Culture Media, Solutions, and Systems in Human ART

Culture Media, Solutions, and Systems in Human ART

Edited by
Patrick Quinn
Emeritus Vice-President, Research and Development,
SAGE IVF, A CooperSurgical Company,
Trumbull, CT, USA

CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE
UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781107619531

First published 2014

Printing in the United Kingdom by TJ International Ltd. Padstow Cornwall

A catalog record for this publication is available from the British Library

Library of Congress Cataloging in Publication data
Culture media, solutions, and systems in human ART / edited by Patrick Quinn.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-107-61953-1 (Paperback)
I. Quinn, Patrick, 1946- editor of compilation.
[DNLM: 1. Reproductive Techniques, Assisted. 2. Culture Media. 3. Infertility–therapy. 4. Solutions. WQ 208]
RC889
616.6′9206–dc23 2013044706

ISBN 978-1-107-61953-1 Paperback

To my wife Kay and my family for their
support and love throughout my career

Contents

Contributors

Jay M. Baltz, PhD
Associate Scientific Director and Senior Scientist; Professor, Department of Obstetrics and Gynecology, University of Ottawa, and Ottawa Hospital Research Institute, Ottawa, Ontario, Canada

Diana Patricia Bernal, DVM
Cryopreservation Coordinator, Reproductive Biology Associates, Sandy Springs, GA, USA

William R. Boone, PhD, HCLD (ABB)
Director of Assisted Reproductive Technology Laboratories, Greenville Hospital System University Medical Center, Greenville, SC, USA

Ching-Chien Chang, PhD
Cryo-Egg Bank Director, Reproductive Biology Associates, Sandy Springs, GA, USA

Ri-Cheng Chian, MSc, PhD
Associate Professor, Department of Obstetrics and Gynecology, McGill University, Montreal, Quebec, Canada

Takeo Cho, BA
Global Sales Division Manager, Astec Co. Ltd., Fukuoka, Japan

Natalie A. Clark, MD
House Officer, Department of Obstetrics and Gynecology, University of Michigan, Ann Arbor, MI, USA

Joe Conaghan, PhD, HCLD
Laboratory Director, Pacific Fertility Center, San Francisco, CA, USA

Shan-Jun Dai, MD, PhD
Visiting Scholar, Department of Obstetrics and Gynecology, McGill University, Montreal, Quebec, Canada

Anna P. Ferraretti, MD, PhD
Scientific Director, S.I.S.Me.R. Reproductive Medicine Unit, Bologna, Italy

Luca Gianaroli, MD
CEO, S.I.S.Me.R. Reproductive Medicine Unit, Bologna, Italy

H. Lee Higdon III, PhD, HCLD (ABB)
Director of Research, Department of Obstetrics and Gynecology, Greenville Hospital System University Medical Center, Greenville, SC, USA

Theresa Jeary, BSc (Hons), MSc
Device Drug Combinations Expert and Technical Manager, Lloyds Register of Quality Assurance, UK

Eduardo Kelly, MD, MBA, ELD (ABB)
Director of Embryology Laboratories, Steptoe Medical Devices, Hingham, MA, USA

Michelle Lane, PhD
Repromed, Dulwich, and Research Centre for Reproductive Health, Discipline of Obstetrics and Gynaecology, University of Adelaide, South Australia, Australia

Henry J. Leese, BSc, PhD, FRCOG (*ad eundem*)
Professor of Biology Emeritus, Hull York Medical School, University of Hull, Hull, UK

M. Cristina Magli, MSc
R&D Director, S.I.S.Me.R Reproductive Medicine Unit, Bologna, Italy

Marius Meintjes, PhD
Scientific Director, Frisco Institute for Reproductive Medicine, Frisco, TX, USA

Kathleen A. Miller, BS, TS
Scientific Director, IVF Florida Reproductive Associates, Margate, FL, USA

Markus H. M. Montag, PhD
IVF Laboratory Director, Department of Gynecological Endocrinology and Fertility Disorder, University of Heidelberg, Heidelberg, Germany; and Ilabcomm, St. Augustin, Germany

André Monteiro da Rocha, PhD, DVM
Research Fellow, MStem Cell Laboratories, Department of Obstetrics and Gynecology, University of Michigan, Ann Arbor, MI, USA

David Mortimer, PhD
Oozoa Biomedical Inc., West Vancouver, British Columbia, Canada

Sharon T. Mortimer, PhD
Oozoa Biomedical Inc., West Vancouver, British Columbia, Canada

Zsolt Peter Nagy, MD, PhD
Scientific and Laboratory Director, Reproductive Biology Associates, Sandy Springs, GA, USA

Kamilla S. Pedersen, PhD
Customer Communication Manager, Unisense FertiliTech A/S, Aarhus N, Denmark

Thomas B. Pool, PhD, HCLD
Scientific and Laboratory Director, Fertility Center of San Antonio, San Antonio, TX, USA

Patrick Quinn, PhD
Emeritus Vice-President, Research and Development, SAGE IVF, A CooperSurgical Company, Trumbull, CT, USA

Niels B. Ramsing, PhD
Chief Scientific Officer, Unisense FertiliTech A/S, Aarhus N, Denmark

Sarah A. Robertson, BSc, PhD
Professor of Reproductive Biomedicine and Director, The Robinson Institute, School of Paediatrics and Reproductive Health, University of Adelaide, Adelaide, Australia

Gary Daniel Smith, PhD, HCLD
Professor, Departments of Obstetrics and Gynecology, Physiology, and Urology; Director, MStem Cell Laboratories, University of Michigan, Ann Arbor, MI, USA

Jason E. Swain, PhD, HCLD
Scientific Director, Department of Obstetrics and Gynecology and Reproductive Sciences Program, University of Michigan, Ann Arbor, MI, USA

Jeremy G. Thompson, PhD, FSRB
Associate Professor, The Robinson Institute, School of Paediatrics and Reproductive Health, University of Adelaide, Adelaide, Australia

Yao Wang, MD, PhD
Visiting Scholar, Department of Obstetrics and Gynecology, McGill University, Montreal, Quebec, Canada

Sarah-Louise Whitear, BSc, PhD
Graduate student, Department of Biology, University of York, York, UK

Deirdre Zander-Fox, PhD
Repromed, Dulwich, and Research Centre for Reproductive Health, Discipline of Obstetrics and Gynaecology, University of Adelaide, South Australia, Australia

Foreword

Patrick Quinn came from humble beginnings as an Australian reproductive biologist with a strong interest in biochemistry. With the rapid expansion of in vitro fertilization (IVF) technologies worldwide, Patrick found his career motivating research shift into the area of preimplantation embryo culture in vitro. When he moved to the USA, he was able to convert his research interests into the full-scale demands of producing high quality media for use in assisted reproductive technologies. He has been extremely successful in the design and production of quality products that have met the high demands of maximizing embryo viability for research and clinical medicine. This book *Culture Media, Solutions, and Systems in Human ART* contains all the ingredients necessary to understand the requirements, pitfalls, and demands of commercial products. These media must meet the highest quality hurdles necessary for an extremely delicate process of maturing, fertilizing, and developing the embryo in the laboratory; the beginnings of human life.

Since the oocyte and early embryo are not merely passive traffickers in isotonic media, Quinn and his collaborating authors take the reader on a journey that all embryologists and students of cell biology should take. The needs of an oocyte to be fertilized properly, to activate the embryonic genome, and to convert the maternal oocyte cell machinery into a developmentally competent and fully functional organism is no mere spontaneous feat. There are many default pathways to abnormality and degeneration, and this book describes many of them. Knowing where this developmental process can go wrong creates the opportunity to ensure that an optimum environment can be created for the developing embryo.

There are excellent authors and coauthors who have contributed to the book; many of them are internationally recognizable from their excellent published research. Many are also involved in clinical IVF and provide a very practical perspective to the issues raised in various chapters. Perhaps this is not the last word written on the design and requirements of optimized IVF culture media but it does address the vast majority of matters that need consideration. A while ago I asked Patrick to design a simple IVF medium that could withstand the rigors of demand in primitive communities where electricity and refrigeration were luxuries that could not be counted on. He, as usual, responded with enthusiasm to meet my request and this is a work in progress. The book will help scholars and practitioners understand the environment they themselves need to work in, make requests of Patrick and his colleagues for situational improvements, and will continue to assist the field to evolve to that perfect "drop" that Patrick has in mind.

Alan Trounson PhD
President, California Institute for Regenerative Medicine, San Francisco
Emeritus Professor, Monash University, Melbourne, Australia