PLACENTA
THE TREE OF LIFE

Edited by
Ornella Parolini
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PLACENTA
THE TREE OF LIFE
GENE AND CELL THERAPY SERIES

Series Editors
Anthony Atala & Nancy Templeton

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Placenta: The Tree of Life
Ornella Parolini
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Contents

Series Preface ................................................................. vii
Preface ........................................................................ ix
Editor ........................................................................... xi
Contributors ..................................................................... xiii

Chapter 1  Structure and Development of the Human Placenta ................. 1
   Joanna L. James and Lawrence W. Chamley

Chapter 2  The Role of Mesenchymal Stem Cells in the Functions and Pathologies of the Human Placenta .............................................. 13
   Gina Diamanta Kusuma, Padma Murthi, and Bill Kalionis

Chapter 3  The Roles of the Human Placenta in Fetal-Maternal Tolerance .......... 39
   Jelmer R. Prins and Sicco A. Scherjon

Chapter 4  The Human Placenta in Wound Healing: Historical and Current Approaches ................................................................. 49
   Carmen García Insausti, José María Moraleda, Gregorio Castellanos, and Francisco José Nicolás

Chapter 5  Cell Populations Isolated from Amnion, Chorion, and Wharton’s Jelly of Human Placenta ......................................................... 69
   Francesco Alviano, Roberta Costa, and Laura Bonsi

Chapter 6  The Immunomodulatory Features of Mesenchymal Stromal Cells Derived from Wharton’s Jelly, Amniotic Membrane, and Chorionic Villi: In Vitro and In Vivo Data ........................................ 91
   Marta Magatti, Mohamed H. Abumaree, Antonietta R. Silini, Rita Anzalone, Salvatore Saieva, Eleonora Russo, Maria Elena Trapani, Giampiero La Rocca, and Ornella Parolini

Chapter 7  Use of Placenta-Derived Cells in Neurological Disorders ............ 129
   Christopher Lawton, Maya Elias, Diego Lozano, Hung Nguyen, Stephanny Reyes, Jaclyn Hoover, and Cesario V. Borlongan
Chapter 8  Use of Amnion Epithelial Cells in Metabolic Liver Disorders .......... 143
            Roberto Gramignoli, Fabio Marongiu, and Stephen C. Strom

Chapter 9  The Use of Placenta-Derived Cells in Autoimmune Disorders ...... 161
            Antonietta R. Silini, Ornella Parolini, and Mario Delgado

Chapter 10 The Use of Placenta-Derived Cells in Inflammatory and Fibrotic Disorders ................................................................. 181
            Euan M. Wallace, Anna Cargnoni, Rebecca Lim, Alex Hodge, and William Sievert

Chapter 11 From Bench to Bedside: Strategy, Regulations, and Good Manufacturing Practice Procedures............................................. 197
            Christian Gabriel

Chapter 12 Applications of Placenta-Derived Cells in Veterinary Medicine..... 217
            Barbara Barboni, Valentina Russo, Paolo Berardinelli, Aurelio Muttini, and Mauro Mattioli
Series Preface

Gene and cell therapies can provide useful therapeutics for numerous diseases and disorders, particularly for those that have no other effective treatments. This book series covers all current topics in gene and cell therapies and their supporting disciplines, from basic research discoveries to clinical applications. Because these fields are continually evolving to produce advanced treatments based on scientific breakthroughs, each book in the series provides a timely in-depth coverage of its focused topic.

The contributors to this second book of the series include a remarkable group of authors who expertly cover topics related to the placenta as a source of cells for therapy. The volume covers important basic areas related to the placenta, such as its development and function, as well as the sources of cells present, like amnion and chorion. Major topics are covered, such the history of the use of placenta for wound healing and the current state of the use of placental cells for neurological disorders, liver disorders, autoimmune diseases, and immunomodulation. Applications of placental derived therapies in veterinary medicine are also covered. This volume, dedicated to the placenta, provides a comprehensive overview of the current state of the field and its future directions.

We would like to thank the volume editor, Dr. Ornella Parolini and the authors, all experts in their fields, for their valuable contributions. We also would like to thank CRC senior acquisitions editor, Dr. C. R. Crumly and the CRC Press editorial and production staff for their efforts and dedication to the Gene and Cell Therapy series.

Anthony Atala, MD
Wake Forest Institute for Regenerative Medicine
and
Nancy Templeton, PhD
Series Editors
Gene and Cell Therapy
Preface

I’m sure that we all can remember one of our first drawings as a child, perhaps that of a tree?

The tree has been one of the most important mythological and religious symbols since ancient times, often regarded as sacred in the ancient world. The image of the tree is also a favorite of many cultures. There are numerous paintings of trees in different religions, such as Judaism, Christianity, Islam, and Hinduism, which indicate prosperity, new beginnings, redemption, and perpetual regeneration.

It is interesting to note that the placenta is tree shaped.

The tree-shaped placenta could be an indication of our origin, of the deep roots which are severed when the umbilical cord is cut, but at which time a new dimension of growth and development begins. As old findings suggest, and seconded by new findings, the placenta’s usefulness and importance begin during gestation, when it nourishes the growing fetus and participates in the complex phenomenon of fetomaternal tolerance. This importance continues even after birth when it takes on a whole new dimension and presents itself for applications in regenerative medicine.

The placenta, which is usually thrown away after birth, is likened to a tree; it is constantly giving and receiving. Just like a tree through its branches and trunk, the placenta is a tree of life which collects nourishment from the mother’s blood through its branches and passes it to the blood of the fetus. The waste from the fetus is discarded through the umbilical cord to the mother’s blood, which in turn absorbs and removes the same. If the placenta is affected, miscarriage, stillbirth, and other life-threatening conditions can occur for both the mother and the fetus. Given its vital role, shockingly little is known about the placenta. The National Institute of Child Health and Human Development describes the placenta as “the least understood human organ and arguably one of the more important, not only for the health of a woman and her fetus during pregnancy, but also for the lifelong health of both.”

Therefore, it is with great enthusiasm that I present to you Placenta: The Tree of Life, a combined effort of many of the world’s renowned scientists, showcasing this intriguing and mysterious organ, especially its potential in novel therapeutic strategies. This book is written by and dedicated to those who are fascinated by the placenta. It will discuss the structure, functions, and pathologies of the human placenta during fetal development, including its functions from the time of its origin in the lining of the uterus. The book also reviews how the placenta sustains life even after birth, including the quest to understand the mechanisms of action underlying the therapeutic benefit of cells isolated from different placental regions, thus truly representing the tree of life. The book encompasses even the most ancient uses of placental tissues, such as the use of fetal membranes as biomaterial in medicine over a century ago, up to the current good manufacturing practices implemented to obtain cells from human placenta envisaged to treat patients with a variety of diseases.

My goal is to take you on an exciting journey which will spark your interest in this organ, which was once discarded after birth. A glance at the Table of Contents, and perhaps reading several chapters, will explain the title of this book,
Preface

*Placenta: The Tree of Life.* The book discusses the marvel of how something that is even today considered biological waste can instead contribute to our nourishment throughout the years. The multiplicity of new scientific societies interested in the therapeutic properties of the placenta clearly underlines the rising interest in the placenta, and I hope that this book will bring the placenta into the center stage it so well deserves.

**REFERENCE**


Ornella Parolini
Editor

Ornella Parolini obtained her undergraduate degree in biological science from the University of Milan, Milan, Italy, in 1988, and her doctorate degree in cellular and molecular biotechnology in biomedicine from the University of Brescia, Brescia, Italy. Dr. Parolini worked from 1991 to 1994 in Memphis, Tennessee, including St. Jude’s Children’s Research Hospital, and from 1995 to 2002 in the University of Vienna, Wien, Austria. During these years, she significantly contributed to the field of primary immunodeficiencies.

After a decade of research in the United States and Austria, Dr. Parolini returned to Brescia, Italy, where she established well-funded research programs in regenerative medicine and was appointed director of the E. Menni Research Center (CREM), Fondazione Poliambulanza, Brescia, Italy. Her strong research accomplishments in immunology brought her to study the human placenta. She considered fetal-maternal tolerance as one of the most fascinating aspects of immunology and envisioned that placental tissues could constitute interesting sources of stem cells ideal not only for their stem cell potential but also for their intrinsic and unique immune characteristics owing to the immunologically challenged environment from which they derive. Since 2002, Dr. Parolini has pioneered research on human placenta–derived stem cells, in particular their unique immunomodulatory properties, proposed to be the basis of the tissue repair mechanisms promoting tissue regeneration. CREM is currently recognized internationally for its research and contributions in this field.

Dr. Parolini is the author of more than 100 publications in peer-reviewed scientific journals and several book chapters, and has patents in the placenta stem cell field. She is member of numerous scientific societies. International Placenta Stem Cell Society (IPLASS) was founded by Dr. Parolini and colleagues in 2009, and she became the first elected president of IPLASS in the same year. In 2014, Dr. Parolini was re-elected as the president for a second term, and thus as of October 2015 she is serving her second term as the president of the society.

Antonietta R. Silini obtained her bachelor of science in microbiology from the University of Maryland, College Park, Maryland, and PhD degree in life sciences from the Mario Negri Institute for Pharmacological Research, Milan, Italy, in collaboration with the Open University of London, UK.

Her past research interests include cancer biology, specifically on understanding the crosstalk between tumor and microenvironment in order to identify targets for therapy.

Her current research interests include investigating placental stem cells and their potential therapeutic effects on different diseases, including cancer. Dr. Silini works at the E. Menni Research Center (CREM), Fondazione Poliambulanza, Brescia, Italy, which is internationally recognized for its research and contributions in this field.
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