambulanza-Istituto Ospedaliero, Brescia, Italy

ELIA PICCININI • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland

RADHIKA POCHAMPALLY • Cancer Institute, University of Mississippi Medical Center, Jackson, MS, USA; Department of Biochemistry, University of Mississippi Medical Center, Jackson, MS, USA

RODOLFO QUARTO • Stem Cell Laboratory, Department of Experimental Medicine, University of Genova, Genoa, Italy

MARINA RADRIZZANI • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland

GIUSEPPE REMUZZI • IRCCS – Istituto di Ricerche Farmacologiche Mario Negri, Centro Anna Maria Astori, Bergamo, Italy; Unit of Nephrology and Dialysis, A.O. Papa Giovanni XXIII, Bergamo, Italy

BRENT RICE • TerumoBCT, Lakewood, CO, USA

CAMILLO RICORDI • Cell Transplant Program and Diabetes Research Institute, University of Miami, Miami, FL, USA

BEATRIZ ROCHA • Rheumatology Division, ProteoRed-PRB2/ISCIII Proteomics Group, INIBIC – Hospital Universitario de A Coruña, A Coruña, Spain
MARKUS THOMAS ROJEWSKI • Institut für Klinische Transfusionsmedizin und Immungenetik Ulm, DRK-Blutspendedienst Baden-Württemberg – Hessen, Ulm, Germany; Institut für Transfusionsmedizin, Universitätsklinikum Ulm, Ulm, Germany

CINZIA ROTA • IRCCS – Istituto di Ricerche Farmacologiche Mario Negri, Centro Anna Maria Astori, Bergamo, Italy

Cristina Ruiz-Romero • Rheumatology Division, ProteoRed-PRB2/ISCIII Proteomics Group, INIBIC – Hospital Universitario de A Coruña, A Coruña, Spain; CIBER-BBN, INIBIC-CHUAC, A Coruña, Spain

A.J. Salgado • Life and Health Sciences Research Institute (ICVS), School of Health Sciences, University of Minho, Braga, Portugal; ICVS/3B’s, PT Government Associate Laboratory, Braga/Guimarães, Portugal

Cristina Sanina • Interdisciplinary Stem Cell Institute, University of Miami Miller School of Medicine, Miami, FL, USA

Cátia Santa • CNC – Center for Neuroscience and Cell Biology, University of Coimbra, Coimbra, Portugal; Institute for Interdisciplinary Research, University of Coimbra (IIIUC), Coimbra, Portugal

Jeffrey Schmeckpeper • Division of Cardiology, Department of Medicine, Duke University Medical Center & Duke Cardiovascular Research Center, Durham, NC, USA

Hubert Schrezenmeier • Institut für Klinische Transfusionsmedizin und Immungenetik Ulm, DRK-Blutspendedienst Baden-Württemberg – Hessen, Ulm, Germany; Institut für Transfusionsmedizin, Universitätsklinikum Ulm, Ulm, Germany

R. Wilder Scott • Department of Cellular and Physiological Sciences and Biomedical Research Centre, University of British Columbia, Vancouver, BC, Canada

Celeste Scotti • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland; IRCCS Istituto Ortopedico Galeazzi, Milan, Italy

Luc Sensebé • UMR5273-U1031 STROMALab, CNRS, INSERM, Université Paul Sabatier Toulouse, EFS, Toulouse, France

S.C. Serra • Life and Health Sciences Research Institute (ICVS), School of Health Sciences, University of Minho, Braga, Portugal; ICVS/3B’s, PT Government Associate Laboratory, Braga/Guimarães, Portugal

Antonietta Silini • Centro di Ricerca E. Menni, Fondazione Poliambulanza-Istituto Ospedaliero, Brescia, Italy

Joost P.G. Sluijter • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands; Interuniversity Cardiology Institute of the Netherlands (ICIN), Utrecht, The Netherlands; Experimental Cardiology Laboratory, Department of Cardiology, University Medical Center Utrecht, Utrecht, CX, The Netherlands

Sabrina Soncin • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland

F.G. Teixeira • Life and Health Sciences Research Institute (ICVS), School of Health Sciences, University of Minho, Braga, Portugal; ICVS/3B’s, PT Government Associate Laboratory, Braga/Guimarães, Portugal

Atanas Todorov • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland

Beatrice Tonnarelli • Department of Biomedicine, University Hospital Basel, University of Basel, Basel, Switzerland

Carlo Tremolada • Istituto Image, Milan, Italy
Hung-Fat Tse • Cardiology Division, Department of Medicine, University of Hong Kong, Hong Kong, China; Research Centre of Heart, Brain, Hormone, and Healthy Aging, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China
Lucia Turchetto • Lugano Cell Factory, Cardiocentro Ticino - Swiss Institute of Regenerative Medicine (SIRM), Lugano, Switzerland
Valentina Turco • Department of Cardiothoracic and Vascular Sciences – Coronary Care Unit and Laboratory of Clinical and Experimental Cardiology, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy; Laboratory of Experimental Cardiology for Cell and Molecular Therapy, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
T. Michael Underhill • Department of Cellular and Physiological Sciences and Biomedical Research Centre, University of British Columbia, Vancouver, BC, Canada
Francesjeka van den Akker • Division Heart and Lungs, Department of Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands
Carlo Ventura • SWITH (Stem Wave Institute for Tissue Healing), Gruppo Villa Maria (GVM) and Ettore Sansavini Health Science Foundation – ONLUS, Lugo (Ravenna), Italy; National Institute of Biostructures and Biosystems (NIBB) at the S. Orsola – Malpighi Hospital, Institute of Cardiology, University of Bologna, Bologna, Italy
Minh Quan Vu • Centre de Recherche du Centre Hospitalier de l’Université de Montréal (CRCHUM), Montreal, QC, Canada; Faculté de Médecine, Université de Montréal, Montreal, QC, Canada
Gordana Vunjak-Novakovic • Department of Biomedical Engineering, Columbia University, New York, NY, USA; Departments of Medicine, Columbia University, New York, NY, USA
Ian A. White • Interdisciplinary Stem Cell Institute, University of Miami Miller School of Medicine, Miami, FL, USA
Ronne Wee Yeh Yeo • Agency for Science Technology and Research, Institute of Medical Biology, Singapore, Singapore
Yue Lin Zhang • Cardiology Division, Department of Medicine, University of Hong Kong, Hong Kong, China; Department of Ophthalmology, Li Ka Shing Faculty of Medicine, University of Hong Kong, Hong Kong, China