

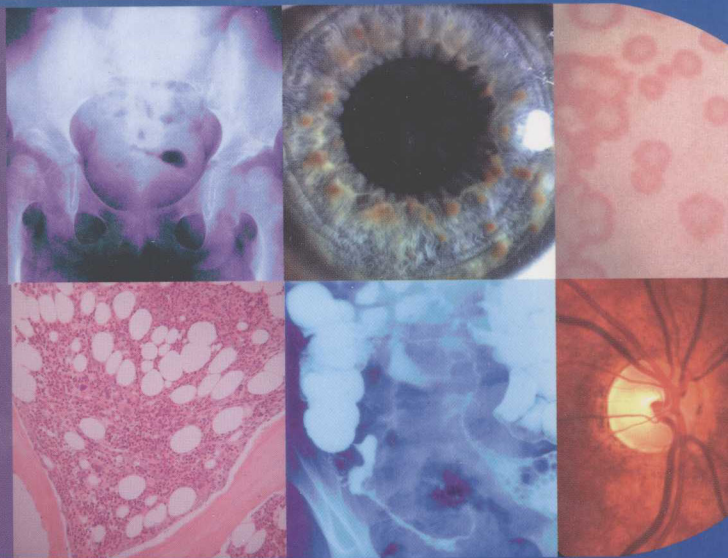
7th
Edition

Forfar & Arneil's

Textbook of Pediatrics

Edited by

Neil McIntosh
Peter Helms
Rosalind Smyth
Stuart Logan



Seventh Edition

Forfar & Arneil's **TEXTBOOK** *of* **PEDIATRICS**

Edited by

Neil McIntosh DSc(Med) FRCP(Edin) FRCP(Lond) FRCPCH

Professor of Child Life and Health, University of Edinburgh;

Honorary Consultant Paediatrician, Lothian University Hospitals NHS Trust, Edinburgh, UK

Peter J. Helms MB BS PhD FRCP(Edin) FRCPCH

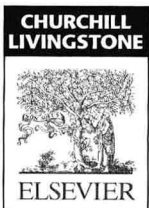
Professor of Child Health, University of Aberdeen, Aberdeen, UK

Rosalind L. Smyth MA MB BS MD FRCPCH F Med Sci

Brough Professor of Paediatric Medicine, University of Liverpool, Liverpool, UK

Stuart Logan MB ChB MSc(Epidemiology) MSc(politics) MRCP FRCPCH

Professor of Paediatric Epidemiology; Director, Institute of Health Research, Peninsula Medical Service School, St Luke's Campus, Exeter, UK



No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or any information storage and retrieval system, without permission in writing from the publishers. Permissions may be sought directly from Elsevier's Rights Department: Phone: (+1) 215 239 3804 (US) or (+44) 1865 843830 (UK); fax: (+44) 1865 853333; e-mail: healthpermissions@elsevier.com. You may also complete your request on-line via the Elsevier website at <http://www.elsevier.com/permissions>.

First edition 1973

Second edition 1978

Third edition 1984

Fourth edition 1992

Fifth edition 1998

Sixth edition 2003

Seventh edition 2008

ISBN 978-0-443-10396-4

IE ISBN 978-0-443-10397-1

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data

A catalog record for this book is available from the Library of Congress

Note

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on their own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Authors assumes any liability for any injury and/or damage to persons or property arising out or related to any use of the material contained in this book.

The Publisher

ELSEVIER your source for books,
journals and multimedia
in the health sciences

www.elsevierhealth.com

Working together to grow
libraries in developing countries

www.elsevier.com | www.bookaid.org | www.sabre.org

ELSEVIER BOOK AID Sabre Foundation
International

The
publisher's
policy is to use
paper manufactured
from sustainable forests

Seventh Edition

Forfar & Arneil's

TEXTBOOK
of **PEDIATRICS**

Preface

One of the most important developments in the 21st century has been the acknowledgment that clinical practice should be embedded where possible in a sound evidence base. The editors of this new edition of *Forfar & Arneil's Textbook of Pediatrics* continue to set contributors the challenging task of ensuring that the statements and recommendations made are based on the most robust clinical research available. The objective assessment of evidence and the formulation of secure recommendations from the evidence are gathering pace. In Child Health the evidence base, with the possible exception of disciplines such as oncology and neonatology, is not as comprehensive or as well defined as we would wish. This edition of *Forfar & Arneil* continues to flag up the most important evidence sources for the content of each chapter. The whole book has been revised and updated and the chapter authors and editors again incorporate where possible secure evidence of therapy, diagnosis, etiology and prognosis. This evidence is incorporated into the individual chapters and in the chapter reference list is starred for easy reference. We believe that the result is the most comprehensive evidence-based general textbook of pediatrics available. Our ability to access best evidence has been greatly enhanced by the rapid advances of information technology and electronic

publishing and consequently another important new feature for this edition is a website of the text in which references listed in PUBMED can be accessed via the internet. We would like to acknowledge the outstanding contributions of the many individual authors and our chapter editors, without whom this ambitious project would not have been possible. It has been a great privilege to work with them. We would also like to thank our own secretaries for their unstinting help (Elaine Forbes, Flora Buthlay, Collette Lorne and Stella Taylor) and of course our respective families for sharing the burden with us.

As with previous editions the book is produced by the Elsevier Organization. There have been many highly professional people involved. We hope that this new 7th edition with its expanded formal evidence base will be well received by you, the reader, and become as trusted a friend and guide as have previous editions.

Neil McIntosh
Peter J. Helms
Rosalind L. Smyth
Stuart Logan

Contributors

Ishaq Abu-Arafeh, MBBS, MD, MRCP, FRCPCH
Consultant in Paediatrics and Paediatric
Neurology, Stirling Royal Infirmary, Stirling;
Honorary Consultant Paediatrician, Fraser of
Allander Neurosciences Unit, Royal Hospital
for Sick Children, Glasgow, UK

N. Archer, MA FRCP FRCPCH DCH
Consultant Paediatric Cardiologist, Oxford
Children's Hospital, Oxford; Honorary
Clinical Senior Lecturer, University of
Oxford, Oxford, UK

Peter D. Arkwright, FRCPCH DPhil
Lecturer in Child Health, Department of
Child Health, University of Manchester,
Manchester, UK

Ian A. Auchterlonie, MB ChB FRCPCH FRCP
Honorary Consultant Paediatrician (Retired),
Royal Aberdeen Children's Hospital,
Aberdeen, UK

Alastair J. Baker, MB ChB FRCP FRCPCH
Consultant Paediatric Hepatologist, King's
College Hospital, London, UK

Susan V. Beath, BSc MB BS MRCP DTM&H FRCPCH
Consultant Paediatric Hepatologist, The
Liver Unit, Birmingham Children's Hospital,
Birmingham, UK

Thomas F. Beattie, MB MSc FRCSed(A&E), FCEM,
FRCPE, FFSEM, DCH
Consultant in Emergency Medicine, Royal
Hospital for Sick Children, Edinburgh;
Honorary Senior Lecturer in Paediatrics,
University of Edinburgh, Edinburgh, UK

Julie-Clare Becher, MB ChB MRCPCH MD
Consultant Neonatologist, Simpson Centre
for Reproductive Health, Royal Infirmary of
Edinburgh, Edinburgh, UK

W. Michael Bisset, BSc MB ChB DCH MSc MD
FRCPE FRCPCH
Consultant Paediatric Gastroenterologist,
Department of Medical Paediatrics, Royal
Aberdeen Children's Hospital, Aberdeen, UK

Peter S. Blair, PhD
Medical Statistician, Senior Research Fellow,
University of Bristol, Division of Child Health,
Royal Hospital for Children, Bristol, UK

Paula H.B. Bolton-Maggs, FRCPCH FRCP FRCPATH
Consultant Haematologist, Manchester
Comprehensive Care Haemophilia Centre,
Department of Clinical Haematology,
Manchester Royal Infirmary, Manchester, UK

Paul L.P. Brand, MD
Consultant Paediatrician and Director of
Postgraduate Education, Princess Amalia
Children's Clinic, Isala klinieken, Zwolle,
The Netherlands

Colin E. Bruce, MB ChB FRCS FRCS(ORTH)
Consultant Paediatric Orthopaedic
Surgeon, Alder Hey Children's Hospital,
Liverpool, UK

Helen Budge, BA BM BCh PhD MRCP FRPCH
Associate Professor of Neonatology,
University of Nottingham, Nottingham,
UK

Neil R.M. Buist, MB ChB FRCPE DCH
Professor Emeritus, Departments of
Paediatrics and Medical Genetics, Oregon
Health and Science University, Portland,
Oregon, USA

Nigel Peter Burrows, MD FRCP
Consultant Dermatologist and Associate
Lecturer, Department of Dermatology,
Addenbrooke's Hospital, Cambridge, UK

Andrew Bush, MD FRCP FRCPCH
Professor of Paediatric Respiriology, Imperial
College, London; Honorary Consultant
Paediatric Chest Physician, Royal Brompton
Hospital, London, UK

Gary Butler, MB BS MD FRCPCH
Professor of Paediatrics, Institute of Health
Sciences, University of Reading and
Department of Paediatrics, Royal Berkshire
Hospital, Reading, UK

Catherine M. Cale, MB ChB PhD MRCP MRCPCH
MRCPATH
Consultant in Paediatric Immunology
and Immunopathology, Department of
Immunology, Great Ormond Street Hospital,
London, UK

Harry Campbell, MD FRCPE FFPH FRSE
Professor of Genetic Epidemiology and
Public Health Sciences, College of Medicine
and Vet Medicine, University of Edinburgh,
Edinburgh, UK

Andrew J. Cant, BSc MD FRCP FRCPH
Consultant in Paediatric Immunology and
Infectious Diseases, Newcastle General
Hospital, Newcastle upon Tyne, UK

Michael Clarke, BSc MRCP DCH FRCPCH
Consultant Paediatric Neurologist, Leeds
Teaching Hospitals NHS Trust, Leeds, UK

Andrew Gavin Cleary, MB ChB BSc MSc MRCPCH
Consultant Paediatric Rheumatologist, Royal
Liverpool Children's Hospital, Liverpool, UK

J. Brian S. Coulter, MD FRCP(I) FRCPCH
Honorary Clinical Lecturer in Tropical
Child Health, Liverpool School of Tropical
Medicine, Liverpool, UK

Jonathan Coutts, MB ChB FRCPCH FRCP(Glas)
Consultant Neonatal and Respiratory
Paediatrician, The Queen Mother's Hospital
and Royal Hospital for Sick Children,
Glasgow, UK

Richard Coward, MB ChB MRCPCH PhD
MRC Clinician Scientist and Consultant
Paediatric Nephrologist, Bristol Royal
Hospital for Children, Bristol, UK

Finella Craig, BSc MBBS MRCP
Consultant in Paediatric Palliative Care,
Great Ormond Street Hospital for Children,
London, UK

Timothy J. David, MB ChB MD PhD FRCP FRCPCH
DCH
Professor of Child Health and Paediatrics,
Honorary Consultant Paediatrician, The
University of Manchester, Manchester, UK

Joyce E. Davidson, BSc MBChB MRCP (UK) FRCPCH
Consultant Paediatric Rheumatologist, Royal
Hospital for Sick Children, Glasgow, and
Royal Hospital for Sick Children,
Edinburgh, UK

E. Graham Davies, MB BChir MA FRCPCH
Consultant Paediatric Immunologist, Great
Ormond Street Hospital, London, UK

Jan Dudley, BM MRCP(UK) FRCPCH PhD
Consultant Paediatric Nephrologist, Bristol
Royal Hospital for Children, Bristol, UK

P. Barton Duell, MD
Associate Professor of Medicine, Division
of Endocrinology, Diabetes, and Clinical
Nutrition; director, Lipid-Atherosclerosis
Laboratory and Metabolic Disorders Clinic,
Oregon Health and Science University,
Portland, Oregon

Heather Elphick, MB ChB MRCP MRCPCH MD
Specialist Registrar in Respiratory
Paediatrics, Sheffield Children's Hospital,
Sheffield, UK

Nicholas D. Embleton, BSc MD FRCPCH
Consultant in Neonatal Medicine and

Honorary Lecturer in Child Health, Newcastle Neonatal Service, Royal Victoria Infirmary, Newcastle upon Tyne, UK

Gregory M. Enns, MB ChB
Associate Professor of Pediatrics, Director, Biochemical Genetics Program, Division of Medical Genetics, Stanford University, Stanford, California, USA

Jeremy Farrar, FRCP DPhil OBE
Professor of Tropical Medicine Oxford University; Honorary Professor of International Health, London School of Hygiene and Tropical Medicine, London; Director, Oxford University Clinical Research Unit, The Hospital for Tropical Diseases, Ho Chi Minh City, Viet Nam

Colin D. Ferrie, BSc MB ChB MD MRCP FRCPCH
Consultant Paediatric Neurologist, Department of Paediatric Neurology, Leeds General Infirmary, Leeds, UK

Alistair R. Fielder, FRCP FRCS FRCOphth
Professor of Ophthalmology, Department of Optometry and Visual Science, City University, London, UK

Brian W. Fleck, MD FRCOph
Consultant Ophthalmologist, Edinburgh Royal Infirmary and Edinburgh Royal Hospital for Sick Children, Edinburgh, UK

Peter J. Fleming, PhD MB ChB FRCPCH FRCP
FRCP(C)
Professor of Infant Health and Developmental Physiology, University of Bristol; Consultant Paediatrician, Royal Hospital for Children, Bristol, UK

Caroline Foster, MB BS MRCP
Honorary Clinical Research Fellow, Imperial College London; SPR Paediatric HIV, St Mary's Hospital, London, UK

Yvonne Freer, RGN RM RSCN BSc PhD
Research and Practice Development Facilitator, Neonatal Intensive Care, Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh, Edinburgh, UK

Vijeya Ganesan, MRCPCH, MD
Senior Lecturer in Paediatric Neurology, Institute of Child Health, University College London, London, UK

Anne S. Garden, FRCOG
Head of Department of Medicine and Director of the Centre for Medical Education, Lancaster University, Lancaster; Honorary Consultant in Paediatric and Adolescent Gynaecology, Royal Liverpool Children's Hospital, Liverpool; Honorary Consultant Gynaecologist, University Hospitals Morecambe Bay Trust, Morecambe, UK

Andrew R. Gennery, MD MRCP MRCPCH
DCH DipMedSci
Senior Lecturer and Honorary Consultant in Paediatric Immunology, BMT Institute of

Cellular Medicine, University of Newcastle upon Tyne, and Children's Bone Marrow Transplant Unit, Newcastle General Hospital, Newcastle upon Tyne, UK

Diana Gibb, MD FRCPCH MSc
Professor of Paediatric Epidemiology, MRC Clinical Trials Unit, University College London, London, UK

K. Michael Gibson, PhD, FACMG
Professor, Pediatrics, Pathology and Human Genetics, Division of Medical Genetics, Children's Hospital of Pittsburgh, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Barbara Golden, BSc MB BCh BAO MD FRCP
FRCPCH DCH RNutr
Associate Dean (Medicine), Clinical Senior Lecturer, Honorary Consultant International Child Health, Child Health Institute, School of Medicine, University of Aberdeen, Royal Aberdeen Children's Hospital, Aberdeen, UK

John M. Goldsmid, BSc MSc PhD FRCPATH FACTM
FASMC CBiol FIBiol FAIBiol HonFRCPA HonFACTM
Emeritus Professor, Discipline of Pathology, University of Tasmania, Hobart, Tasmania, Australia

John R.W. Govan, BSc PhD DSc
Professor of Microbial Pathogenicity, Centre for Infectious Diseases, University of Edinburgh Medical School, Edinburgh, UK

Stephen M. Graham, FRACP
Paediatric Research Fellow and Deputy Director Malawi-Liverpool-Wellcome Trust Clinical Research Programme, University of Malawi College of Medicine, Blantyre, Malawi; Senior Clinical Lecturer, Liverpool School of Tropical Medicine, Liverpool, UK

Anne Green, BSc MSc PhD FRCPATH FRCS FIBiol
FRCPCH.
Consultant Clinical Scientist, Birmingham Children's Hospital NHS Trust, Birmingham, UK

Marcus Grompe, MD
Director, Oregon Stem Cell Center; Professor, Department of Molecular and Medical Genetics, Oregon and Health Science University, Portland, Oregon, USA

Henry L. Halliday, FRCPCE FRCP FRCPCH
Chair of Child Health and Welfare Research Group, Department of Child Health, Queen's University Belfast, Northern Ireland, UK

Christina Halsey, BM BCh BA MRCP MRCPATH
Leukaemia Research Fund Clinical Research Fellow, Faculty of Medicine, Glasgow University, Glasgow, UK

Cary O. Harding, MD
Assistant Professor, Molecular and Medical Genetics; Director of the Biochemical Genetics Clinical Laboratory, Oregon Health

and Science University, Portland, Oregon, USA

C. Anthony Hart, BScMB BS PhD FRCPCH FRCPATH
Professor, Division of Medical Microbiology, School of Infection and Host Defence, University of Liverpool, Liverpool, UK

Paul T. Heath, MB BS FRACP FRCPCH
Senior Lecturer and Honorary Consultant, Paediatric Infectious Diseases, Division of Child Health, St George's University of London, London, UK

Peter J. Helms, MB BS PhD FRCP(Edin) FRCPCH
Professor of Child Health, University of Aberdeen, Aberdeen, UK

John Henderson, MD FRCP FRCPCH FRCPed
Reader in Paediatric Respiratory Medicine, University of Bristol and Bristol Royal Hospital for Children, Bristol, UK

Tom Hilliard, MD FRCPCH
Consultant Respiratory Paediatrician, Bristol Children's Hospital, Bristol, UK

Peter Hoare, DM FRCPsych
Senior Lecturer, University of Edinburgh; Honorary Consultant Psychiatrist, Royal Hospital for Sick Children, Edinburgh, UK

Richard F. Howard, BSc MBChB FRCA
Consultant in Anaesthesia and Pain Management, Great Ormond Street Hospital for Children, London, UK

Imelda Hughes, FRCPCH
Consultant Paediatric Neurologist, Department of Paediatric Neurology, Royal Manchester Children's Hospital, Manchester, UK

Robert Hume, BSc MB ChB PhD FRCP(Edin) FRCPCH
Professor of Developmental Medicine, Maternal and Child Health Sciences, University of Dundee, Dundee, UK

Carol Inward, MBBCh MD FRCPCH
Consultant Paediatric Nephrologist, Bristol Royal Hospital for Children, Bristol, UK

David Isaacs, MB BChir MD FRACP FRCPCH
Senior Staff Specialist at Children's Hospital at Westmead; Clinical Professor in Paediatric Infectious Diseases, University of Sydney, Sydney, Australia

Omar Ismayil, MD MSc MRCPCH
Consultant Neurologist, Damascus University Children's Hospital, Mezza, Damascus, Syria

Huw R. Jenkins, MA MD FRCP FRCPCH
Consultant Paediatric Gastroenterologist, Department of Child Health, University Hospital of Wales, Cardiff, Wales, UK

Cheryl A. Jones, MB BS PhD FRACP
Associate Professor, and Sub Dean Postgraduate Studies, Discipline of Paediatrics and Child Health, University of Sydney; Sydney, New South Wales, Australia

Christopher J.H. Kelnar, MA MD FRCP FRCPCH
Professor of Paediatric Endocrinology,
Section of Child Life and Health, Division of
Reproductive and Developmental Sciences,
University of Edinburgh, Edinburgh, UK

Alison M. Kemp, MB BCH DCH MRCP
FRCPCH FRCP(Edin)
Reader in Child Health, Department of Child
Health, Cardiff University, Cardiff, Wales

Alastair I.G. Kerr, MBChB FRCS(Edin & Glas)
Consultant Otolaryngologist, Ear, Nose and
Throat Department, Royal Infirmary for Sick
Children, Edinburgh, UK

Alison M. Kesson, MB BS PhD FRACP FRCPA
Virologist, Microbiologist and Paediatric
Infectious Disease Physician, The Children's
Hospital, Westmead, Sydney New South
Wales; Conjoint Associate Professor,
Paediatrics and Child Health, University of
Sydney, Sydney New South Wales, Australia

Maurice A. Kibel, FRCP(Edin) DCH(Lond).
Emeritus Professor of Child Health, School
of Child and Adolescent Health, University of
Cape Town, South Africa

Denise Kitchiner, MD FRCP FRCPCH
Consultant Paediatric Cardiologist,
Royal Liverpool Children's NHS Trust,
Liverpool, UK

Nigel J. Klein, BSc MB BS MRCP PhD FRCPCH
Professor of Infection and Immunity,
University College London; Head, Infectious
Diseases and Microbiology Unit, Institute of
Child Health; Head, Department of Infection,
University College London; Consultant in
Infectious Diseases and Microbiology,
Great Ormond Street Hospital NHS Trust,
London, UK

David M. Koeller, MD
Associate Professor, Pediatrics and Molecular
and Medical Genetics; Chief, Division
of Metabolism, Department of Pediatrics,
Doernbecher Children's Hospital, Oregon
Health and Science University, Portland,
Oregon, USA

Sailesh Kotecha, MA FRCPCH PhD
Professor of Child Health, Department of
Child Health, Wales College of Medicine,
Cardiff University, Cardiff, Wales, UK

Karen Kotloff, MD
Professor, Pediatrics and Medicine, Center
for Vaccine Development, University of
Maryland School of Medicine, Baltimore,
Maryland, USA

Ian A. Laing, MA MD FRCP FRCPCH
Consultant Neonatologist, Simpson Centre
for Reproductive Health, Royal Infirmary of
Edinburgh, Edinburgh, UK

David G. Lalloo, MB BS MD FRCP
Reader In Tropical Medicine, Liverpool
School of Tropical Medicine, Liverpool, UK

Alison Leaf, BSc MB ChB MD MRCP FRCPCH
Consultant Neonatologist, Southmead
Hospital, Bristol, UK

Malcolm I. Levene, MD FRCPCH FMedSci
Professor of Paediatrics and Child Health,
University of Leeds, Leeds General Infirmary,
Leeds, UK

Leesa M. Linck, MD MPH
Consultant Paediatrician,
The County Clinic, Winthrop,
Washington State, USA.

John H. Livingston, MB ChB FRCP FRCPCH
Consultant Paediatric Neurologist,
Department of Paediatric Neurology, Leeds
General Infirmary, Leeds, UK

Stuart Logan, MB ChB MSc(Epidemiology)
MSc(Econ) MRCP FRCPCH
Professor of Paediatric Epidemiology;
Director, Institute of Health and Social
Care Research, Peninsula Medical School,
St Luke's Campus, Exeter, UK

Diana N.J. Lockwood, BSc MD FRCP
Consultant Physician and Leprologist,
Hospital for Tropical Diseases, London, UK

Andrew J. Lyon, MA MB FRCP FRCPCH
Consultant Neonatologist, Simpson Centre
for Reproductive Health, Royal Infirmary of
Edinburgh, Edinburgh, UK

Ronan Lyons, MD FFPH FFFPMI MPH DCH
Professor of Public Health, Centre for Health
Information, Research and Evaluation,
School of Medicine, Swansea University,
Swansea, UK

Anita Macdonald, PhD BSc SRD
Consultant Dietician in Inherited Metabolic
Disorders, Birmingham Children's Hospital,
Birmingham, UK, Head of Dietetics,
Birmingham Children's Hospital NHS Trust,
Birmingham, UK

Mary McGraw, FRCP FRCPCH
Consultant Paediatric Nephrologist,
Bristol Royal Hospital for Children,
Bristol, UK

Keiran McHugh, FRCR FRCPI DCH
Consultant Paediatric Radiologist, Great
Ormond Street Hospital for Children,
London, UK

Neil McIntosh, DSc(Med)
Professor of Child Life and Health,
Department of Child Life and Health,
University of Edinburgh; Honorary
Consultant Paediatrician, Lothian University
Hospitals NHS Trust, Edinburgh, UK

G.A. Mackinlay, MB BS LRCP FRCSEd
FRCSEng FRCPCH
Senior Lecturer, Department of Clinical
Surgery, University of Edinburgh; Consultant
Paediatric Surgeon, Department of Paediatric
Surgery, Royal Hospital for Sick Children,
Edinburgh, UK

Ian McKinley, OBE BSc MB ChB DCH FRCP FRCPCH
Senior Lecturer in Child Health, McKay-
Gordon Centre, Royal Manchester Children's
Hospital, Manchester, UK

Sheila A.M. McLean, LLB MLitt PhD LLD FRSE
FRCGP FMedSci FRCP(Edin) FRSA
International Bar Association Professor of
Law and Ethics in Medicine, University of
Glasgow, UK

Sabine Maguire, MB BCh BAO MRCPI FRCPI FRCPCH
Senior Lecturer in Child Health, Cardiff
University, Department of Child Health,
Cardiff, UK

Janice Main, FRCP(Edin) FRCP(Lond)
Reader and Consultant Physician in
Infectious diseases and General Medicine,
Department of Medicine, Imperial College,
St Mary's Hospital, London, UK

Guy Makin, BA BM BCh PhD MRCP FRCPCH
Senior Lecturer in Paediatric Oncology,
University of Manchester; Honorary
Consultant Paediatric Oncologist,
Royal Manchester Children's Hospital,
Manchester, UK

Timothy Martland, MB ChB MRCP MRCPCH
Consultant Paediatric Neurologist,
Department of Paediatric Neurology,
Royal Manchester Children's Hospital,
Manchester, UK

Amha Mekasha, MD MSc
Associate Professor of Paediatrics and Child
Health, Department of Paediatrics and
Child Health, Addis Ababa University,
Addis Ababa, Ethiopia

Craig Mellis, MB BS MPH MD FRACP
Head of School, Associate Dean, Central
Clinic School, Faculty of Medicine, The
University of Sydney, Sydney, Australia

Stefan Meyer, MD PhD MRCPCH
CRUK Clinician Scientist and Consultant
Paediatric Oncologist, University of
Manchester, Royal Manchester Children's
Hospital and Young Oncology Unit, Christie
Hospital, Manchester, UK, Stefan Meyer MD
PhD MRCPCH

Alan E. Mills, MA MB DCP DPath FRCPA.
FFPathRCPI FACTM
Consultant Pathologist, Dorevitch Pathology,
Bendigo, Victoria, Australia

Elizabeth Molyneux, OBE FRCP FRCPCH FEM
Professor and Head of Department of
Paediatrics, College of Medicine, Blantyre,
Malawi, C Africa.

Malcolm E. Molyneux, MD FRCP FMedSci
Director, Malawi-Liverpool-Wellcome Trust
Clinical Research Programme, College of
Medicine, University of Malawi, Malawi;
Professor of Tropical Medicine, School of
Tropical Medicine, University of Liverpool,
Liverpool, UK

Kim Mulholland, MD FRACP

Professor of Child Health, London School of Hygiene and Tropical Medicine, London, UK, Infectious Disease Epidemiology Unit, London School of Hygiene and Tropical Medicine, London, UK

Alan O. Mulvihill, FRCSI FRCSed

Consultant Ophthalmic Surgeon, Princess Alexandra Eye Pavilion and Royal Hospital for Sick Children, Edinburgh, UK

Richard W. Newton, MD FRCPCH FRCP

Consultant Paediatric Neurologist, Royal Manchester Children's Hospital, Manchester, UK

Angus Nicoll, CBE FFFHM FRCP FRCPCH

Director, Communicable Disease Surveillance Centre, Centre for Infection, Health Protection Agency, London, UK

James Y. Paton, MD, FRCPCH FRCPSG

Reader in Paediatric Respiratory Medicine, Division of Developmental Medicine, University of Glasgow, Royal Hospital for Sick Children, Glasgow, UK

Michael A. Patton, MA MSc MBChB FRCPCH

Professor of Medical Genetics and Consultant Medical Geneticist, Department of Medical Genetics, St George's Hospital Medical School, London, UK

Philip L. Pearl, MD

Associate Professor of Paediatrics and Neurology, Department of Neurology, Children's National Medical Center, The George Washington University School of Medicine, Washington DC, USA

Gale A. Pearson, MB BS MRCP FRCPCH

Consultant in Paediatric Intensive Care, Birmingham Children's Hospital, Birmingham, UK

Stavros Petrou, BSc MPhil PhD

MRC Senior Non-Clinical Research Fellow, National Perinatal Epidemiology Unit, University of Oxford, Oxford, UK

Ian J. Ramage, FRCPCH

Consultant Paediatric Nephrologist, Royal Hospital for Sick Children, Glasgow, UK

John J. Reilly, BSc PhD

Professor of Paediatric Energy Metabolism, University Division of Developmental Medicine, Royal Hospital for Sick Children, Glasgow, UK

J.M. Rennie, MD FRCP FRCPCH DCH

Consultant and Senior Lecturer in Neonatal Medicine, Elizabeth Garrett Anderson and Obstetric Hospital, University College London Hospitals, London

Sam Richmond, MB BS FRCP FRCPCH

Consultant Neonatologist, Sunderland Royal Hospital, Sunderland, UK

Irene A.G. Roberts, MD FRCP FRCPPath FRCPCH DRCOG

Professor of Paediatric Haematology and Consultant Paediatric Haematologist, Hammersmith Hospital and St Mary's Hospitals, Imperial College, London, UK

Peter T. Rudd, MD FRCPCH

Consultant Paediatrician, Royal United Hospital, Bath, UK

S.C. Robson, MD MRCOG

Professor of Fetal Medicine, School of Surgical and Reproductive Sciences, Newcastle University, Newcastle upon Tyne, UK

Jean-Baptiste Roulet, PhD

Associate Professor (Research), Division of Metabolism, Department of Paediatrics, Oregon Health and Science University, Portland, Oregon, USA; Adjunct Associate Professor of Pharmacology and Therapeutics, University of Calgary, Calgary, Alberta, Canada

George Rylance, MB FRCPCH

Consultant in Paediatrics, Department of Child Health, Royal Victoria Infirmary, Newcastle upon Tyne, UK

Moin A. Saleem, MB BS FRCP PhD

Reader and Honorary Consultant Paediatric Nephrologist, Bristol Children's Hospital, University of Bristol, Bristol, UK

Alison Salt, MB BS MSc FRACP FRCPCH

Consultant Developmental Paediatrician, Neurodisability Service, Great Ormond Street Hospital for Children NHS Trust and Institute of Child Health, London, UK

Jenefer Sargent, MA MB BCh MSc MRCPCH

Consultant Developmental Paediatrician, Neurodisability Service, Great Ormond Street Hospital for Children NHS Trust, London, UK

Ayad Shafiq, FRCOphth MRCPPaeds DCH BM BCH

Consultant Ophthalmologist, Royal Victoria Hospital, Newcastle upon Tyne, UK

Jonathan R. Skinner, MB ChB FRCPCH FRACP MD

Paediatric Cardiologist, Green Lane Paediatric and Cardiac Services, Starship Children's Hospital, Auckland, New Zealand

Alan Smyth, MA MB BS MRCP MD FRCPCH

Reader in Child Health, University of Nottingham; Honorary Consultant in Paediatric Respiratory Medicine, Nottingham University Hospitals NHS Trust, Nottingham, UK

Rosalind L. Smyth, MA MB BS MD FRCPCH

Brough Professor of Paediatric Medicine, University of Liverpool, Liverpool, UK

Robert D. Steiner, MD

Professor, Pediatrics and Molecular and Medical Genetics; Vice Chair for Research, Department of Pediatrics, Doernbecher

Children's Hospital; Deputy Director, Oregon Clinical and Translational Research Institute, Oregon Health and Science University, Portland, Oregon, USA

Ben Stenson, MD FRCPCH FRCP

Consultant Neonatologist, Simpson Centre for Reproductive Health, Royal Infirmary of Edinburgh, Edinburgh, UK

Terence Stephenson, DM FRCP FRCPCH

Professor of Child Health; Dean, Faculty of Medicine and Health Sciences, Medical School, University of Nottingham, Queen's Medical Centre, Nottingham, UK

Stephen Stick, PhD MB BChir MRCP FRACP

Associate Professor, Department of Respiratory Medicine, Princess Margaret Hospital for Children, University of Western Australia, Australia

Stephen Sturgiss, MD MRCOG

Consultant in Obstetrics and Fetal Medicine, Royal Victoria Infirmary, Newcastle upon Tyne, UK

David Sweet, MD FRCPCH

Consultant Neonatologist, Royal Maternity Hospital, Belfast, Northern Ireland, UK

Angela E. Thomas, MB BS PhD FRCP FRCPPath FRCPCH

Consultant Paediatric Haematologist, Royal Hospital for Sick Children, Edinburgh, UK

James Tooley, MB BS MRCPCH

Consultant in Neonatal Medicine, Neonatal Intensive Care Unit, St Michael's Hospital, Bristol, UK

E. Jane Tizard, MB BS, FRCP FRCPCH

Consultant Paediatric Nephrologist, Bristol Royal Hospital for Children, Bristol, UK

Russell Viner, MB BS FRCPCH FRACP FRCP PhD

Consultant in Adolescent Medicine and Endocrinology, Department of Paediatrics, Middlesex Hospital, London, UK

Rachel Webster, BSc PhD DipRCPPath

Clinical Scientist, Department of Clinical Biochemistry, Birmingham Children's Hospital, Birmingham, UK

Philip D. Welsby, FRCP(Ed)

Consultant in Infectious Diseases, Infectious Disease Unit, Western General Hospital, Edinburgh, UK

Johannes Wildhaber, MD PhD

Head, Division of Respiratory Medicine, University Children's Hospital, Zürich, Switzerland

Anthony F. Williams, BSc DPhil MB BS FRCP FRCPCH

Reader in Child Nutrition, St George's, University of London, London, UK

Access the fully searchable text of Forfar and Arneil online free when you buy this book!

www.forfarandarneil.com

.....

How to register

- ❶ Scratch off the sticker below and get your unique PIN number.
 - ❷ Go to www.forfarandarneil.com for simple instructions for how to register. You will be asked to enter your unique PIN number.
-

Important note

Purchase of this book includes a limited personal licence for the life of this edition to the online version, for use exclusively by the individual who has purchased the title. This licence and access to www.forfarandarneil.com operates strictly on the basis of a single user per PIN number. The sharing of passwords is strictly prohibited, and any attempt to do so will invalidate the password. The licence and access may not be lent, resold or otherwise circulated. Full details of the licence and terms and conditions of use are available on registration.

Book cannot be
returned
once panel is
scratched off

Scratch off the
sticker with care!

.....

Seventh Edition

Forfar & Arneil's

TEXTBOOK
of **PEDIATRICS**

Commissioning Editor: Ellen Green, Pauline Graham

Development Editor: Janice Urquhart

Project Manager: Nancy Arnott

Design Direction: Erik Bigland

Illustrators: Tim Loughhead, Richard Prime

Bridget A. Wills, BmedSci BM BS MRCP DTM&H
Clinical Senior Lecturer in Paediatrics,
University of Oxford – Wellcome Trust
Clinical Research Unit, Ho Chi Minh City,
Vietnam

David C. Wilson, MD FRCP FRCPCH
Senior Lecturer in Paediatric
Gastroenterology and Nutrition, Child Life

and Health, Department of Reproductive
and Developmental Sciences, University of
Edinburgh, Edinburgh, UK

Rachael Wood, BSc MB ChB DCH MFH MFPH
Clinical Academic Fellow, Department
of Public Health Sciences and Centre for
International Public Health Policy University
of Edinburgh, Edinburgh, UK

Christopher Wren, MB ChB FRCP FRCPCH
Consultant Paediatric Cardiologist, Freeman
Hospital, Newcastle upon Tyne, UK



Plate 15.15 Correct positioning and technique for accurate measurement of (a) height, (b) supine length, (c) sitting height, (d) head circumference. For description see text (see p. 430).

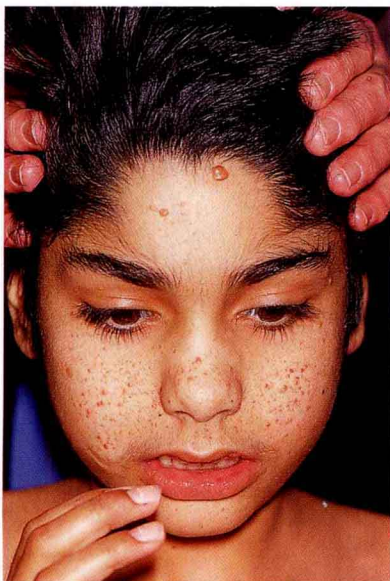


Plate 22.15 Tuberous sclerosis: adenoma sebaceum (see p. 839).



Plate 22.16 (a) Tuberous sclerosis: Shagreen patch (see p. 839).



(b)
Plate 22.16 (b) Tuberous sclerosis: depigmented patches (see p. 839).

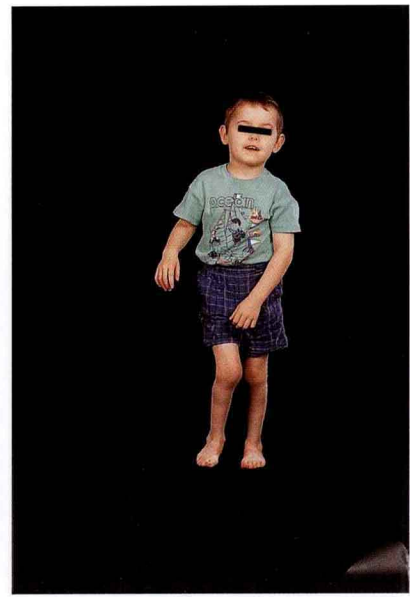


Plate 22.26 Diplegic gait. Internal rotation with hip adduction (see p. 890).



Plate 22.28 Ataxic 3-year-old child showing broad-based gait and elevated arms (see p. 891).

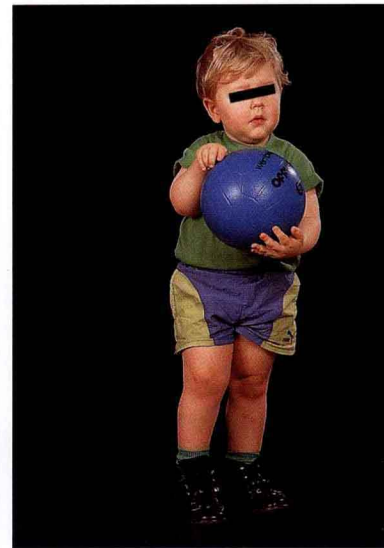


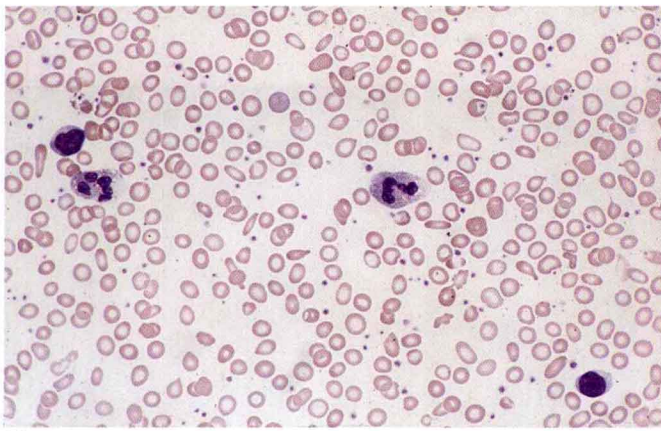
Plate 22.29 Spastic hemiplegia, right-sided – hyperpronated (see p. 892).



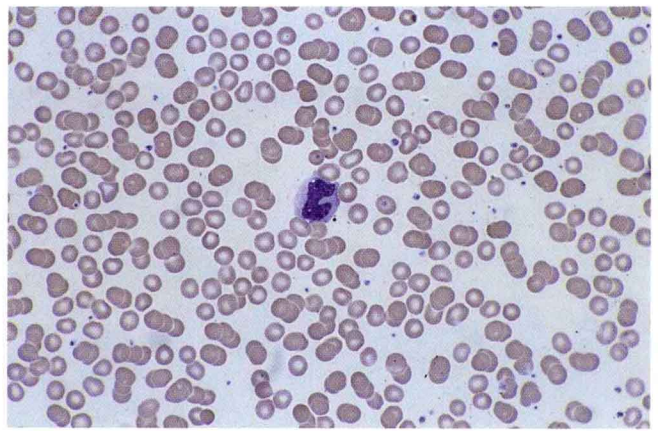
Plate 22.30 A child with dyskinetic cerebral palsy, showing uncontrolled patterns of movement and flaccid trunk, while attempting to reach out (see p. 892).



Plate 22.32 Central core disease: the cores show absence of staining with NADH (see p. 910).

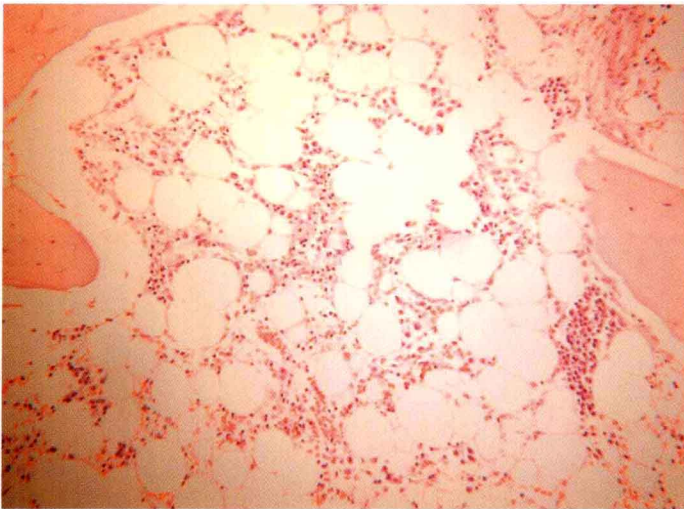


(a)



(b)

Plate 23.4 Peripheral blood appearances in severe hypochromic iron deficiency with microcytic red cells (a) compared with a normal film (b) (same magnification) (see p. 962).



(a)



(b)

Plate 23.7 The appearances of aplastic bone marrow (a) with a normal marrow (b) for comparison (trephine biopsy) (see p. 965).

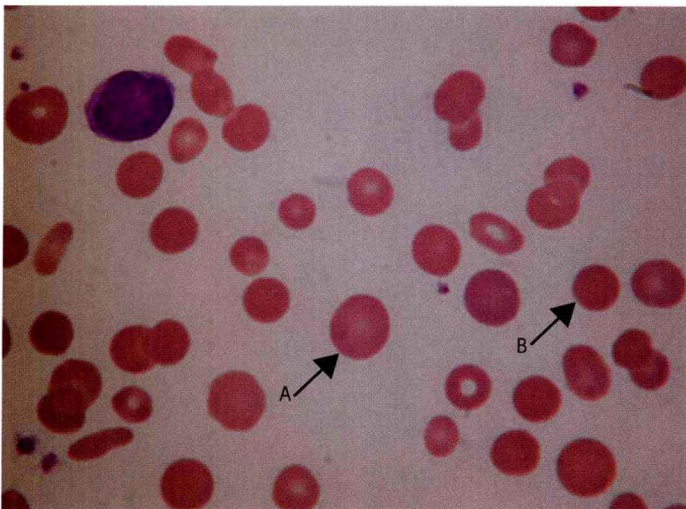


Plate 23.10 Peripheral blood appearance in spherocytosis with spherocytes and polychromasia. A, polychromatic cell; B, microspherocyte (see p. 967).

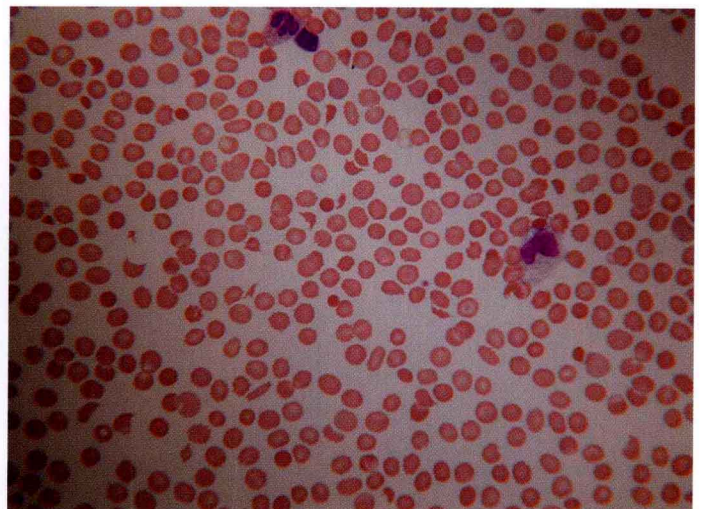
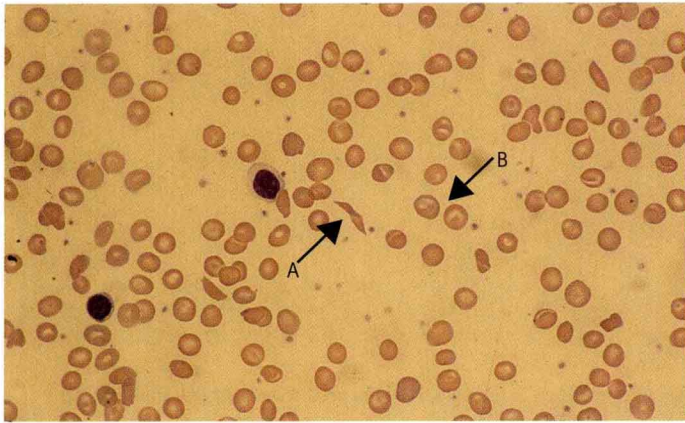


Plate 23.12 Red cell appearances in red cell fragmentation syndromes (see p. 969).



(a)



(b)

Plate 23.15 (a) Peripheral blood appearance in homozygous sickle cell disease with target cells, polychromasia and distorted red cells (A, sickle cell; B target cell). (b) Swelling of the fingers from dactylitis, a common mode of presentation of sickle cell disease in late infancy. (From Lissauer & Clayden 2001³⁵ with permission) (see p. 971).



Plate 23.20 Acute ankle hemarthrosis in a child with severe hemophilia A (see p. 979).



Plate 23.21 (a) Severe hemophilia in an adolescent showing fixed flexion of right knee, marked arthropathy of left knee and muscle wasting (see p. 980).



Plate 23.26 Acute monocytic leukemia causing gum infiltration (see p. 985).