
Neonatology

Giuseppe Buonocore • Rodolfo Bracci
Michael Weindling
Editors

Neonatology

A Practical Approach to Neonatal
Diseases

Second Edition

With 568 Figures and 386 Tables

 Springer

Editors

Giuseppe Buonocore
Department of Pediatrics
Obstetrics and Reproductive Medicine
University of Siena
Siena, Italy

Rodolfo Bracci
Department of Pediatrics
Obstetrics and Reproductive Medicine
University of Siena
Siena, Italy

Michael Weindling
Liverpool Women's Hospital Neonatal Unit
Liverpool, UK

ISBN 978-3-319-29487-2 ISBN 978-3-319-29489-6 (eBook)
ISBN 978-3-319-29488-9 (print and electronic bundle)
<https://doi.org/10.1007/978-3-319-29489-6>

Library of Congress Control Number: 2018940273

1st edition: © Springer-Verlag Italia 2012

© Springer International Publishing AG, part of Springer Nature 2018

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. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Printed on acid-free paper

This Springer imprint is published by the registered company Springer International Publishing AG part of Springer Nature.

The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Introduction

Neonatology is a science in rapid evolution. The speed of this evolution may cause some to doubt what a traditional textbook is able to achieve in bringing the most up-to-date developments to a reader's attention. Although the interested reader will use other electronic means to access current information, this is not always possible. We firmly believe that, through their own experience, experts are able to bring their own perspective and interest to a subject and act as a guide to the interested and committed reader. We therefore believe that this textbook should act as a conduit of reliable information from the expert to the clinician. We have tried to make this textbook into a genuine guide to the best and most up-to-date answers for neonatologists who are striving to give the best and highest quality care to sick babies.

All practicing clinicians work within their own culture and resources. Each has to make judgments about the best and most appropriate application of available resources to the care of their small sick patients. We hope that this textbook will support the dedicated clinician by providing the best evidence available in the various sub-specialisms of neonatology, particularly when the issue of best treatment continues to be debated. The reader who needs rapid and comprehensive information about a topic requires that the information provided should be synthesized intelligently, exhaustively, and clearly. Subjects should be updated as much as possible. We have endeavored to meet these requirements. We think that the aim of a modern textbook should be to describe the present state of the science, suggesting ways in which this might be improved, and to provide a sound understanding of pathophysiology and diagnostic and therapeutic procedures. Our overall aim is to support and optimize the care of the newborn. In this way, our approach is "practical" and aims to assist neonatologists in their daily work.

In this second edition, the text has been largely revised by experts who contributed to the previous volume. They have added new information, some of it through short- and long-term follow-up, to support the evidence that underpins good clinical practice. Some chapters are completely new.

We are grateful to all the authors for their time and contributions. We would also like to thank Andrew Spencer, Tina Shelton, Vasowati Shome, and the publication team of Springer for their great efforts in publishing this book.

We sincerely hope that this volume has built on the success of its predecessor and continues to support clinicians in a readily accessible and useful way.

Contents

Volume 1

Part I Epidemiology and Fetal Neonatal Medicine	1
1 Development and General Characteristics of Preterm and Term Newborn	3
Domenico Arduini, Gaia Pasquali, Stefano Parmigiani, Daniela Gianotti, and Giulio Bevilacqua	
2 Risk Factors for Gestational Diseases	27
Silvia Vannuccini, Michela Torricelli, Filiberto Maria Severi, and Felice Petraglia	
3 Epigenetic Mechanisms	41
Felicia M. Low and Peter D. Gluckman	
4 Congenital Malformations and Syndromes: Early Diagnosis and Prognosis in Neonatal Medicine	49
Giovanni Corsello and Mario Giuffrè	
5 Prenatal and Postnatal Inflammatory Mechanisms	73
Kirsten Glaser and Christian P. Speer	
6 The Fetus at Risk: Chorioamnionitis	95
Mikko Hallman and Tuula Kaukola	
7 Diagnosis of Fetal Distress	105
Silvia Vannuccini, Caterina Bocchi, Filiberto Maria Severi, and Felice Petraglia	
8 In Vitro Fertilization and Multiple Pregnancies	129
Maria Angela Rustico, Mariano Lanna, and Enrico Ferrazzi	
9 Intrauterine Growth Restriction: Obstetric and Neonatal Aspects. Intervention Strategies	147
Enrico Bertino, Giovanna Oggè, Paola Di Nicola, Francesca Giuliani, Alessandra Coscia, and Tullia Todros	

10	Late Preterm Infants at Risk for Short-Term and Long-Term Morbidity and Mortality	171
	Avroy A. Fanaroff	
11	Ethical Problems in Neonatal Medicine	183
	Otwin Linderkamp	
12	Care of Extremely Low-Birth-Weight Infants and Timing of Discharge. Information and Psychosocial Intervention in Neonatology	203
	Fabio A. Mosca, Monica Fumagalli, Maria Elena Bolis, and Massimo Agosti	
13	The Process of Decision-Making in Neonatology	219
	Endla K. Anday and Michael Spear	
14	Follow-Up Outcomes of High-Risk Infants	229
	Neil Marlow	
15	Early Markers of Poor Outcome in Neonatal Medicine	237
	Fabrizio Ferrari, Licia Lugli, Elisabetta Garetti, Isotta Guidotti, Marisa Pugliese, and Laura Lucaccioni	
16	Quality of Neonatal Intensive Care and Outcome for High-Risk Newborn Infants	251
	Liz McKechnie and Kathryn Johnson	
17	Cerebral Plasticity and Functional Reorganization in Children with Congenital Brain Lesions	265
	Viviana Marchi, Andrea Guzzetta, and Giovanni Cioni	
Part II	Perinatal and Neonatal Care	277
18	Organization of Perinatal Care: Training of Doctors and Nurses	279
	Neil Marlow	
19	Neonatal Transport Services	291
	Rocco Agostino, Roberto Aufieri, and Maurizio Gente	
20	Risk Management of Newborns	305
	Isabelle Ligi and Sophie Tardieu	
21	Guidelines and Protocols for Newborns	315
	Rinaldo Zanini and Roberto Bellù	
22	Physical Environment for Newborns: The Thermal Environment	323
	Daniele Trevisanuto and Gunnar Sedin	
23	Neonatology and the Law	347
	Vittorio Fineschi, Francesca Maglietta, and Emanuela Turillazzi	

24	Environment and Early Developmental Care for Newborns	357
	Dominique Haumont	
25	Neonatal Pain: Neurophysiology, Recognition, Prevention, and Management with Nonpharmacological Interventions	365
	Carlo Bellieni, Celeste Johnston, Marsha Campbell-Yeo, Britney Benoit, and Timothy Disher	
26	Neonatal Anesthesia	383
	Nicola Disma, Leila Mameli, Rachele Bonfiglio, Clelia Zanaboni, and Pietro Tuo	
27	Neonatal Care in the Delivery Room: Initial Management and Approach to Low Risk Newborns	395
	Tara M. Randis and Jennifer M. Duchon	
28	Early Detection of Neonatal Depression and Asphyxia	409
	Paolo Biban and Davide Silvagni	
29	Resuscitation of the Newborn	423
	Ola D. Saugstad	
30	Oxygen Toxicity in Newborns	439
	Rodolfo Bracci, Serafina Perrone, Maximo Vento, and Giuseppe Buonocore	
31	Physical Examination of the Newborn	457
	Alessandra Coscia, Paola Di Nicola, Enrico Bertino, and Claudio Fabris	
32	Primary Investigations in the Term and Preterm Newborn	471
	Diego Gazzolo, Francesco Risso, and Andrea Sanna	
33	Oxygen Saturation Monitoring in Neonatal Period	481
	Augusto Sola and Sergio Golombek	
Part III	Nutrition	501
34	Physiology of the Gastrointestinal Tract in Newborns	503
	Arieh Riskin, Carlo Agostoni, and Raanan Shamir	
35	Hormones and Gastrointestinal Function of Newborns	535
	Flavia Prodam, Simonetta Bellone, Roberta Ricotti, Alice Monzani, Giulia Genoni, Enza Giglione, and Gianni Bona	
36	Human Milk and Formulas for Neonatal Nutrition	557
	Riccardo Davanzo, Jenny Bua, and Laura Travan	
37	Nutritional Recommendations for the Very-Low-Birth-Weight Newborn	587
	Ekhard E. Ziegler	

- 38 Enteral Feeding of the Very-Low-Birth-Weight Infant** 595
Johannes B. (Hans) van Goudoever
- 39 Parenteral Nutrition** 605
Jacques Rigo and Thibault Senterre
- 40 Postdischarge Nutrition in Preterm Infants** 619
Richard J. Cooke
- 41 Calcium and Phosphorus Homeostasis: Pathophysiology** ... 639
Jacques Rigo, Catherine Pieltain, Renaud Viellevoye, and Franco Bagnoli
- 42 Micronutrients and Vitamins** 669
Olivier Claris and Guy Putet

Part IV Pharmacology and Infants of Smoking, Addicted, and Diabetic Mother 675

- 43 Safety of Medications During Pregnancy and Breastfeeding: Infants of Drug-Addicted Mothers** 677
Karel Allegaert, Timvan Mieghem, and John N. van den Anker
- 44 Developmental Pharmacology and Therapeutics in Neonatal Medicine** 693
Karel Allegaert, Janko Samardzic, Milica Bajcetic, and John N. van den Anker
- 45 Infants of Smoking Mothers** 709
Roberto Paludetto, Letizia Capasso, and Francesco Raimondi
- 46 Infants of Diabetic Mothers** 717
Erin A. Osterholm, Jane E. Barthell, and Michael K. Georgieff

Volume 2

Part V Respiratory System 731

- 47 Neonatal Lung Development and Pulmonary Malformations** 733
Corrado Moretti and Paola Papoff
- 48 Neonatal Pulmonary Physiology of Term and Preterm Newborns** 759
Corrado Moretti and Paola Papoff
- 49 Control of Breathing in Newborns** 775
Ruben E. Alvaro and Henrique Rigatto
- 50 Meconium Aspiration Syndrome** 791
Simone Pratesi and Carlo Dani

51	Molecular Structure of Surfactant: Biochemical Aspects in Newborns	801
	Tore Curstedt	
52	Surfactant Metabolism in Neonatal Lung Diseases	809
	Virgilio P. Carnielli and Paola E. Cogo	
53	Respiratory Distress Syndrome: Predisposing Factors, Pathophysiology, and Diagnosis	823
	Mikko Hallman, Timo Saarela, and Luc J. I. Zimmermann	
54	Treatment of Respiratory Failure in Newborn: Mechanical Ventilation	843
	Colin Morley and Gianluca Lista	
55	Pulmonary Hemorrhage, Transient Tachypnea, and Neonatal Pneumonia	865
	Mary Elaine Patrinos and Richard J. Martin	
56	Pulmonary Air Leakage in Newborns	873
	Paola Papoff and Corrado Moretti	
57	Bronchopulmonary Dysplasia/Chronic Lung Disease of the Newborn	887
	Vineet Bhandari	
58	Lung Ultrasound in Neonatal Diagnostic	913
	Francesco Raimondi, Fiorella Migliaro, and Letizia Capasso	
59	Rare Lung Diseases of Newborns	917
	Paolo Tagliabue and Elena Ciarmoli	
60	Persistent Pulmonary Hypertension of the Newborn	933
	Jason Gien, John P. Kinsella, and Steven H. Abman	
61	Pulmonary Hypertension in Congenital Diaphragmatic Hernia	963
	Jason Gien, John P. Kinsella, and Steven H. Abman	
62	Continuous Positive Airways Pressure and Other Noninvasive Respiratory Techniques in Newborns	971
	Fabrizio Sandri, Gina Ancora, Gianluca Lista, and Luc J. I. Zimmermann	
63	Lung Diseases: Surfactant Replacement Therapy in Newborns	995
	Henry L. Halliday	
64	Extracorporeal Membrane Oxygenation for Neonates	1007
	Anne Greenough, Niovi Papalexopoulou, Munir Ahmed, and Adam P. R. Smith	

65	Lung Diseases: Problems of Steroid Treatment of Fetus and Newborn	1015
	Henry L. Halliday	
66	Apnea of Prematurity and Sudden Infant Death Syndrome	1021
	Christian F. Poets	
Part VI Cardiovascular System		1035
67	Cardiovascular Physiology, Pathology, and Clinical Investigation in Neonatal Medicine	1037
	Luciane Piazza, Angelo Micheletti, Javier Fernandez Sarabia, Diana Negura, Carmelo Arcidiacono, Antonio Saracino, Mario Carminati, and Francesca R. Pluchinotta	
68	Early Diagnosis of Congenital Heart Disease: When and How to Treat	1065
	Francesca R. Pluchinotta, Luciane Piazza, Angelo Micheletti, Javier Fernandez Sarabia, Diana Negura, Carmelo Arcidiacono, Antonio Saracino, and Mario Carminati	
69	Patent Ductus Arteriosus	1079
	Bart Van Overmeire	
70	Cardiac Emergencies in the Newborn	1093
	Liam Mahoney, Hector Rojas-Anaya, and Heike Rabe	
71	Blood Pressure Disorders in the Neonate: Hypotension and Hypertension	1111
	Jonathan M. Fanaroff and Avroy A. Fanaroff	
72	Polycythemia and Hyperviscosity in Neonates	1125
	Otwin Linderkamp	
Part VII Hyperbilirubinemia and Liver Diseases		1141
73	Bilirubin Metabolism, Unconjugated Hyperbilirubinemia, and Physiologic Neonatal Jaundice	1143
	Giovanna Bertini and Carlo Dani	
74	Pathologic Unconjugated Hyperbilirubinemia—Isoimmunization, Abnormalities of Red Blood Cells, and Infections	1151
	Michael Kaplan, Ronald J. Wong, and David K. Stevenson	
75	Kernicterus, Bilirubin-Induced Neurological Dysfunction, and New Treatments for Unconjugated Hyperbilirubinemia in Neonates	1169
	Christian V. Hulzebos, Claudio Tiribelli, Frans J. C. Cuperus, and Petr H. Dijk	

76	Treatment of Hyperbilirubinemia in Newborns	1185
	Jon F. Watchko and M. Jeffrey Maisels	
77	Pathology and Treatment of Liver Diseases in Newborns ...	1207
	Giuseppe Maggiore, Silvia Riva, and Marco Sciveres	
78	Neonatal Cholestasis: Conjugated Hyperbilirubinemia	1223
	Nandini Kataria and Glenn R. Gourley	
79	Surgical Treatment of Biliary Tract Malformations in Newborns	1243
	Pierluigi Pedersini	
Part VIII Orofacial and Gastrointestinal Malformations and Diseases		1253
80	Orofacial Malformations	1255
	Giorgio Iannetti, Maria Teresa Fadda, Marco Della Monaca, and Giulio Bosco	
81	Esophageal Atresia of Newborns	1281
	Mario Messina, Francesco Molinaro, Alfredo Garzi, and Rossella Angotti	
82	Gastrointestinal Malformations of Newborns	1295
	Marcello Dòmini	
83	Rare Surgical Emergencies of Newborns	1331
	Mario Messina, Francesco Molinaro, and Rossella Angotti	
84	Meconium Plug Syndrome	1339
	Mario Messina, Rossella Angotti, and Francesco Molinaro	
85	Hirschsprung's Disease in Newborns	1345
	Girolamo Mattioli, Maria Grazia Faticato, Alessio Pini Prato, and Vincenzo Jasonni	
86	Gastroenteritis and Intractable Diarrhea in Newborns	1355
	Andrea De Luca and Giacomo Zanelli	
87	Rehydration After Diarrhea in Newborns	1365
	Carlo V. Bellieni	
88	Necrotizing Enterocolitis of Newborns	1373
	Sarah Bajorek and Josef Neu	
89	Surgical Treatment in Newborns of Necrotizing Enterocolitis	1395
	Nigel J. Hall and Agostino Pierro	
Part IX Hematology, Immunology, and Malignancies		1403
90	Hematology and Immunology of Newborns: Overview	1405
	Robert D. Christensen	

91	Pathophysiology of Coagulation and Deficiencies of Coagulation Factors in Newborn	1431
	Paola Saracco and Rodney P. A. Rivers	
92	The Thrombotic Risk of the Newborn	1455
	Molinari Angelo Claudio and Paola Saracco	
93	Coagulation Disorders: Clinical Aspects of Platelet Disorders	1471
	Antonio Del Vecchio	
94	Anemia in the Neonatal Period	1489
	Robert D. Christensen and Robin K. Ohls	
95	Fetal and Neonatal Hydrops	1515
	Gennaro Vetrano and Mario De Curtis	
96	Physiology and Abnormalities of Leukocytes in Newborns	1523
	Kurt R. Schibler	
97	Neonatal Hereditary Neutropenia	1549
	Gaetano Chirico and Carmelita D'Ippolito	
98	Recombinant G-CSF Treatment of Severe Chronic Neutropenia in Neonates and Infants	1561
	Robert D. Christensen	
99	Fundamentals of Feto-Neonatal Immunology	1575
	Akhil Maheshwari and Edmund F. La Gamma	
100	Congenital Immunodeficiencies in Newborns	1607
	Alessandro Plebani, Gaetano Chirico, and Vassilios Lougaris	
101	Inflammatory Mediators in Neonatal Asphyxia and Infection	1619
	Kaoru Okazaki, Akira Nishida, and Hirokazu Kimura	
102	Neonatal Malignancies	1641
	Serena Catania, Stefano Chiaravalli, Franca Fossati-Bellani, and Maura Massimino	

Volume 3

Part X	Fetal and Neonatal Infections	1661
103	Fetal Infections: Cytomegalovirus, Herpes Simplex, and Varicella	1663
	Giovanni Nigro	
104	Fetal Infections: Rubella, HIV, HCV, HBV, and Human Parvovirus B19	1681
	Pier Angelo Tovo, Stefania Bezzio, and Clara Gabiano	

105	Fetal Infections: Congenital Syphilis and Tuberculosis	1703
	Pier Angelo Tovo, Carlo Scolfaro, Silvia Garazzino, and Federica Mignone	
106	Toxoplasmosis in the Fetus and Newborn	1711
	Wilma Buffolano	
107	Neonatal Bacterial and Fungal Infections	1727
	Mauro Stronati and Alessandro Borghesi	
108	Neonatal Septic Shock	1773
	Rajesh K. Aneja, Ruby V. Aneja, Misty Good, and Joseph A. Carcillo	
109	Neonatal Viral Infections: Enteroviruses and Respiratory Syncytial Virus	1785
	Paolo Manzoni, Davide Montin, Elena Tavella, and Pier Angelo Tovo	
110	Vaccinations and Neonatal Immunity	1793
	Alberto G. Ugazio and Alberto E. Tozzi	
Part XI Endocrine, Metabolic, and Renal Diseases		1803
111	Inborn Errors of Metabolism and Newborns	1805
	Nicola Brunetti-Pierri, Giancarlo Parenti, and Generoso Andria	
112	Endocrine Diseases and Disorders of Thyroid Function in Newborns	1833
	Paolo Ghirri, Antonio Balsamo, Massimiliano Ciantelli, Paolo Cavarzere, Alessandro Cicognani, Antonio Boldrini, and Alessandra Cassio	
113	Disorders of Sexual Development in Newborns	1893
	Antonio Balsamo, Paolo Ghirri, Silvano Bertelloni, Rosa T. Scaramuzza, Franco D'Alberon, Alessandro Cicognani, and Antonio Boldrini	
114	Pathophysiology of Fetal and Neonatal Kidneys	1919
	Farid Boubred and Umberto Simeoni	
115	Acute and Chronic Renal Failure in the Newborn Infant ...	1935
	Jean-Pierre Guignard and Uma Sankari Ali	
116	Diagnosis and Treatment of Renal and Urinary Tract Malformations in Newborns	1955
	Vassilios Fanos, Marco Zaffanello, and Michele Mussap	

Part XII Neurology	1997
117 Brain Development and Perinatal Vulnerability to Cerebral Damage	1999
Luca A. Ramenghi, Monica Fumagalli, and Veena Supramaniam	
118 Inflammation and Perinatal Brain Injury	2019
Henrik Hagberg, Carina Mallard, and Karin Sävman	
119 Normal and Abnormal Neurodevelopmental and Behavioral Outcomes of Very Low-Birth Weight (VLBW) Infants	2031
Betty R. Vohr	
120 Neurological Examination of the Newborn Infant	2055
Fabrizio Ferrari, Licia Lugli, Luca Ori, Elisa della Casa, Isotta Guidotti, Natascia Bertoncelli, and Laura Lucaccioni	
121 Neonatal Electroencephalography	2081
Lena K. Hellström-Westas	
122 Neuroimaging Studies	2091
Luca A. Ramenghi and Petra S. Hüppi	
123 Malformations of Cortical Development in Newborns: Genetic Aspects	2113
Renzo Guerrini and Elena Parrini	
124 Congenital Malformations of the Brain: Spectrum and Causes	2125
Elie Saliba	
125 Biochemical Basis of Hypoxic-Ischemic Encephalopathy ...	2143
Maria Delivoria-Papadopoulos, Panagiotis Kratimenos, and Endla K. Anday	
126 Clinical Aspects and Treatment of the Hypoxic-Ischemic Syndrome	2165
Floris Groenendaal and Frank van Bel	
127 Neuroprotective Strategies for Newborns	2185
Bobbi Fleiss, Claire Thornton, and Pierre Gressens	
128 Cerebral Hemorrhage in Newborns	2201
Linda S. de Vries and Axel Heep	
129 Neonatal Stroke: Mechanisms	2225
Paul P. Govaert and Jeroen Dudink	
130 Neonatal Stroke: Clinical Presentation, Imaging, Treatment, and Prognosis	2251
Paul P. Govaert and Jeroen Dudink	

131 Neonatal Seizures	2287
Lena K. Hellström-Westas and Malcolm Levene	
132 The Timing of Neonatal Brain Damage	2295
Serafina Perrone and Giuseppe Buonocore	
133 Epidemiology of Adverse Cerebral Outcome of Newborns	2315
Neil Marlow	
134 Neuromuscular Disorders in Newborns	2323
Salvatore Grosso and Silvia Ferranti	
Part XIII Ophthalmology, Orthopedics, and Skin Diseases ...	2337
135 Ocular Malformations	2339
Elena Piozzi and Alessandra Del Longo	
136 Retinopathy of Prematurity	2349
José Carlos Rivera, Elsa Duchemin-Kermorvant, Allison Dorfman, Tianwei Ellen Zhou, Luis H. Ospina, and Sylvain Chemtob	
137 Neonatal Orthopedic Surgery	2387
Peter D. Pizzutillo and Martin J. Herman	
138 Neonatal Skin Disorders	2391
Michele Fimiani, Roberta Bilenchi, Filomena Mandato, Stefania Mei, Niccolò Nami, Rosa Maria Strangi, and Arianna Lamberti	
Part XIV Appendices	2427
139 Laboratory Medicine: Reference Values and Evidence-Based Medicine	2429
Mariangela Longini, Fabrizio Proietti, Francesco Bazzini, and Elisa Belvisi	
140 Laboratory Medicine: Reference Intervals for Laboratory Tests and Procedures	2433
Mariangela Longini, Fabrizio Proietti, Francesco Bazzini, and Elisa Belvisi	
Index	2459

About the Editors



Giuseppe Buonocore is an Italian pediatrician, who is internationally recognized for his research on neonatal diseases, oxidative stress, and early identification of the newborn at high risk of brain damage. He is a full Professor of Pediatrics, Department of Molecular and Developmental Medicine, University of Siena, Italy, and Director of the Division of Pediatric-Neonatology, Azienda Ospedaliera-Universitaria of Siena, Italy. He is Chairman of Pediatrics at the School of Specialization in Pediatrics and Neonatology, University of Siena, Italy.

He is the President and Coordinator of European scientific network EUROpe Against Infant Brain Injury (EURAIBI). He has been a Visiting Professor at the University of Pennsylvania, the University of Florida, the University Hospitals of New York, as well as at the University of Oulu, Finland, at Taipei Medical University, and at Chang Gung Memorial Hospital at Linkou, Taiwan.

He is also the past President of ESPR and UENPS and currently President of the National College of University Full Professors of Pediatrics. He is involved in the coordination of numerous pan-European clinical trials as well as American and Australian. He has received many scientific awards: including the Seventh annual Dr. Donald V Eitzman lectures “Iron homeostasis metabolism and toxicity,” University of Florida (2000), and the “Goccia d’oro 2010” for the efforts and results in the scientific research in the field of

Prenatal, Perinatal, and Neonatal Brain Damage. He also holds the patent of a scientific invention: the “Machine for automatic assessment of pain in neonates.”

Dr. Buonocore has supervised more than 200 M.D./Ph.D. students (1994/2018) in Medicine and Surgery, Pediatrics, and Diagnostic Biochemistry. His current research interests are in the mechanisms of cell damage in the neonatal brain, with special reference to hypoxia, and the role of oxidant radicals in neonatal diseases and in babies with birth asphyxia. Additional research interest fields are ethics in perinatology and fetal and neonatal pain prevention. His research team is funded by several agencies including the Italian Ministry of University and Scientific Research as well as the European Community. Prof. Buonocore is author of more than 900 publications: 3 books and 27 book chapters, 300 peer-reviewed articles, and more than 617 presentations at international conferences and national meetings. He is currently Editor-in-Chief of *Current Pediatric Reviews*, Associate Editor of *Journal of Pineal Research*, and on the editorial board of several international scientific journals. He has organized more than 20 European conferences and has been the scientific coordinator or participant in several national and international clinical trials.



Rodolfo Bracci was born in Siena (Italy) in 1931. After graduating in Medicine and Surgery from the University of Siena Medical School in 1955, he became Assistant Professor of Pediatrics in the University of Siena. He was Post doctoral Trainee at the Albert Einstein College of Medicine, New York (1964–1965). At that time, working under the direction of Professor Ruth Gross, he made the first experiences on the antioxidant properties of the red cells of newborn. After his return to Italy, he became Assistant Professor of Pediatrics at the University of Florence and later at the University of Siena. He continued to be involved in the field of oxygen toxicity of the erythrocyte of newborn, and in 1967, he demonstrated that the red cells of newborn may have not only a low protection against reacting oxygen species but also an increased production of them.

Professor of Neonatology of the University of Siena and Director of the Neonatal Intensive Care Unit of the Siena Hospital, he was leading a staff of researchers involved in the physiopathology of the neonate, particularly in the calcium homeostasis, in the opioids metabolism, and especially in the

problems of oxygen toxicity in the red cells as well as in various organs. More than a hundred papers were published in important international journals by the doctors working under the guidance of Rodolfo Bracci. He was invited speaker in many international congresses and seminars in various cities in Europe and in America.

He has been member of the European Society of Pediatric Hematology and Immunology, the European Society for Pediatric Research, the European Society for Perinatal Medicine, the Neonatal Intensive Care Collegium, the Italian Society of Pediatrics, and the Italian Society of Neonatology.

Retired from University of Siena in 2001, he continued to publish papers, mainly together with Professor G. Buonocore.

Michael Weindling is Emeritus Professor of Perinatal Medicine at the University of Liverpool and Honorary Consultant Neonatologist at Liverpool Women's Hospital, where he was responsible for the care of newborn babies in a tertiary neonatal intensive care unit until he retired from clinical work in 2013. He is an Associate Editor of *Acta Paediatrica*. He continues with his research interest into the maintenance of appropriate brain oxygenation, cerebral hemodynamics, and the prevention of acquired damage of the developing brain.

He studied medicine at Guy's Hospital in London and qualified in 1973. His training in London included a period at the Great Ormond Street Hospital for Sick Children and then as research fellow at the University of Oxford, where he studied the cerebral hemodynamics of the developing brain. Michael Weindling was appointed a Senior Lecturer and consultant in Liverpool in 1985. During his early years as a consultant, he undertook a master's degree in medical ethics at the University of Keele with a dissertation into the changing moral status of the developing human from conceptus to neonate. He was promoted to Professor in 1996 with a personal chair entitled Professor of Perinatal Medicine, a title chosen to reflect his interest into the rapidly changing requirements of the developing brain. He has a considerable interest in medical education and for several years was Head of the School of Paediatrics in Merseyside.

Contributors

Steven H. Abman University of Colorado Denver – Anschutz Medical Campus, Denver, CO, USA

Massimo Agosti Neonatology and NICU – Maternal and Child Department, Ospedale "F del Ponte", Varese, Italy

Rocco Agostino Ethics Committee, Pediatric Hospital Bambino Gesù, Rome, Italy

Carlo Agostoni Pediatric Clinic, Department of Clinical Sciences and Community Health, University of Milan Fondazione, IRCCS Ca Granda, Ospedale Maggiore Policlinico, Milano, Italy

Munir Ahmed Division of Asthma, Allergy and Lung Biology, MRC Centre for Allergic Mechanisms of Asthma, King's College London, London, UK

Uma Sankari Ali Nephrology Division and PICU, BJ Wadia Hospital for Children, Mumbai, India

Karel Allegaert Neonatal Intensive Care Unit, University Hospitals Leuven, Leuven, Belgium

Department of Development and Regeneration, KU Leuven, Leuven, Belgium
Intensive Care and Department of Pediatric Surgery, Erasmus MC – Sophia Children's Hospital, Rotterdam, The Netherlands

Ruben E. Alvaro Department of Pediatrics, WR004 Women's Hospital, University of Manitoba, Winnipeg, MB, Canada

Gina Ancora Neonatology and Neonatal Intensive Care Unit, Ospedale Infermi, Rimini, Italy

Endla K. Anday Department of Pediatrics, Drexel University College of Medicine, St. Christopher's Hospital for Children, Neonatal-Perinatal Medicine, Philadelphia, PA, USA

Generoso Andria Department of Translational Medicine, Section of Pediatrics, Federico II University of Naples, Naples, Italy

Rajesh K. Aneja Departments of Critical Care Medicine and Pediatrics, University of Pittsburgh School of Medicine, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA

Ruby V. Aneja Division of Neonatology, Temple University, West Penn Hospital, Pittsburgh, PA, USA

Molinari Angelo Claudio Thrombosis and Hemostasis Unit, Giannina Gaslini Children's Hospital, Genova, Italy

Rossella Angotti Department of Pediatrics, Obstetrics and Reproductive Medicine, Section of Pediatric Surgery, University of Siena, Siena, Italy

Carmelo Arcidiacono Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Domenico Arduini Department of Obstetrics and Gynecology, University of Rome Tor Vergata, Rome, Italy

Roberto Aufferi Division of Neonatology and Neonatal Intensive Care, Casilino General Hospital, Rome, Italy

Franco Bagnoli Department of Pediatrics, Obstetrics and Reproductive Medicine, University of Siena, Siena, Italy

Milica Bajcetic Institute of Pharmacology, Clinical Pharmacology and Toxicology, Medical Faculty, University of Belgrade, Belgrade, Serbia
Clinical Pharmacology Unit, University Children's Hospital, Belgrade, Serbia

Sarah Bajorek Department of Pediatrics, Division of Neonatology, University of Florida, College of Medicine, Gainesville, FL, USA

Antonio Balsamo Department of Medical and Surgical Sciences, Pediatric Unit, Center for Rare Endocrine Diseases (CARENDO BO), S.Orsola Malpighi University Hospital, Bologna, Italy

Jane E. Barthell Children's Hospitals and Clinics of Minnesota, Minneapolis, MN, USA

Francesco Bazzini Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Roberto Bellù NICU, Ospedale Manzoni, Lecco, Italy

Franca Fossati-Bellani Pediatric Oncology Department, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy

Carlo V. Bellieni Neonatal Intensive Care Unit, Siena University Hospital, Siena, Italy

Simonetta Bellone Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Elisa Belvisi Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Britney Benoit School of Nursing, Centre for Pediatric Pain Research, Maternal-Newborn Program, Dalhousie University, IWK Health Centre, Halifax, Canada

Silvano Bertelloni Adolescent Medicine Unit, Division of Pediatrics, S. Chiara Hospital, University of Pisa, Pisa, Italy

Giovanna Bertini Neonatal Intensive Care Unit, Careggi University Hospital, Florence, Italy

Enrico Bertino Neonatal Unit, University of Turin, Turin, Italy

Natascia Bertoncetti Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Giulio Bevilacqua Department of Pediatrics and Neonatology, Eastern Liguria Hospital, La Spezia, Italy

Stefania Bezzio Department of Pediatrics, University of Turin, Turin, Italy

Vineet Bhandari Neonatology/Pediatrics, St. Christopher's Hospital for Children/Drexel University College of Medicine, Philadelphia, PA, USA
Drexel University, Philadelphia, PA, USA

Paolo Biban Azienda Ospedaliera Universitaria Integrata Verona, Verona, Italy

Roberta Bilenchi Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Caterina Bocchi Obstetrics and Gynecology, Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Antonio Boldrini Department of Clinical and Experimental Medicine, Division of Neonatology and Neonatal Intensive Care Unit, Santa Chiara University Hospital, Pisa, Italy

Maria Elena Bolis Neonatology and NICU – Maternal and Child Department, Ospedale "F del Ponte", Varese, Italy

Gianni Bona Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Rachele Bonfiglio Department of Anesthesia, Pediatric and Neonatal Intensive Care, Istituto Giannina Gaslini, Genoa, Italy

Alessandro Borghesi Neonatal Intensive Care Unit, Fondazione IRCCS Policlinico 'San Matteo', Pavia, Italy

Giulio Bosco Sapienza Università di Roma, Policlinico Umberto I di Roma, Rome, Italy

Farid Boubred Division of Neonatology, La Conception Hospital, Marseille, France

Rodolfo Bracci University of Siena, Siena, Italy

Nicola Brunetti-Pierri Department of Translational Medicine, Section of Pediatrics, Federico II University of Naples, Naples, Italy

Jenny Bua Division of Neonatology, Institute for Maternal and Child Health IRCCS ‘Burlo Garofolo’, Trieste, Italy

Wilma Buffolano Heading Coordinating Centre for Perinatal Infection-Campania Region, Translational Medicine Department, Federico II Medical School, Naples, Italy

Giuseppe Buonocore University of Siena, Siena, Italy

Marsha Campbell-Yeo Departments of Pediatrics, Psychology and Neuroscience, Dalhousie University School of Nursing, Halifax, Canada

Letizia Capasso Division of Neonatology, Department of Translational Medical Sciences, Università “Federico II” di Napoli, Naples, Italy

Joseph A. Carcillo Departments of Critical Care Medicine and Pediatrics, University of Pittsburgh School of Medicine, Children’s Hospital of Pittsburgh, Pittsburgh, PA, USA

Mario Carminati Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Virgilio P. Carnielli Division of Neonatology, Salesi Hospital, Polytechnic University of Marche, Ancona, Italy

Elisa della Casa Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Alessandra Cassio Department of Medical and Surgical Sciences, Pediatric Endocrinology Unit, S. Orsola-Malpighi University Hospital, Bologna, Italy

Serena Catania Pediatric Oncology Department, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy

Paolo Cavarzere Pediatric Unit, Department of Mother and Child, University Hospital of Verona, Verona, Italy

Sylvain Chemtob Departments of Pediatrics, Ophthalmology and Pharmacology, Centre Hospitalier, Universitaire Sainte-Justine, Research Center, Montréal, QC, Canada

Department of Ophthalmology, Maisonneuve-Rosemont Hospital Research Center, Montréal, QC, Canada

Stefano Chiaravalli Pediatric Oncology Department, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy

Gaetano Chirico Neonatology and Intensive Neonatal Therapy Unit, Spedali Civili of Brescia, Brescia, Italy

Robert D. Christensen Divisions of Neonatology and Hematology, Department of Pediatrics, University of Utah School of Medicine, Intermountain Healthcare, Salt Lake City, UT, USA

Massimiliano Ciantelli Department of Clinical and Experimental Medicine, Division of Neonatology and Neonatal Intensive Care Unit, S. Chiara University Hospital, Pisa, Italy
Azienda Ospedaliero-Universitaria Pisana, Pisa, Italy

Elena Ciarmoli Neonatologia e Terapia Intensiva Neonatale, Fondazione MBBM, ASST-Ospedale San Gerardo-Monza, Monza, Italy

Alessandro Cicognani Department of Medical and Surgical Sciences, Pediatric Unit, Center for Rare Endocrine Diseases (CARENDO BO), S.Orsola Malpighi University Hospital, Bologna, Italy

Giovanni Cioni IRCCS Stella Maris, Department of Developmental Neuroscience, Pisa, Italy
University of Pisa, Department of Clinical and Experimental Neuroscience, Pisa, Italy

Olivier Claris Department of Neonatology, Hôpital Femme Mère Enfant, Bron, France
Hopices Civils de Lyon and Université Claude Bernard, Lyon, France

Paola E. Cogo Division of Pediatrics, Department of Medicine, S. Maria della Misericordia University Hospital, University of Udine, Udine, Italy

Richard J. Cooke Department of Pediatrics, University of Tennessee Health Science Center, Memphis, TN, USA

Giovanni Corsello Department of Sciences for Health Promotion and Mother and Child Care, University of Palermo, Palermo, Italy

Alessandra Coscia Neonatal Unit, University of Turin, Turin, Italy

Frans J. C. Cuperus Department of Gastroenterology and Hepatology, University Medical Center Groningen, Groningen, The Netherlands

Tore Curstedt Department of Molecular Medicine and Surgery, Karolinska Institutet, Karolinska University Hospital, Stockholm, Sweden

Mario De Curtis Dipartimento Materno-Infantile, Università “La Sapienza”, Rome, Italy

Carlo Dani Neonatal Intensive Care Unit, Careggi University Hospital, Florence, Italy
Università degli Studi di Firenze, Florence, Italy

Riccardo Davanzo Department of Mother and Child Health, Madonna delle Grazie Hospital, Matera, Italy

Franco D'Alberton Department of Medical and Surgical Sciences, Pediatric Unit, Center for Rare Endocrine Diseases (CARENDO BO), S.Orsola Malpighi University Hospital, Bologna, Italy

Andrea De Luca Department of Medical Biotechnologies, University of Siena, Siena, Italy

UOC Malattie Infettive Universitarie, Azienda Ospedaliera Universitaria Senese, Siena, Italy

Linda S. de Vries Department of Neonatology, Wilhelmina Children's Hospital, University Medical Center, Utrecht, The Netherlands

Antonio Del Vecchio Department of Women's and Children's Health, Neonatal Intensive Care Unit, Di Venere Hospital, ASL Bari, Bari, Italy

Maria Delivoria-Papadopoulos Department of Pediatrics, Drexel University College of Medicine, St. Christopher's Hospital for Children, Neonatal-Perinatal Medicine, Philadelphia, PA, USA

Marco Della Monaca Sapienza Università di Roma, Policlinico Umberto I di Roma, Rome, Italy

Paola Di Nicola Neonatal Unit, University of Turin, Turin, Italy

Petr H. Dijk Beatrix Children's Hospital, University Medical Center Groningen, Groningen, The Netherlands

Carmelita D'Ippolito Pediatric Oncohematology and Bone Marrow Transplant, Spedali Civili Hospital, Brescia, Italy

Timothy Disher Centre for Pediatric Pain Research, Dalhousie University School of Nursing and IWK Health Centre, Halifax, Canada

Nicola Disma Department of Anesthesia, Pediatric and Neonatal Intensive Care, Istituto Giannina Gaslini, Genoa, Italy

Marcello Dòmini U.O. di Chirurgia pediatrica – Ospedale S.Orsola, Università degli Studi – Alma Mater Studiorum, di Bologna, Italy

Allison Dorfman Department of Ophthalmology/Neurology, McGill University-Montreal Children's Hospital Research Institute, Montreal, QC, Canada

Elsa Duchemin-Kermorvant INSERM UMRS1138, Centre de Recherche des Cordeliers, Paris, France

Jennifer M. Duchon Division of Neonatology, St. Joseph's Regional Medical Center, Paterson, NJ, USA

Jeroen Dudink Neonatology, Sophia Children's Hospital, Erasmus MC Rotterdam, Rotterdam, Zuid-Holland, The Netherlands

Claudio Fabris Neonatal Unit, University of Turin, Turin, Italy

Maria Teresa Fadda Sapienza Università di Roma, Policlinico Umberto I di Roma, Rome, Italy

Avroy A. Fanaroff Case Western Reserve University School of Medicine Rainbow Babies and Children's Hospital, Cleveland, OH, USA

Jonathan M. Fanaroff Case Western Reserve University School of Medicine Rainbow Babies and Children's Hospital, Cleveland, OH, USA

Vassilios Fanos Department of Surgery, Neonatal Intensive Care Unit, Neonatal Pathology and Neonatal Section, AOU and University of Cagliari, Cagliari, Italy

Maria Grazia Faticato Department of Pediatric Surgery, University of Genoa, Genoa, Italy

Giannina Gaslini Institute, Genoa, Italy

Silvia Ferranti Department of Molecular Medicine and Development, University of Siena, Siena, Italy,

Fabrizio Ferrari Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University of Modena and Reggio Emilia, Modena, Italy

Enrico Ferrazzi Prenatal Diagnosis and Fetal Surgery Unit, Dept. of Woman, Mother and Neonate, Buzzi Children's Hospital Department of Clinical Sciences, University of Milan, Milan, Italy

Michele Fimiani Dipartimento di Medicina Clinica e Scienze Immunologiche – Sezione di Dermatologia, Università degli Studi di Siena, Policlinico “Santa Maria alle Scotte”, Siena, Italy

Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Vittorio Fineschi Department of Anatomical, Histological, Forensic Medicine and Orthopaedic Sciences, “Sapienza” University of Rome, Rome, Italy

Bobbi Fleiss UMR1141, Insem-Paris Diderot University, Hôpital Robert Debré, Paris, France

Centre for the Developing Brain, Department of Perinatal Imaging and Health, Division of Imaging Sciences and Biomedical Engineering, King's College London, King's Health Partners, St. Thomas' Hospital, London, UK

Monica Fumagalli NICU, Department of Clinical Sciences and Community Health, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico Milano, Università degli Studi di Milano, Milan, Italy

Clara Gabiano Department of Pediatrics, University of Turin, Turin, Italy

Silvia Garazzino Department of Pediatrics, University of Turin, Regina Margherita Childrens Hospital, AOU Città della Salute e della Scienza di Torino, Turin, Italy

Elisabetta Garetti Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University of Modena and Reggio Emilia, Modena, Italy

Alfredo Garzi Department of Pediatrics, Obstetrics and Reproductive Medicine, Section of Pediatric Surgery, University of Siena, Siena, Italy

Università degli Studi di Salerno, Fisciano, Italy

Diego Gazzolo Neonatal Intensive Care Unit, Department of Maternal, Fetal and Neonatal Medicine, S. Arrigo Children's Hospital, Alessandria, Italy

Giulia Genoni Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Maurizio Gente Department of Pediatrics and Infant Neuropsychiatry, Neonatal Emergency Transport Service, Sapienza University of Rome, Rome, Italy

Michael K. Georgieff Division of Neonatology, Department of Pediatrics Center for Neurobehavioral Development, University of Minnesota, Minneapolis, MN, USA

Paolo Ghirri Department of Clinical and Experimental Medicine, Division of Neonatology and Neonatal Intensive Care Unit, Santa Chiara University Hospital, Pisa, Italy

Daniela Gianotti Department of Pediatrics and Neonatology, Eastern Liguria Hospital, La Spezia, Italy

Jason Gien University of Colorado Denver, Denver, CO, USA

Enza Giglione Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Mario Giuffrè Department of Sciences for Health Promotion and Mother and Child Care, University of Palermo, Palermo, Italy

Francesca Giuliani Neonatal Unit, University of Turin, Turin, Italy

Kirsten Glaser University Children's Hospital, University of Würzburg, Würzburg, Germany

Peter D. Gluckman Liggins Institute, University of Auckland, Auckland, New Zealand

Sergio Golombek New York Medical College, New York, USA

Misty Good Division of Neonatology, University of Pittsburgh School of Medicine, Children's Hospital of Pittsburgh, Pittsburgh, PA, USA

Glenn R. Gourley Department of Pediatrics, University of Minnesota, Minneapolis, USA

Paul P. Govaert Neonatology, Sophia Children's Hospital, Erasmus MC Rotterdam, Rotterdam, Zuid-Holland, The Netherlands

Anne Greenough Division of Asthma, Allergy and Lung Biology, MRC Centre for Allergic Mechanisms of Asthma, King's College London, London, UK

NIHR Biomedical Centre at Guy's and St Thomas NHS Foundation Trust and King's College London, London, UK

NICU, King's College Hospital, London, UK

Pierre Gressens UMR1141, Insem-Paris Diderot University, Hôpital Robert Debré, Paris, France

Centre for the Developing Brain, Department of Perinatal Imaging and Health, Division of Imaging Sciences and Biomedical Engineering, King's College London, King's Health Partners, St. Thomas' Hospital, London, UK

Floris Groenendaal Department of Neonatology, Wilhelmina Children's Hospital, University Medical Center Utrecht, Utrecht, The Netherlands

Salvatore Grosso Department of Molecular Medicine and Development, University of Siena, Siena, Italy,

Renzo Guerrini Pediatric Neurology and Neurogenetics Unit and Laboratories, Neuroscience Department, A. Meyer Children's Hospital – University of Florence, Florence, Italy

Isotta Guidotti Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Jean-Pierre Guignard Lausanne University Medical School, Lausanne, Switzerland

Andrea Guzzetta IRCCS Stella Maris, Department of Developmental Neuroscience, Pisa, Italy

University of Pisa, Department of Clinical and Experimental Neuroscience, Pisa, Italy

Henrik Hagberg Perinatal Center, Department of Obstetrics and Gynecology, Sahlgrenska Academy, University of Gothenburg, Goteborg, Sweden

Centre for the Developing Brain, Division of Imaging Sciences and Biomedical Engineering, King's College London, King's Health Partners, St. Thomas' Hospital, London, UK

Nigel J. Hall University Surgery Unit, Faculty of Medicine, University of Southampton, Southampton, UK

Henry L. Halliday Formerly Regional Neonatal Unit, Royal Maternity Hospital, Belfast, UK

Formerly Department of Child Health, Queen's University Belfast, Belfast, UK

Mikko Hallman Department of Children and Adolescents, Oulu University Hospital, and PEDEGO Research Unit, Medical Research Center Oulu, University of Oulu, Oulu, Finland

Dominique Haumont Department of Neonatology, Saint – Pierre University Hospital, Brussels, Belgium

Axel Heep Department of Neonatology, Southmead Hospital, North Bristol NHS Trust, Bristol, UK

Lena K. Hellström-Westas Department of Women’s and Children’s Health, Uppsala University and University Hospital, Uppsala, Sweden

Martin J. Herman Department of Orthopaedic Surgery, Drexel University College of Medicine, St. Christopher’s Hospital for Children, Philadelphia, PA, USA

Christian V. Hulzebos Beatrix Children’s Hospital, University Medical Center Groningen, Groningen, The Netherlands

Petra S. Hüppi Division of Neonatology, Giannina Gaslini Children’s Hospital, Genoa, Italy

Giorgio Iannetti Università degli Studi di Siena, Policlinico S. Maria alle Scotte, Siena, Italy

Sapienza Università di Roma, Policlinico Umberto I di Roma, Rome, Italy

Vincenzo Jasonni Department of Pediatric Surgery, University of Genoa, Genoa, Italy

Giannina Gaslini Institute, Genoa, Italy

Kathryn Johnson Centre for Newborn Care, Leeds Teaching Hospitals Trust, Leeds, UK

Celeste Johnston School of Nursing, McGill University, Montreal, Canada

Michael Kaplan Department of Neonatology, Shaare Zedek Medical Center, Jerusalem, Israel

The Faculty of Medicine, Hebrew University, Jerusalem, Israel,

Nandini Kataria Department of Pediatrics, University of Minnesota, Long Beach, California, USA

Tuula Kaukola Department of Children and Adolescents, Oulu University Hospital, and PEDEGO Research Center, MRC Oulu, University of Oulu, Oulu, Finland

Hirokazu Kimura Infectious Diseases Surveillance Center, National Institute of Infectious Diseases, Tokyo, Japan

John P. Kinsella University of Denver, Denver, CO, USA

Panagiotis Kratimenos Neonatologist, Children’s National Medical Center, Center for Research in Neuroscience, George Washington University School of Medicine and Health Sciences, Washington, DC, USA

Edmund F. La Gamma Division of Newborn Medicine, Maria Fareri Children's Hospital, Westchester Medical Center – New York Medical College, Valhalla, NY, USA

Arianna Lamberti Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Mariano Lanna Prenatal Diagnosis and Fetal Surgery Unit, Dept. of Woman, Mother and Neonate, Buzzi Children's Hospital Department of Clinical Sciences, University of Milan, Milan, Italy

Malcolm Levene Academic Unit of Paediatrics and Child Health, University of Leeds, Leeds, UK

Department of Neonatal Medicine, Leeds Teaching Hospitals Trust, Leeds, UK

Isabelle Ligi Division of Neonatology, La Conception Hospital, Marseille, France

Otwin Linderkamp Division of Neonatology, Department of Pediatrics, University of Heidelberg, Heidelberg, Germany

Gianluca Lista Neonatology and Neonatal Intensive Care Unit, Ospedale dei Bambini V. Buzzi, Milan, Italy

Mariangela Longini Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Alessandra Del Longo Department of Pediatric Ophthalmology, Niguarda Ca' Granda Hospital, Milan, Italy

Vassilios Lougaris Pediatrics Clinic, Department of Clinical and Experimental Sciences, University of Brescia and Spedali Civili of Brescia, Brescia, Italy

Felicia M. Low Liggins Institute, University of Auckland, Auckland, New Zealand

Laura Lucaccioni Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Licia Lugli Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Giuseppe Maggiore Department of Medical Sciences-Pediatrics, University of Ferrara, University Hospital Arcispedale Sant Anna di Cona, CONA (Ferrara), Italy

Francesca Maglietta Department of Legal Medicine, University of Foggia, Foggia, Italy

Akhil Maheshwari Division of Neonatology, University of South Florida, Tampa, FL, USA

Liam Mahoney Academic Department of Paediatrics, Royal Alexandra Children's Hospital, Brighton, UK

M. Jeffrey Maisels Department of Pediatrics, Oakland University William Beaumont School of Medicine, Beaumont Children's Hospital, Royal Oak, MI, USA

Carina Mallard Department of Physiology, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

Leila Mameli Department of Anesthesia, Pediatric and Neonatal Intensive Care, Istituto Giannina Gaslini, Genoa, Italy

Filomena Mandato Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Paolo Manzoni Division of Neonatology, Department of Obstetrics and Neonatology, AOU Città della Salute e della Scienza, Turin, Italy

Viviana Marchi IRCCS Stella Maris, Department of Developmental Neuroscience, Pisa, Italy

University of Pisa, Department of Clinical and Experimental Neuroscience, Pisa, Italy

Neil Marlow Institute for Women's Health, University College London, London, UK

Richard J. Martin Rainbow Babies and Children's Hospital, Division of Neonatology, Case Western Reserve University School of Medicine, Cleveland, OH, USA

Maura Massimo Pediatric Oncology Department, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy

Girolamo Mattioli Department of Pediatric Surgery, University of Genoa, Genoa, Italy

Giannina Gaslini Institute, Genoa, Italy

Liz McKechnie Centre for Newborn Care, Leeds Teaching Hospitals Trust, Leeds, UK

Stefania Mei Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Mario Messina Department of Pediatrics, Obstetrics and Reproductive Medicine, Section of Pediatric Surgery, Policlinico "Le Scotte", University of Siena, Siena, Italy

Department of Medical, Surgical and Neurological Sciences, Section of Pediatric Surgery, University of Siena, Siena, Italy

Angelo Micheletti Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Fiorella Migliaro Division of Neonatology, Department of Translational Medical Sciences, Università "Federico II" di Napoli, Naples, Italy

Federica Mignone Department of Pediatrics, University of Turin, Regina Margherita Childrens Hospital, AOU Città della Salute e della Scienza di Torino, Turin, Italy

Francesco Molinaro Department of Pediatrics, Obstetrics and Reproductive Medicine, Section of Pediatric Surgery, Policlinico “Le Scotte”, University of Siena, Siena, Italy

Department of Medical, Surgical and Neurological Sciences, Section of Pediatric Surgery, University of Siena, Siena, Italy

Davide Montin Division of Neonatology, Department of Obstetrics and Neonatology, AOU Città della Salute e della Scienza, Turin, Italy

Department of Pediatrics, University of Turin, Turin, Italy

Alice Monzani Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Corrado Moretti Università degli Studi di Roma “La Sapienza”, Rome, Italy

Colin Morley Dept Obstetrics and Gynecology, University of Cambridge at Rosie Maternity Hospital, Cambridge, UK

Fabio A. Mosca NICU, Department of Clinical Sciences and Community Health, Fondazione IRCCS Ca’ Granda Ospedale Maggiore Policlinico Milano, Università degli Studi di Milano, Milan, Italy

Michele Mussap Laboratory Medicine, Ospedale Policlinico San Martino, Genoa, Italy

Niccolò Nami Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Diana Negura Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Josef Neu Department of Pediatrics, Division of Neonatology, University of Florida, College of Medicine, Gainesville, FL, USA

Giovanni Nigro Maternal-Infant Department, University of L’Aquila, L’Aquila, Italy

Akira Nishida Department of Neonatology, Tokyo Metropolitan Children’s Medical Center, Tokyo, Japan

Giovanna Oggè Maternal-Fetal Medicine Unit, University of Turin, Turin, Italy

Robin K. Ohls Department of Pediatrics, Division of Neonatology, University of New Mexico, Albuquerque, NM, USA

Kaoru Okazaki Department of Neonatology, Tokyo Metropolitan Children’s Medical Center, Tokyo, Japan

Luca Ori Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University Hospital of Modena, Modena, Italy

Luis H. Ospina Departments of Pediatrics, Ophthalmology and Pharmacology, Centre Hospitalier, Universitaire Sainte-Justine, Research Center, Montréal, QC, Canada

Erin A. Osterholm Division of Neonatology, Department of Pediatrics Center for Neurobehavioral Development, University of Minnesota, Minneapolis, MN, USA

Roberto Paludetto Translational Medical Sciences, Università “Federico II” di Napoli, Naples, Italy

Niovi Papalexopoulou Division of Asthma, Allergy and Lung Biology, MRC Centre for Allergic Mechanisms of Asthma, King’s College London, London, UK

Paola Papoff Pediatric Intensive Care Unit, Sapienza University of Rome, Rome, Italy

Giancarlo Parenti Department of Translational Medicine, Section of Pediatrics, Federico II University of Naples, Naples, Italy

Stefano Parmigiani Department of Pediatrics and Neonatology, Eastern Liguria Hospital, La Spezia, Italy

Elena Parrini Pediatric Neurology and Neurogenetics Unit and Laboratories, Neuroscience Department, A. Meyer Children’s Hospital – University of Florence, Florence, Italy

Gaia Pasquali Department of Obstetrics and Gynecology, University of Rome Tor Vergata, Rome, Italy

Mary Elaine Patrinós Case Western Reserve University School of Medicine, Cleveland, OH, USA

Pierluigi Pedersini National Center for Surgical Treatment of Pediatric Hepatobiliary Malformations, Pediatric Surgery, University of Brescia, Brescia, Italy

Serafina Perrone Department of Molecular and Developmental Medicine, University Hospital of Siena, Siena, Italy

Felice Petraglia Obstetrics and Gynecology, Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Luciane Piazza Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Catherine Pieltain Department of Neonatology, University of Liège, CHR de la Citadelle, Liège, Belgium

Agostino Pierro Division of General and Thoracic Surgery, The Hospital for Sick Children, Toronto, Canada

Alessio Pini Prato Giannina Gaslini Institute, Genoa, Italy

Elena Piozzi Department of Pediatric Ophthalmology, Niguarda Ca' Granda Hospital, Milan, Italy

Peter D. Pizzutillo Section of Orthopaedic Surgery, St. Christopher's Hospital for Children, Philadelphia, PA, USA
Tenet Healthcare, Dallas, TX, USA

Alessandro Plebani Pediatrics Clinic, Department of Clinical and Experimental Sciences, University of Brescia and Spedali Civili of Brescia, Brescia, Italy

Francesca R. Pluchinotta Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Christian F. Poets Department of Neonatology, Tübingen University Hospital, Tübingen, Germany

Simone Pratesi Neonatal Intensive Care Unit, Careggi University Hospital, Florence, Italy

Flavia Prodam Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Fabrizio Proietti Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Marisa Pugliese Neonatal Intensive Care Unit, Department of Medical and Surgical Sciences of the Mother, Children and Adults, University of Modena and Reggio Emilia, Modena, Italy

Guy Putet Department of Neonatology, Hopital de la Croix-Rousse, Hospices Civils de Lyon and Universite Claude Bernard, Lyon, France

Heike Rabe Academic Department of Paediatrics, Royal Alexandra Children's Hospital, Brighton, UK

Francesco Raimondi Division of Neonatology, Department of Translational Medical Sciences, Università "Federico II" di Napoli, Naples, Italy

Luca A. Ramenghi Division of Neonatology, Giannina Gaslini Children's Hospital, Genoa, Italy

Tara M. Randis Department of Pediatrics, New York University School of Medicine, New York, NY, USA

Roberta Ricotti Department of Health Sciences, Division of Pediatrics, University of Piemonte Orientale, Novara, Italy

Henrique Rigatto Department of Pediatrics, WR004 Women's Hospital, University of Manitoba, Winnipeg, MB, Canada

Jacques Rigo Department of Neonatology, University of Liège, CHR de la Citadelle, Liège, Belgium

Arieh Riskin Department of Neonatology, Bnai Zion Medical Center, Rappaport Faculty of Medicine, Technion, Israel Institute of Technology, Haifa, Israel

Francesco Risso Neonatal Intensive Care Unit, Department of Emergency Medicine, G. Gaslini Children's Hospital, Genoa, Italy

Silvia Riva Pediatric Hepatology and Liver Transplant Unit, IRCCS-ISMETT - University of Pittsburgh Medical Center (UPMC), Palermo, Italy

José Carlos Rivera Departments of Pediatrics, Ophthalmology and Pharmacology, Centre Hospitalier, Universitaire Sainte-Justine, Research Center, Montréal, QC, Canada

Department of Ophthalmology, Maisonneuve-Rosemont Hospital Research Center, Montréal, QC, Canada

Rodney P. A. Rivers Section of Paediatrics, Department of Medicine, Imperial College, London, UK

Hector Rojas-Anaya Academic Department of Paediatrics, Royal Alexandra Children's Hospital, Brighton, UK

Maria Angela Rustico Prenatal Diagnosis and Fetal Surgery Unit, Dept. of Woman, Mother and Neonate, Buzzi Children's Hospital Department of Clinical Sciences, University of Milan, Milan, Italy

Karin Sävman Department of Pediatrics, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

Timo Saarela Department of Children and Adolescents, Oulu University Hospital, Oulu, Finland

Elie Saliba Department of Neonatology and Pediatric Intensive Care, Université François Rabelais and CHRU de Tours, Tours, France
Inserm U930, France, Université François Rabelais and CHRU de Tours, Tours, France

Janko Samardzic Department of Paediatric Pharmacology, University Children's Hospital Basel, Basel, Switzerland
Institute of Pharmacology, Clinical Pharmacology and Toxicology, Medical Faculty, University of Belgrade, Belgrade, Serbia

Fabrizio Sandri Neonatology and Neonatal Intensive Care Unit, Ospedale Maggiore, Bologna, Italy

Andrea Sannia Neonatal Intensive Care Unit, Department of Emergency Medicine, G. Gaslini Children's Hospital, Genoa, Italy

Javier Fernandez Sarabia Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Paola Saracco Pediatric Hematology, Department of Pediatrics, University Hospital Città della Salute e della Scienza, Torino, Italy

Antonio Saracino Department of Pediatric Cardiology, IRCCS Policlinico San Donato, San Siro, Milan, Italy

Ola D. Saugstad Department of Pediatric Research, Rikshospitalet, Oslo University Hospital, University of Oslo, Oslo, Norway

Rosa T. Scaramuzzo Neonatology and Neonatal Intensive Care Unit, Santa Chiara University Hospital, Pisa, Italy

Kurt R. Schibler Perinatal Institute, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

Marco Sciveres Pediatric Hepatology and Liver Transplant Unit, IRCCS-ISMETT - University of Pittsburgh Medical Center (UPMC), Palermo, Italy

Carlo Scolfaro Department of Pediatrics, University of Turin, Regina Margherita Childrens Hospital, AOU Città della Salute e della Scienza di Torino, Turin, Italy

Gunnar Sedin Department of Women's and Children's Health, University Children's Hospital, Uppsala, Sweden

Thibault Senterre Department of Neonatology, University of Liège, CHR de la Citadelle, Liège, Belgium

Filiberto Maria Severi Obstetrics and Gynecology, Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Raanan Shamir Institute of Gastroenterology Nutrition and Liver Diseases, Schneider Children's Medical Center, Sackler Faculty of Medicine, Tel-Aviv University, Petach-Tikva, Israel

Davide Silvagni Azienda Ospedaliera Universitaria Integrata Verona, Verona, Italy

Umberto Simeoni Division of Pediatrics, CHUV and UNIL, Lausanne, Vaud, Switzerland

Adam P. R. Smith Division of Asthma, Allergy and Lung Biology, MRC Centre for Allergic Mechanisms of Asthma, King's College London, London, UK

Augusto Sola Ibero American Society of Neonatology (SIBEN), Wellington, FL, USA

Michael Spear Department of Pediatrics, Drexel University College of Medicine, St. Christopher's Hospital for Children, Philadelphia, PA, USA

Christian P. Speer University Children's Hospital, University of Würzburg, Würzburg, Germany

David K. Stevenson Department of Pediatrics, Stanford University School of Medicine, Medical School Office Building, Stanford, CA, USA

Rosa Maria Strangi Department of Medical, Surgical and Neurological Sciences, Dermatology Section, University of Siena, Siena, Italy

Mauro Stronati Neonatal Intensive Care Unit, Fondazione IRCCS Policlinico ‘San Matteo’, Pavia, Italy

Veena Supramaniam Perinatal Imaging Group, Robert Steiner MR Unit, MRC Clinical Sciences Centre and Wigglesworth Perinatal Pathology Services, Hammersmith Hospital, Imperial College, London, UK

Paolo Tagliabue Neonatologia e Terapia Intensiva Neonatale, Fondazione MBBM, ASST-Ospedale San Gerardo-Monza, Monza, Italy

Sophie Tardieu Medical Evaluation Department, Public Health Department, La Conception Hospital, Marseille, France

Elena Tavella Division of Neonatology, Department of Obstetrics and Neonatology, AOU Città della Salute e della Scienza, Turin, Italy

Claire Thornton Centre for the Developing Brain, Department of Perinatal Imaging and Health, Division of Imaging Sciences and Biomedical Engineering, King’s College London, King’s Health Partners, St. Thomas’ Hospital, London, UK

Claudio Tiribelli Liver Research Centre, University of Trieste, Trieste, Italy

Tullia Todros Maternal-Fetal Medicine Unit, University of Turin, Turin, Italy

Michela Torricelli Obstetrics and Gynecology, Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Pier Angelo Tovo Department of Pediatrics, University of Turin, Regina Margherita Childrens Hospital, AOU Città della Salute e della Scienza di Torino, Turin, Italy

Alberto E. Tozzi Multifactorial and Complex Diseases Research Area, Bambino Gesù Children’s Hospital, Rome, Italy

Laura Travan Division of Neonatology, Institute for Maternal and Child Health IRCCS ‘Burlo Garofolo’, Trieste, Italy

Daniele Trevisanuto Department of Women’s and Children’s Health, Azienda Ospedaliera di Padova, University of Padua, Padua, Italy

Pietro Tuo Department of Anesthesia, Pediatric and Neonatal Intensive Care, Istituto Giannina Gaslini, Genoa, Italy

Emanuela Turillazzi Department of Legal Medicine, University of Foggia, Foggia, Italy

Alberto G. Ugazio Institute of Child and Adolescent Health, Bambino Gesù Children’s Hospital, Rome, Italy

Frank van Bel Department of Neonatology, Wilhelmina Children’s Hospital, University Medical Center Utrecht, Utrecht, The Netherlands

John N. van den Anker Division of Pediatric Clinical Pharmacology, Children's National Health System, Washington, DC, USA

Departments of Pediatrics, Integrative Systems Biology, Pharmacology and Physiology, George Washington University, School of Medicine and Health Sciences, Washington, DC, USA

Intensive Care and Department of Pediatric Surgery, Erasmus MC – Sophia Children's Hospital, Rotterdam, The Netherlands

Johannes B. (Hans) van Goudoever Department of Pediatrics, Emma Children's Hospital – AMC and VU University Medical Center, Amsterdam, The Netherlands

Tim van Mieghem Department of Development and Regeneration, KU Leuven, Leuven, Belgium

Obstetrics and Gynecology, University Hospitals Leuven, Leuven, Belgium

Bart Van Overmeire Neonatology Service, Erasmus Hospital Université Libre de Bruxelles, Brussels, Belgium

Silvia Vannuccini Obstetrics and Gynecology, Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy

Maximo Vento Neonatal Research Unit, Health Research Institute Hospital La Fe, University and Polytechnic Hospital La Fe, Valencia, Spain

Gennaro Vetrano U.O.C. Pediatria/Neonatologia/UTIN, Osp. "Sacro Cuore di Gesù", Benevento, Italy

Renaud Viellevoye Department of Neonatology, University of Liège, CHR de la Citadelle, Liège, Belgium

Betty R. Vohr Department of Pediatrics, The Warren Alpert Medical School of Brown University, Providence, RI, USA

Women and Infants Hospital, Providence, RI, USA

Jon F. Watchko Division of Newborn Medicine, Department of Pediatrics, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Ronald J. Wong Department of Pediatrics, Stanford University School of Medicine, Stanford, CA, USA

Marco Zaffanello Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy

Department of Life and Reproduction Sciences Pediatric Section, University of Verona, Verona, Italy

Department of Surgery, University of Cagliari, Cagliari, Italy

Clelia Zanaboni Department of Anesthesia, Pediatric and Neonatal Intensive Care, Istituto Giannina Gaslini, Genoa, Italy

Giacomo Zanelli Department of Medical Biotechnologies, University of Siena, Siena, Italy

Rinaldo Zanini NICU, Ospedale Manzoni, Lecco, Italy

Tianwei Ellen Zhou Departments of Pediatrics, Ophthalmology and Pharmacology, Centre Hospitalier, Universitaire Sainte-Justine, Research Center, Montréal, QC, Canada

Ekhard E. Ziegler Department of Pediatrics, University of Iowa, Iowa City, IA, USA

Luc J. I. Zimmermann Department of Pediatrics and Neonatology, School for Oncology and Developmental Biology (GROW), Maastricht University Medical Center, Maastricht, The Netherlands