FUNDAMENTALS

Fundamentals of

Children's Anatomy and Physiology

A Textbook for Nursing and Healthcare Students

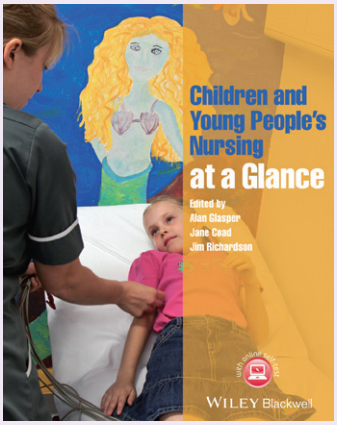
EDITED BY
IAN PEATE
AND ELIZABETH GORMLEY-FLEMING

with online self-test

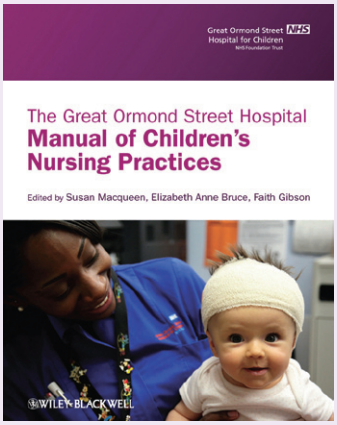
Available on
CourseSmart
Learn Smart. Choose Smart.
Wiley E-Text
Powered by VitalSource®

WILEY Blackwell

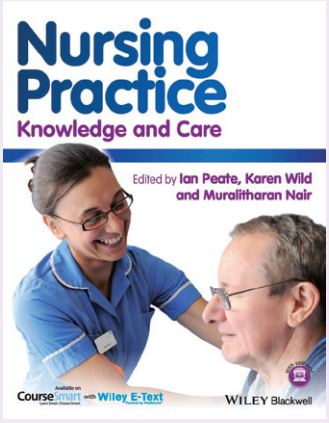
Titles of related interest



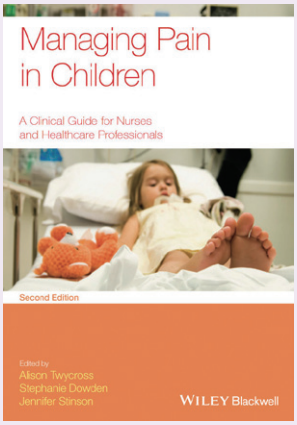
ISBN: 978-1-118-51628-7
The perfect companion for study and revision for pre-registration children's nursing students from the publishers of the market-leading *at a Glance* series, this book explores assessment and screening, working with families, the newborn infant, the developing child, child health policy, nursing the sick child and young person, and chronic and life-limiting conditions.



ISBN: 978-1-4051-0932-1
'This manual builds on the knowledge, skills and expertise of one of the UK's finest children's hospitals and explains comprehensive, evidence-based care clearly.' (*Nursing Children and Young People*, 1 October 2012)



ISBN: 978-1-118-48136-3
Nursing Practice is the essential, textbook to support you throughout your entire nursing degree, from your first year onwards. It explores all the clinical and professional issues that you need to know in one complete volume, covering all fields of nursing: Adult, Child, Mental Health, Learning Disabilities and also Maternity care, in both acute and community settings.



ISBN: 978-0-470-67054-5
'A well-written resource that covers a range of pertinent topics in pediatric pain…This clinical guide is a welcome addition to the pediatric pain literature and would serve well as a textbook for a course in pediatric pain.' (Pediatric Pain Letter)

This title is also available as an e-book. For more details, please see
www.wiley.com/buy/9781118625057
or scan this QR code:

Fundamentals of

Children's Anatomy and Physiology

In memory of our dear colleague Debbie Davies.

Fundamentals of

Children's Anatomy and Physiology

A Textbook for Nursing and Healthcare Students

EDITED BY

IAN PEATE

Visiting Professor of Nursing, Head of the School of Health Studies, Gibraltar and Editor in Chief, *British Journal of Nursing*

AND

ELIZABETH GORMLEY-FLEMING

Associate Dean of School, Academic Quality Assurance, Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

WILEY Blackwell

This edition first published 2015 © 2015 by John Wiley & Sons, Ltd

Registered Office
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

Editorial Offices
350 Main Street, Malden, MA 02148-5020, USA
9600 Garsington Road, Oxford, OX4 2DQ, UK
The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

For details of our global editorial offices, for customer services, and for information about how to apply for permission to reuse the copyright material in this book please see our website at www.wiley.com/wiley-blackwell.

Library of Congress Cataloging-in-Publication Data

Fundamentals of children's anatomy and physiology: a textbook for nursing and healthcare students / edited by Ian Peate and Elizabeth Gormley-Fleming.
p. ; cm.
Includes bibliographical references and index.
ISBN 978-1-118-62505-7 (pbk.)
I. Peate, Ian, editor. II. Gormley-Fleming, Elizabeth, editor.
[DNLM: 1. Anatomy. 2. Child. 3. Physiological Phenomena. QS 4]
QP34.5
612–dc23
2014038945

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

Cover image: iStock/© Yuri_Arcurs

Set in 10/12pt MyriadPro by Toppan Best-set Premedia Limited, Hong Kong

1 2015

Contents

About the series

Wiley's *Fundamentals* series are a wide-ranging selection of textbooks written to support pre-registration nursing and other healthcare students throughout their course. Packed full of useful features such as learning objectives, activities to test knowledge and understanding, and clinical scenarios, the titles are also highly illustrated and fully supported by interactive MCQs, and each one includes access to a **Wiley E-Text: powered by VitalSource** – an interactive digital version of the book including downloadable text and images and highlighting and note-taking facilities. Accessible on your laptop, mobile phone or tablet device, the *Fundamentals* series is *the* most flexible, supportive textbook series available for nursing and healthcare students today.

Contributors

Elizabeth Akers RN B. Nursing, BSc (Hons), Diploma in Tropical Nursing PG Cert (Teaching and Learning)
Practice Educator, Bear Ward, Cardiac Unit, Great Ormond Street Hospital NHS Foundation Trust, London

Born in central New South Wales, Elizabeth grew up in the great Australian outdoors. Elizabeth began her general nurse training at the University of Sydney in 1993 and completed a post-graduate year at Sydney Children's Hospital in 1996. On an adventurous whim Elizabeth accepted a post at Great Ormond Street Hospital in London and has since moved to the Bedfordshire countryside to raise her family. Elizabeth still works at Great Ormond Street Hospital in the cardiac unit, where she is one of a team of practice educators. Elizabeth's special interests are in simulation, general paediatrics and congenital heart disease.

Ann L. Bevan RN, RSCN, PhD
Senior Lecturer, School of Health and Social Care, Bournemouth University, Bournemouth, UK

Ann began her nursing career at Poole General Hospital before then moving on to various other positions and further education. She has worked in various places around the UK and in Hong Kong, before moving to Canada where she worked in clinical practice for 5 years before moving into education. Ann returned to her current post in 2010. Her key interests are child health, childhood nutrition and obesity, health promotion and action research. Ann's publications are growing, and she is a Board member and Treasurer of Phi Mu Honour Society for Nurses in England.

Mary Brady RN, RSCN, CHSM, BSc, PGCHE, MSc
Senior Lecturer, Faculty of Health, Social Care and Education, Kingston University, London, UK

After completing RN training, Mary undertook RSCN training. Afterwards, she worked on a general paediatric ward for infants, then moved to Birmingham Children's Hospital to work on a neonatal and infant surgical ward as a staff nurse and then sister. She completed the paediatric intensive care course at the Hospital for Sick Children (Great Ormond Street) and worked on the cardiac ICU. In 1991 she moved to a neonatal unit as a surgical sister. From 1995 to 2004 she was ward manager/senior sister on a general children's ward.

In 2004, Mary moved into nurse education, where she is currently Field lead for children's nursing. She teaches pre- and post-registration nurses, midwives and paramedics.

Mary is an external examiner at Huddersfield University.

Petra Brown RGN DPSN BSc (Hons) MA
Lecturer, School of Health and Social Care, Bournemouth University, Bournemouth, UK

Petra began her nursing a career in 1988 at Salisbury School of Nursing, becoming a staff nurse. She has worked in a variety of clinical areas, including recovery, intensive & coronary care and telephone triage. On completing her Critical Care degree, Petra started her career in nurse education as a Practice Educator for critical care, A&E and orthopaedics at Bournemouth and Christchurch NHS Hospital. On completing a Master's Degree in Health and Social Care Practice

Education, she was appointed as a lecturer at Bournemouth University on the overseas and pre-registration nursing courses. Her key areas of interest are nursing practice, overseas nursing, nurse education, practice development, respiratory and critical care.

Mary L. Donnelly SRN, RSCN, DipEd, PG Cert Ed, BSc (Hons), MA
Senior Lecturer in Children's Health, Alternate Professional Lead and Programme Field Tutor for Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Mary began her nursing career in 1978 training to be a state registered nurse at Edgware General Hospital's School of Nursing. On completion of training she became a staff nurse in the Accident and Emergency department at Edgware General and later became a senior staff nurse on the children's ward at the same hospital. In 1986 she became an Industrial Nursing Officer, but returned to accident and emergency nursing in 1990. While working in the accident and emergency department at Barnet General Hospital, Mary studied for her second registration as a Registered Sick Children's Nurse, becoming an Accident and Emergency Sister and Paediatric Nurse Specialist for the same hospital. In 2001 she became a Nurse Facilitator for the North Central London Workforce Development Confederation and later went on to become the acting lead nurse for the cadet nursing scheme for the same NHS organization. Mary has worked as a lecturer in Child Health at the University of Hertfordshire since 2003 and is currently the Alternate Professional Leader and Programme Field Tutor for Children's Nursing at the same institution.

Elizabeth Gormley-Fleming RGN, RSCN, BSc (Hons), MA (Keele), PG Dip HE (Herts)
Associate Dean of School, Academic Quality Assurance, Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Liz commenced her nursing career in Ireland, where she qualified as an RGN and RSCN. After working in Our Lady's Hospital for Sick Children in Dublin, she moved to London to work at Northwest London NHS Trust initially in adult nursing, but then moved to Children's Services where she had a variety of roles from staff nurse to lead nurse. Liz also worked in Northern Ireland during the 1990s, where she worked in childrens' orthopaedics and as a school nurse. Liz has worked in education since 2001, initially as a clinical facilitator before moving into full-time HE in 2003. Her areas of interest are care of the acutely ill child, healthcare law and ethics, the use of technology in higher education and practice-based learning.

Debbie Martin MSc, BSc (Hons), EN(G), RSCN, PGDEd, DipON(Oxford)
Senior Lecturer in Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Debbie commenced her nursing career in 1979 at The Nuffield Orthopaedic Centre, Oxford; after completing a Diploma in Orthopaedic nursing she went on to Mount Vernon Hospital and became an Enrolled Nurse. She worked part time for a number of years, at Mount Vernon and St Albans Hospital whilst bringing up a family, then undertook further training to become a Registered Sick Children's Nurse. She worked as a Staff Nurse and a Junior Sister at Hemel Hempstead Hospital and then moved into a placement support and practice development role. She moved into nurse education at the University of Hertfordshire in 2006. Her key areas of interest are pre-registration nurse education, simulation in nurse education, adolescent health and care of siblings of children with long-term conditions.

Alison Mosenthal RGN, RSCN, Dip N (London), Diploma Nursing Education, MSc
Senior Lecturer in Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Alison began her nursing career at St Thomas' Hospital London before undertaking her RSCN training at Great Ormond Street in 1979. After qualifying she worked in the respiratory intensive care unit and then moved into nurse education in the School of Nursing at Great Ormond Street in 1983.

After a career break raising her family, Alison returned to clinical nursing working as a clinical nurse specialist in paediatric Immunology nursing at St Georges' Healthcare NHS Trust in 1996. She remains in clinical practice there, but returned to teaching in higher education at the University of Hertfordshire in 2010. She currently works there part time as a senior lecturer on the children's nursing course.

Joanne Outteridge RN (Child), ENB 415, BN (Hons), PG Dip Health Care Ethics, PG Dip HE, MSc
Senior Lecturer, Department of Family and Community Studies, Anglia Ruskin University, Cambridge, UK

Jo began her nursing career as a children's nurse at the Evelina Children's Hospital, London, working in paediatric cardiology and then paediatric intensive care. She then moved to teaching children's pre-registration and respiratory nursing at City University, London, becoming a lecturer practitioner on the children's medical wards at the Royal London Hospital.

Jo now works at Anglia Ruskin University, teaching children's high-dependency and intensive care nursing, and leading an interprofessional MSc Children and Young People.

Ian Peate EN(G) RGN DipN (Lond) RNT BEd (Hons) MA (Lond) LLM
Visiting Professor of Nursing, Head of the School of Health Studies, Gibraltar and Editor in Chief, *British Journal of Nursing*

Ian began his nursing a career in 1981 at Central Middlesex Hospital, becoming an Enrolled Nurse working in an intensive care unit. He later undertook 3 years' student nurse training at Central Middlesex and Northwick Park Hospitals, becoming a Staff Nurse and then a Charge Nurse. He has worked in nurse education since 1989. His key areas of interest are nursing practice and theory, men's health, sexual health and HIV. Ian has published widely; he is Visiting Professor of Nursing, Editor in Chief of the *British Journal of Nursing* and Head of the School of Health Studies Gibraltar.

Julia Petty RGN, RSCN, BSc (Hons), MSc, PGCE, MA
Senior Lecturer, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Julia began her children's nursing career at Great Ormond Street Hospital before moving on to work in various other positions in children's and neonatal care. She worked in clinical practice for 8 years before moving into higher education. Julia worked as a Senior Lecturer at City University, London, for 12 years before commencing her current post in April 2013. Her key interests are neonatal health, outcome of early care and the impact in childhood, and most recently the development of online learning resources in neonatal/children's nursing care. Julia has a considerable publication portfolio and has developed an online, interactive learning resource in neonatal care. She is a resuscitation instructor for the UK Resuscitation Council in newborn life support, a member of the Neonatal Nurses Association Special Interest Education group as well as being on the editorial board as education editor for the *Journal of Neonatal Nursing*. Her

recent research interest involves exploring learners' needs and satisfaction in interactive online learning and how user involvement can inform the development of resources for children's nurses.

Sheila Roberts RGN RSCN RNT BA (Hons) MA
Senior Lecturer, Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Sheila began her nursing career in 1979 at the Queen Elizabeth School of Nursing in Birmingham, working primarily at Birmingham Children's Hospital. She moved to general paediatrics at Kidderminster, Ipswich and finally at Bedford Hospital, where she became ward sister. Sheila moved into nurse education in 2006. Her areas of interest include nursing practice and teaching nursing skills to students, along with an interest in the cardiac and respiratory systems and child development. More recently, Sheila has been involved in projects involving children as service users within the pre-registration nursing curriculum.

Peter Vickers Cert Ed, Dip CD, SRN, RSCN, BA, PhD, FHEA

After training as a schoolteacher, and undertaking many jobs both within and without teaching, Peter began his nursing career in 1980 at York District Hospital, followed by Great Ormond Street Children's Hospital, London, where he specialized in Immunology and Infectious Diseases, eventually becoming a Clinical Nurse Specialist in Paediatric Immunology. In 1999 he was awarded a PhD following research undertaken into children with Severe Combined Immune Deficiency (SCID) in the UK and Germany. He commenced working in nurse education in 2001. His key areas of interest are immunology, infectious diseases, genetics and research, and he has published widely – both as the author of a book on SCID, and co-author of a book on research, as well as contributing many chapters to academic textbooks. Although now retired, he is still active in writing, and in 2012 he was elected as President of INGID (the international organization for nurses working in primary immunodeficiencies).

Lisa Whiting DHRes, MSc, BA (Hons) RGN, RSCN, RNT, LTCL, FHEA
Professional Lead, Children's Nursing, School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Lisa completed the 4-year RGN/RSCN programme at the Queen Elizabeth Medical Centre, Birmingham, in 1983. She gained a range of paediatric clinical experience, developing her career within the area of critical care nursing and becoming a ward sister on the children's cardiac intensive care unit at Guy's Hospital. Lisa has worked in education for a number of years, teaching students undertaking a range of children's nursing programmes. In addition, Lisa has studied academically, nurturing an interest in child health promotion; she has completed a Doctorate in Health Research that drew on an ethnographic approach to facilitate the emergence of assets that underpin children's wellbeing.

Lisa is now Professional Lead for Children's Nursing at the University of Hertfordshire.

Preface

Caring for children (young people) and their families, sick or well, requires the nurse to have an understanding of a range of complex issues. It is important that you have insight into the anatomy and physiology of the child. The anatomical and physiological systems of children are different to those of the adult. In some instances there are marked differences and in others these are subtle.

Children are not little adults. Recognizing and responding to their anatomical and physiological differences is essential when caring for a child sick or well (Rzucidlo and Shirk, 2004). The body of a child is in a constant state of development and maturation and progressive growth, with dynamic biochemical processes.

The term child will be adopted throughout this text; this refers to children and young people aged between 0 and 16 years of age.

An individual is seen and treated as a whole, however; the human body is composed of organic and inorganic molecules that are organized at a variety of different structural levels. If the nurse is to ensure children and their families are to receive appropriate and timely care, they need to be educated in such a way that they can recognize illness, provide effective treatment and make appropriate referrals with the child at the centre of all they do.

In the nursing and healthcare literature (the psycho-social sciences) children have been well represented; however, there is a dearth of texts that focus on the anatomy and physiology of the child. If nurses are to be prepared to be effective children's nurses then they must demonstrate a sound knowledge of child-related anatomy and physiology with the intention of providing safe and effective nursing care.

The overall aim of this succinct and concise text is to provide you with a sound understanding of the fundamentals associated with the anatomy and physiology of children and the related biological sciences that will enable you to develop your practical caring skills and to enhance your knowledge in order to become a caring, kind and compassionate children's nurse. Having developed your knowledge you will be able to deliver increasingly complex care for children, sick or well, in a range of settings that safeguards and promotes the welfare of vulnerable children in an appropriate, coordinated, multidisciplinary, integrated and family-centred manner.

As children grow, so they develop physically and psychologically. As the child progressively grows and develops, their immature systemic organs and biochemical processes will influence disease processes as well as any therapeutic strategies.

Fundamentals of Children's Anatomy and Physiology provides you with the opportunity to apply the content to the care of children, young people and their families. As you begin to understand how children respond or adapt to pathophysiological changes and stresses you will be able to appreciate that children (regardless of age) have specific biological needs.

The integration and application of evidence-based theory to practice is a key component of effective and safe health care. This goal cannot be achieved without an understanding of the anatomical and pathophysiological aspects associated with child health.

This text provides you with structure and a comprehensive approach to anatomy and physiology. Expert nurses who have a passion and commitment to the child, young person and family

have written the chapters with you, the student, at the fore. The text is designed to be used as a reference text in the practice placement setting, the classroom or at home. It is not intended to be read from cover to cover in one sitting.

Anatomy and physiology

Living systems can be defined from a number of perspectives. At the very smallest level, the chemical level, atoms, molecules and the chemical bonds connecting atoms provide the structure upon which life is based. The smallest unit of life is the cell. Tissue is a group of cells that are similar and they perform a common function. Organs are groups of different types of tissues performing together to carry out a specific activity. A system is two or more organs working together to carry out a particular activity. Another system that possesses the characteristics of living things is an organism, this having the capacity to obtain and process energy, the ability to react to changes in the environment and to reproduce.

As anatomy is associated with the function of a living organism, it is almost always inseparable from physiology. Physiology is the science dealing with the study of the function of cells, tissues, organs and organisms; in essence, it is the study of life.

This text focuses on human anatomy and physiology. The definition used here to define anatomy is the study of the structure and function of the human body. This allows reference to function as well as structure. In all biological organisms, structure and function are closely interconnected. The human body operates through interrelated systems and, as such, by and large, a systems approach is used in this text.

The Nursing and Midwifery Council

Nursing practice is constantly changing and evolving. The Nursing and Midwifery Council (NMC, 2010), in detailing the field standard for competence for children's nurses, states that the nurse must be able to care safely and effectively for children and young people in all settings to deliver care that meets essential and complex physical and mental health needs informed by a deep understanding of biological, psychological and social factors throughout infancy, childhood and adolescence. This text will help you to further develop and consolidate your knowledge and prepare you to undertake care delivery activities in primary, secondary and tertiary settings.

Theory associated with the biological sciences provides the scientific basis for children's nursing practice; acquiring a sound, up-to-date biological theory is essential for safe, effective professional practice in all healthcare settings. When you apply the knowledge associated with the biological sciences to clinical care you are demonstrating that you are providing safe and effective care, a hallmark of the professional children's nurse in changing contemporary society. Safe, high-quality and effective care for all is something that all health-care professionals should be striving to provide; it is not possible to do this effectively if you do not fully appreciate the whole being, the whole person.

You are undertaking your programme of study in order to acquire the competencies required to meet the criteria for registration with the NMC permitting you to practice as a registered nurse. The application of biological sciences theory encourages critical thinking in practice related to children's nursing as well as helping to provide a rationale for interventions undertaken and to structure care provision that can minimize or avoid complications and adverse consequences.

Chapter content

The essence of the text will be its 'student friendliness' and easy navigation. Each chapter commences with learning outcomes, helping you to pre-plan learning and understand the rationale for the discrete yet intertwined chapters.

There are a number of features provided that aim to help you learn, retain and recall information. Each chapter contains:

- 'Learning outcomes' at the beginning of the chapter.
- Ten 'test your prior knowledge' questions at the beginning of each chapter.
- Boxed clinical applications: applying the anatomy and physiology to common child health conditions to provide a clinical focus.
- Review questions and chapter activities to help reinforce retention and learning.
- A glossary of terms.
- A list of conditions is provided prompting you to make notes about each listed condition.
- A colour-coded format and layout has been used to help enhance learning.
- Full-colour illustrations.

Web-based materials

The text will be supplemented with web-based materials that you are able to access; for example:

- MCQs (long and short answer)
- 'Label the diagram' flashcards
- Glossary of terms used throughout the printed book

There are 19 chapters; the majority of them are concerned with body systems. The first chapter recognizes that a child's health is greatly influenced by social, political and environmental factors (influencing factors), and these complex interrelated dynamics must be acknowledged. As such, the opening chapter provides an overview of the child and society, enabling and reminding you that the care of the child must always be placed in context.

Other chapters at the beginning of the text consider issues such as homeostasis and homeostatic mechanisms and how this important biological concept is evident at microscopic and macroscopic biological levels. Emphasis will be placed on functional and dysfunctional homeostasis. The various scientific principles are addressed early on, leading to chapters related to the cell, genetics and tissues before taking the reader in to the body systems.

We have very much enjoyed writing this text, and we hope that you enjoy reading it and then applying the contents to the care you have the privilege of delivering to children, young people and their families. It has allowed us to share with you our understanding of the anatomy and physiology of the child and young people.

References

NMC (2010) Standards for Pre registration Nursing Education. Nursing and Midwifery Council, London, http://standards.nmc-uk.org/PublishedDocuments/Standards%20for%20pre-registration%20nursing%20education%2016082010.pdf (accessed July 2014).

Rzucidlo, S.E., Shirk, B.J. (2004) Trauma nursing: pediatric patients. *RN*, **76** (6), 36–41.

Acknowledgements

Ian would like to thank his partner Jussi Lahtinen for his encouragement and Mrs Frances Cohen for her constant inspiration and support.

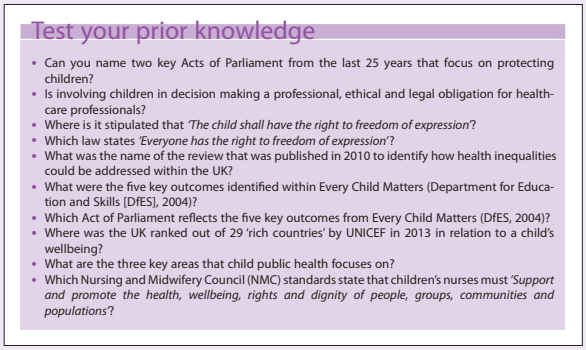
Liz would like to thank her husband, Kieran, and Kate and Eilis, her daughters, for their love, support and patience.

Ian and Liz would like to thank all their colleagues for their help, support and guidance with this book.

How to use your textbook

Features contained within your textbook

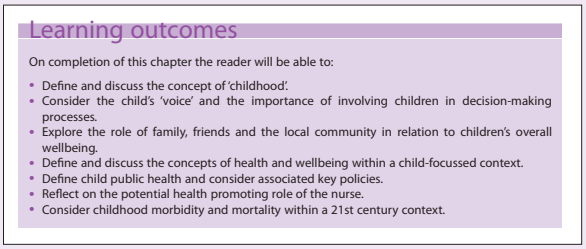
Every chapter begins with 10 **test your prior knowledge questions**.



Test your prior knowledge

- Can you name two key Acts of Parliament from the last 25 years that focus on protecting children?
- Is involving children in decision making a professional, ethical and legal obligation for health-care professionals?
- Where is it stipulated that *'The child shall have the right to freedom of expression'*?
- Which law states *'Everyone has the right to freedom of expression'*?
- What was the name of the review that was published in 2010 to identify how health inequalities could be addressed within the UK?
- What were the five key outcomes identified within Every Child Matters (Department for Education and Skills [DfES], 2004)?
- Which Act of Parliament reflects the five key outcomes from Every Child Matters (DfES, 2004)?
- Where was the UK ranked out of 29 'rich countries' by UNICEF in 2013 in relation to a child's wellbeing?
- What are the three key areas that child public health focuses on?
- Which Nursing and Midwifery Council (NMC) standards state that children's nurses must *'Support and promote the health, wellbeing, rights and dignity of people, groups, communities and populations'*?

Learning outcome boxes give a summary of the topics covered in a chapter.

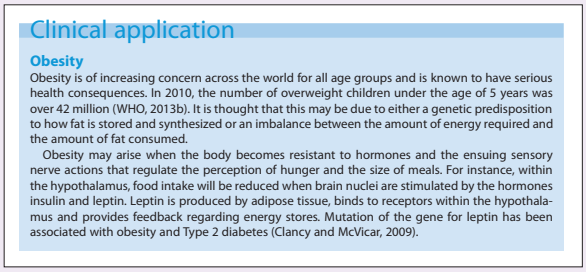


Learning outcomes

On completion of this chapter the reader will be able to:

- Define and discuss the concept of 'childhood'.
- Consider the child's 'voice' and the importance of involving children in decision-making processes.
- Explore the role of family, friends and the local community in relation to children's overall wellbeing.
- Define and discuss the concepts of health and wellbeing within a child-focussed context.
- Define child public health and consider associated key policies.
- Reflect on the potential health promoting role of the nurse.
- Consider childhood morbidity and mortality within a 21st century context.

Clinical application boxes give inside information on a topic.



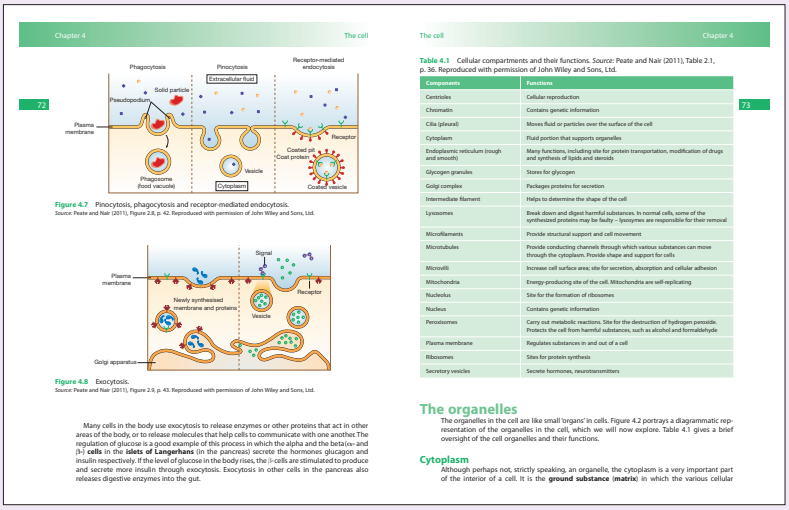
Clinical application

Obesity

Obesity is of increasing concern across the world for all age groups and is known to have serious health consequences. In 2010, the number of overweight children under the age of 5 years was over 42 million (WHO, 2013b). It is thought that this may be due to either a genetic predisposition to how fat is stored and synthesized or an imbalance between the amount of energy required and the amount of fat consumed.

Obesity may arise when the body becomes resistant to hormones and the ensuing sensory nerve actions that regulate the perception of hunger and the size of meals. For instance, within the hypothalamus, food intake will be reduced when brain nuclei are stimulated by the hormones insulin and leptin. Leptin is produced by adipose tissue, binds to receptors within the hypothalamus and provides feedback regarding energy stores. Mutation of the gene for leptin has been associated with obesity and Type 2 diabetes (Clancy and McVicar, 2009).

Your textbook is full of **illustrations and tables**.



Chapter 4 The cell

72

Figure 4.7 Pinocytosis, phagocytosis and receptor-mediated endocytosis.
Source: Peate and Nair (2011), Figure 2.8, p. 42. Reproduced with permission of John Wiley and Sons, Ltd.

Figure 4.8 Exocytosis.
Source: Peate and Nair (2011), Figure 2.9, p. 43. Reproduced with permission of John Wiley and Sons, Ltd.

Many cells in the body use exocytosis to release enzymes or other proteins that act in other areas of the body, or to release molecules that help cells to communicate with one another. The regulation of glucose is a good example of this process in which the alpha and the beta(α- and β-) **cells** in the **islets of Langerhans** ((in the pancreas) secrete the hormones glucagon and insulin respectively. If the level of glucose in the body rises, the ß-cells are stimulated to produce and secrete more insulin through exocytosis. Exocytosis in other cells in the pancreas also releases digestive enzymes into the gut.

The cell Chapter 4

73

Table 4.1 Cellular compartments and their functions. *Source:* Peate and Nair (2011), Table 2.1, p. 36. Reproduced with permission of John Wiley and Sons, Ltd.

Components	Functions
Centrioles	Cellular reproduction
Chromatin	Contains genetic information
Cilia (pleural)	Moves fluid or particles over the surface of the cell
Cytoplasm	Fluid portion that supports organelles
Endoplasmic reticulum (rough and smooth)	Many functions, including site for protein transportation, modification of drugs and synthesis of lipids and steroids
Glycogen granules	Stores for glycogen
Golgi complex	Packages proteins for secretion
Intermediate filament	Helps to determine the shape of the cell
Lysosomes	Break down and digest harmful substances. In normal cells, some of the synthesized proteins may be faulty – lysosymes are responsible for their removal
Microfilaments	Provide structural support and cell movement
Microtubules	Provide conducting channels through which various substances can move through the cytoplasm. Provide shape and support for cells
Microvilli	Increase cell surface area; site for secretion, absorption and cellular adhesion
Mitochondria	Energy-producing site of the cell. Mitochondria are self-replicating
Nucleolus	Site for the formation of ribosomes
Nucleus	Contains genetic information
Peroxisomes	Carry out metabolic reactions. Site for the destruction of hydrogen peroxide. Protects the cell from harmful substances, such as alcohol and formaldehyde
Plasma membrane	Regulates substances in and out of a cell
Ribosomes	Sites for protein synthesis
Secretory vesicles	Secrete hormones, neurotransmitters

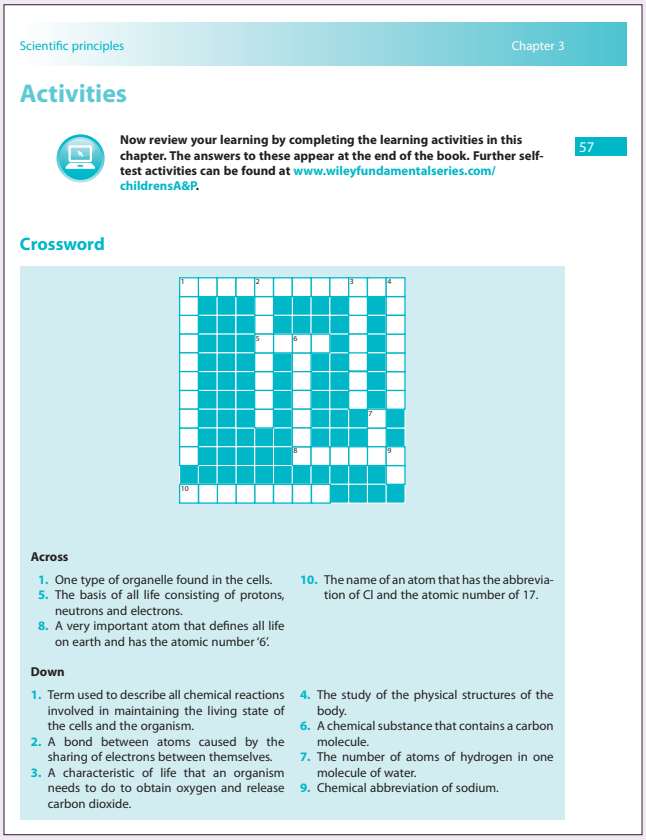
The organelles

The organelles in the cell are like small 'organs' in cells. Figure 4.2 portrays a diagrammatic representation of the organelles in the cell, which we will now explore. Table 4.1 gives a brief oversight of the cell organelles and their functions.

Cytoplasm

Although perhaps not, strictly speaking, an organelle, the cytoplasm is a very important part of the interior of a cell. It is the **ground substance** (**matrix**) in which the various cellular

End of chapter **activities** help you test yourself after each chapter.



Scientific principles Chapter 3

57

Activities

Now review your learning by completing the learning activities in this chapter. The answers to these appear at the end of the book. Further self-test activities can be found at www.wileyfundamentalseries.com/childrensA&P.

Crossword

Across

1. One type of organelle found in the cells.
5. The basis of all life consisting of protons, neutrons and electrons.
8. A very important atom that defines all life on earth and has the atomic number '6'.
10. The name of an atom that has the abbreviation of Cl and the atomic number of 17.

Down

1. Term used to describe all chemical reactions involved in maintaining the living state of the cells and the organism.
2. A bond between atoms caused by the sharing of electrons between themselves.
3. A characteristic of life that an organism needs to do to obtain oxygen and release carbon dioxide.
4. The study of the physical structures of the body.
6. A chemical substance that contains a carbon molecule.
7. The number of atoms of hydrogen in one molecule of water.
9. Chemical abbreviation of sodium.

The website icon indicates that you can find accompanying resources on the book's companion website.

The anytime, anywhere textbook

Wiley E-Text

For the first time, your textbook comes with free access to a **Wiley E-Text: Powered by VitalSource** version – a digital, interactive version of this textbook which you own as soon as you download it. Your **Wiley E-Text** allows you to:

Search: Save time by finding terms and topics instantly in your book, your notes, even your whole library (once you've downloaded more textbooks)
Note and Highlight: Colour code, highlight and make digital notes right in the text so you can find them quickly and easily
Organize: Keep books, notes and class materials organized in folders inside the application
Share: Exchange notes and highlights with friends, classmates and study groups
Upgrade: Your textbook can be transferred when you need to change or upgrade computers
Link: Link directly from the page of your interactive textbook to all of the material contained on the companion website

Image not available in this digital edition.

The **Wiley E-Text** version will also allow you to copy and paste any photograph or illustration into assignments, presentations and your own notes.

To access your Wiley E-Text:

- Find the redemption code on the inside front cover of this book and carefully scratch away the top coating of the label. Visit **www.vitalsource.com/software/bookshelf/downloads** to download the Bookshelf application to your computer, laptop, tablet or mobile device.
- If you have purchased this title as an e-book, access to your **Wiley E-Text** is available with proof of purchase within 90 days. Visit **http://support.wiley.com** to request a redemption code via the 'Live Chat' or 'Ask A Question' tabs.
- Open the Bookshelf application on your computer and register for an account.
- Follow the registration process and enter your redemption code to download your digital book.
- For full access instructions, visit **www.wileyfundamentalseries.com/childrenA&P**.

The VitalSource Bookshelf can now be used to view your Wiley E-Text on iOS, Android and Kindle Fire!

- **For iOS:** Visit the app store to download the VitalSource Bookshelf: **http://bit.ly/17ib3XS**
- **For Android and Kindle Fire:** Visit the Google Play Market to download the VitalSource Bookshelf: **http://bit.ly/BSAAGP**

You can now sign in with the email address and password you used when you created your VitalSource Bookshelf Account.

Full E-Text support for mobile devices is available at: **http://support.vitalsource.com**

CourseSmart

CourseSmart gives you instant access (via computer or mobile device) to this Wiley-Blackwell e-book and its extra electronic functionality, at 40% off the recommended retail print price. See all the benefits at **www.coursesmart.com/students**.

Instructors … receive your own digital desk copies!

CourseSmart also offers instructors an immediate, efficient, and environmentally-friendly way to review this textbook for your course.

Image not available in this digital edition.

For more information visit **www.coursesmart.com/instructors**.

With **CourseSmart**, you can create lecture notes quickly with copy and paste, and share pages and notes with your students. Access your **CourseSmart** digital textbook from your computer or mobile device instantly for evaluation, class preparation, and as a teaching tool in the classroom.

Simply sign in at **http://instructors.coursesmart.com/bookshelf** to download your Bookshelf and get started. To request your desk copy, hit 'Request Online Copy' on your search results or book product page.

We hope you enjoy using your new textbook. Good luck with your studies!

About the companion website

Don't forget to visit the companion website for this book:

www.wileyfundamentalseries.com/childrensA&P

There you will find valuable material designed to enhance your learning, including:

- Interactive multiple choice questions
- 'Label the diagram' flashcards
- Searchable glossary

Scan this QR code to visit the companion website:

Chapter 1

The child in society: enhancing health and wellbeing

Lisa Whiting and Mary Donnelly

School of Health and Social Work, University of Hertfordshire, Hatfield, UK

Aim

The aim of this chapter is to consider the concept of childhood and the enhancement of the overall health and wellbeing of children and young people.

Learning outcomes

On completion of this chapter the reader will be able to:

- Define and discuss the concept of 'childhood'.
- Consider the child's 'voice' and the importance of involving children in decision-making processes.
- Explore the role of family, friends and the local community in relation to children's overall wellbeing.
- Define and discuss the concepts of health and wellbeing within a child-focussed context.
- Define child public health and consider associated key policies.
- Reflect on the potential health promoting role of the nurse.
- Consider childhood morbidity and mortality within a 21st century context.

Fundamentals of Children's Anatomy and Physiology: A Textbook for Nursing and Healthcare Students, First Edition. Edited by Ian Peate and Elizabeth Gormley-Fleming.

Companion website: www.wileyfundamentalseries.com/childrensA&P

Test your prior knowledge

- Can you name two key Acts of Parliament from the last 25 years that focus on protecting children?
- Is involving children in decision making a professional, ethical and legal obligation for health-care professionals?
- Where is it stipulated that *'The child shall have the right to freedom of expression'*?
- Which law states *'Everyone has the right to freedom of expression'*?
- What was the name of the review that was published in 2010 to identify how health inequalities could be addressed within the UK?
- What were the five key outcomes identified within Every Child Matters (Department for Education and Skills [DfES], 2004)?
- Which Act of Parliament reflects the five key outcomes from Every Child Matters (DfES, 2004)?
- Where was the UK ranked out of 29 'rich countries' by UNICEF in 2013 in relation to a child's wellbeing?
- What are the three key areas that child public health focuses on?
- Which Nursing and Midwifery Council (NMC) standards state that children's nurses must *'Support and promote the health, wellbeing, rights and dignity of people, groups, communities and populations'*?

Introduction

> *Health in childhood determines health throughout life and into the next generation. … Ill health or harmful lifestyle choices in childhood can lead to ill health throughout life, which creates health, financial and social burdens for countries today and tomorrow.*
>
> (World Health Organization [WHO], 2005: ix)

This quote confirms that the promotion and maintenance of children's health and wellbeing is of paramount importance, both now and for the future; this is something that has been widely recognized and has received considerable attention (e.g. the UK Department for Education and Skills [DfES], 2004; DfES and Department of Health [DH], 2004; Department for Children, Schools and Families [DCSF], 2007a; DCSF and DH, 2009; DH, 2010a–c; Department for Education [DfE], 2011).

Children are a fundamental and invaluable part of society. To promote their overall health, it is essential that key aspects of children's lives are appreciated, as well as some of the factors that have the potential to impact on their overall wellbeing. This chapter provides an introduction to the concept of childhood, reflecting on the child's 'voice' and the importance of involving children in any decisions that may affect them. The significance of the child's immediate environment, in terms of their family, friends and community, is considered; this is followed by a discussion focussing on children's health and wellbeing (including the public health agenda) and the potential health-promoting role of the nurse. The chapter concludes by briefly considering childhood morbidity and mortality, thus 'setting the scene' for the subsequent chapters.

The term 'child', used throughout the chapter, refers to children and young people aged between 0 and 18 years.