

Principles of Pathophysiology



Shane Bullock | Majella Hales

Second Edition

Detailed table of contents

About the authors	xii	Autosomal dominant inheritance	55
Preface	xiii	Autosomal recessive inheritance	56
Acknowledgements	xv	X-linked inheritance	56
Features of the text	xvi	Chromosomal abnormalities	57
Educator resources	xviii	Threshold and penetrance	61
		Principles of multifactorial inheritance	64
		Congenital malformations	64
PART 1		5 NEOPLASIA	69
Cellular and tissue pathophysiology	1	Introduction	69
1 PATHOPHYSIOLOGICAL TERMINOLOGY, CELLULAR ADAPTATION AND INJURY	2	Epidemiology of cancer	70
Introduction	3	Carcinogenicity and cancer	75
Important terminology	3	Characteristics of cancer cells	77
Cellular responses to stimuli	3	Tumour invasion and metastasis	82
Cellular adaptations	5	Classification of tumours	82
Maladaptive cellular adaptation	7	Clinical manifestations of cancer	84
Cellular injury	7	Screening, diagnosis and management	87
Agents of cell injury	12		
2 DETERMINANTS OF HEALTH AND ILLNESS	20	PART 2	
Introduction	20	Body defences and immune system pathophysiology	99
Determinants of health and illness	21	6 STRESS AND ITS ROLE IN DISEASE	100
Disease burden and mortality	22	Introduction	100
Individual factors influencing health	23	Stressors	101
Sociocultural and socioeconomic determinants of health	28	Historical perspectives on the stress response	101
Environmental determinants of health	30	Current perspectives on the stress response	104
The Australian context	34	Ageing and the stress response	105
		Sex differences in the stress response	105
3 INFLAMMATION AND HEALING	39	7 IMMUNE DISORDERS	112
Introduction	40	Introduction	112
Acute inflammation	40	An overview of immune function	113
Chronic inflammation	44	Types of immune dysfunction	114
Healing and repair	44	Immune overactivity	120
4 GENETIC DISORDERS	53	8 INFECTION	131
Introduction	54	Introduction	131
Principles of genetic inheritance	54	Infectious organisms	132
Clinical diagnosis	55	Types of colonisation by microorganisms	137
		Chain of transmission	138

Antimicrobial drugs	140	15 MENTAL HEALTH DISORDERS	291
Emerging infectious diseases	142	Introduction	291
PART 3		Mental health and illness classified	292
Nervous system pathophysiology	149	Factors influencing mental health and wellness	292
9 BRAIN AND SPINAL CORD DYSFUNCTION	150	Brain regions involved in affect, cognition and behaviour	292
Introduction	151	Affective disorders	292
Consciousness	151	Anxiety disorders	298
Cerebrovascular accidents	155	Microbiome–gut–brain axis	301
CNS infections	161	Psychosis	305
Guillain–Barré syndrome	165	Substance dependence and behavioural addictions	306
Hydrocephalus	166	Dual diagnosis	317
Cerebral palsy	167	PART 4	
Cerebellar disorders	169	Endocrine pathophysiology	325
Neural tube defects	169	16 CONCEPTS OF ENDOCRINE DYSFUNCTION	326
10 NEURODEGENERATIVE DISORDERS	177	Introduction	326
Introduction	177	The importance of endocrine feedback mechanisms	327
Common pathophysiological processes implicated in neurodegeneration	178	Types of pathophysiological mechanisms	328
Parkinson's disease	179	Methods used to assess endocrine function	332
Alzheimer's disease	183	Principles of treatment	333
Huntington's disease	187	17 HYPOTHALAMIC–PITUITARY DISORDERS	339
Multiple sclerosis	189	Introduction	339
Motor neurone disease	191	Growth hormone	340
11 NEUROTRAUMA	199	Prolactin hypersecretion	346
Introduction	200	Antidiuretic hormone	347
Traumatic brain injury (TBI)	200	Multi-hormone pituitary disruptions	350
Spinal cord injury	211	18 THYROID AND PARATHYROID DISORDERS	361
12 SEIZURES AND EPILEPSY	234	Introduction	362
Introduction	234	Thyroid disorders	363
Seizures	235	Parathyroid disorders	369
13 NOCICEPTION AND PAIN	249	19 ADRENAL GLAND DISORDERS	379
Introduction	250	Introduction	380
Epidemiology of pain	250	Disorders of the adrenal cortex	380
Nociception and pain	250	Disorders of the adrenal medulla	391
Pain assessment	256	20 DIABETES MELLITUS	400
Neuropathic pain	259	Introduction	401
Clinical diagnosis and management of pain	262	Type 1 diabetes mellitus	401
14 DISORDERS OF THE SPECIAL SENSES	269	Type 2 diabetes mellitus	402
Introduction	269	Gestational diabetes	404
Vision impairment	270	Clinical manifestations and complications of diabetes	407
Hearing impairment	278	Clinical diagnosis and management of diabetes mellitus	410
Balance and vestibular disorders	285		

PART 5

Cardiovascular pathophysiology	419
21 BLOOD DISORDERS	420
Introduction	421
Anaemias	421
Decreased production of erythrocytes	421
Increased destruction of erythrocytes: extracellular causes	428
Increased destruction of erythrocytes: intracellular causes	430
Loss of erythrocytes from blood loss	432
Polycythaemias	433
Haemophilias	435
Thrombocytopenia	437
Leukaemia and lymphoma	437
Multiple myeloma	443
22 VASCULAR DISORDERS AND CIRCULATORY SHOCK	450
Introduction	451
Hypertension	451
Common conditions affecting arteries	455
Aneurysms	458
Arteriovenous malformations	460
Common conditions affecting veins	463
Thrombophlebitis and phlebothrombosis	465
Circulatory shock	467
23 CORONARY ARTERY DISEASE	478
Introduction	478
Coronary artery disease	480
Acute coronary syndrome	488
24 CARDIAC MUSCLE AND VALVE DISORDERS	498
Introduction	499
Heart failure	499
Other causes of heart failure	504
Heart failure: risk factors, clinical manifestations, complications and diagnosis and management	512
25 DYSRHYTHMIAS	522
Introduction	522
Aetiology and pathophysiology	523
Clinical manifestations	528
Clinical diagnosis and management	531

PART 6

Pulmonary pathophysiology	543
26 PULMONARY DYSFUNCTION	544
Introduction	545
Respiratory rate, rhythm and depth	545
Alterations in oxygen and carbon dioxide levels	551
Pulmonary dysfunction	555
Respiratory assessments and investigations	559
Respiratory failure	568
27 OBSTRUCTIVE PULMONARY DISORDERS	579
Introduction	579
Asthma	580
Status asthmaticus	586
Bronchitis	587
Emphysema	590
Mechanisms of gas trapping	595
Cystic fibrosis	596
Bronchiectasis	601
28 RESTRICTIVE RESPIRATORY DISORDERS	609
Introduction	609
Parenchymal lung disorders	610
Extraparenchymal lung disorders	620
29 RESPIRATORY INFECTIONS, CANCERS AND VASCULAR CONDITIONS	631
Introduction	632
Respiratory infections	632
Upper respiratory tract infections	632
Lower respiratory tract infections	634
Lung cancer	642
Pulmonary vascular conditions	650

PART 7

Fluid, electrolyte and renal pathophysiology	667
30 FLUID IMBALANCES	668
Introduction	668
Distribution of body water and fluid balance	669
Compartment osmolality	670
Alterations in body fluid levels	670

Fluid deficits	670	Chronic inflammatory bowel diseases	790
Fluid excesses	671	Intestinal obstruction	794
31 ELECTROLYTE IMBALANCES	683	38 DISORDERS OF THE LIVER, GALL BLADDER AND PANCREAS	805
Introduction	683	Introduction	805
Distribution of electrolytes	684	An overview of the pathophysiology of hepatobiliary disease	806
Electrolyte imbalances	685	Major hepatobiliary diseases	809
32 COMMON INFLAMMATORY DISORDERS OF THE KIDNEYS AND URINARY TRACT	704	Major pancreatic diseases	820
Introduction	704	Cystic fibrosis	823
The normal kidneys	705	PART 9	
Bacterial urinary tract infections	705	Reproductive pathophysiology	831
Kidney disorders	708	39 FEMALE REPRODUCTIVE DISORDERS	832
Urinary incontinence	718	Introduction	833
33 RENAL NEOPLASMS AND OBSTRUCTIONS	725	Menstrual disorders	833
Introduction	725	Genitourinary prolapse	836
Polycystic kidney disease	726	Reproductive neoplasms	839
Renal system cancers	727	Female reproductive cancers	842
Renal obstructions	731	Inflammatory and infectious disorders	843
34 ACUTE KIDNEY INJURY AND CHRONIC KIDNEY DISEASE	739	Breast disorders	846
Introduction	740	Ectopic pregnancy	851
Acute kidney injury	740	Female infertility	852
Chronic kidney disease	742	40 MALE REPRODUCTIVE DISORDERS	861
PART 8		Introduction	861
Gastrointestinal pathophysiology	753	Prostate disorders	862
35 GASTRO-OESOPHAGEAL REFLUX DISEASE AND PEPTIC ULCER DISEASE	754	Urethral and penile disorders	867
Introduction	755	Testicular and scrotal disorders	874
Gastro-oesophageal reflux disease	755	Sexually transmitted infections	879
Peptic ulcer disease	758	PART 10	
36 MALABSORPTION SYNDROMES	766	Musculoskeletal pathophysiology	887
Introduction	767	41 MUSCULOSKELETAL TRAUMA AND MUSCLE DISORDERS	888
Maldigestion	767	Introduction	889
Impaired mucosal function	768	Musculoskeletal trauma	889
Alterations in microbial flora	772	Fractures	894
37 INTESTINAL DISORDERS	780	Muscle disorders	901
Introduction	781	Inflammatory myopathies	904
Infectious conditions of the intestines	781	Muscular dystrophy	907
Acute inflammatory conditions of the intestines	784	Muscle atrophy	908
Intestinal neoplasms	787	Muscle contractures	909
		Muscle cramp	909
		Delayed onset muscle soreness (DOMS)	910
		Rhabdomyolysis	911

42 BONE AND JOINT DISORDERS	919	44 SKIN CANCERS, BURNS AND SCARRING	994
Introduction	920	Introduction	994
Bone and joint developmental disorders	920	Skin cancers	994
Arthritis	926	Burns	998
Metabolic bone and joint diseases	937	Scarring	1005
Infective bone disorders	946		
Osteogenic tumours	947	45 BITES AND STINGS	1012
PART 11		Introduction	1012
Integumentary system pathophysiology	957	Spider bites	1013
		Snake bites	1015
43 INTEGUMENTARY SYSTEM DISORDERS	958	Tick bites	1017
Introduction	959	Wasp and bee stings	1018
Inflammatory skin conditions	959	Marine bites and stings	1019
Skin infections	967		
Viral infections	972	Glossary	1024
Fungal infections	976	Index	1042
Parasitic infections	979		
Dermal appendage disorders	980		



About the authors

SHANE BULLOCK

Shane has been involved in the education of health professionals and science students for more than 30 years. He is an academic at the Monash University School of Rural Health, where he is responsible for the delivery of the first year of the university's graduate-entry medical course. Shane is the co-author of two Australian textbooks, *Fundamentals of Pharmacology*, now in its 8th edition, and *Psychopharmacology for Health Professionals*. He has also published a number of journal articles on health professional education.

MAJELLA HALES

Majella has been nursing for over 25 years, much of this time in education roles both clinically and in academia. She is the co-founder of *Sciencopia*, a business producing and manufacturing educational resources for nurses and other undergraduate health care professionals. She maintains her clinical experience working occasional agency shifts in critical care units across south-east Queensland and through clinical facilitation with undergraduate nursing students. Majella authored several chapters of Kozier & Erb's *Fundamentals of Nursing Vols 1–3* and LeMone and Burke's *Medical–Surgical Nursing*. Along with journal articles and conference presentations, she has also produced the original skills DVD for *Tollefson's Clinical Psychomotor Skills* text, and adapted the American case study resource *The Neighbourhood*. She is also co-author of the *Essential Aussie Drugs* pocket-book series.

Preface

OUR GOALS

Principles of Pathophysiology is the first wholly local, comprehensive pathophysiology textbook written for students studying nursing and allied health in Australia and New Zealand. Where possible we have embedded throughout this text epidemiological data, lifespan issues, Indigenous issues, clinical practices, drug names, units of measurement and websites that are relevant to the Australian and New Zealand region.

Most of the existing pathophysiology books are unwieldy in both a physical and a readable sense. There is a common format—around half of the book comprises chapters on the normal anatomy and physiology of the body systems. In our view these chapters are redundant, as student health professionals purchase anatomy and physiology textbooks during their first year at university. The approach that we have taken is to maintain the focus on pathophysiology and to complement other textbooks that the students have at hand that cover anatomy/physiology and pharmacology.

The book is designed to be very readable and accessible for students studying their chosen profession prior to registration. We have endeavoured to strongly link and integrate the science with clinical practice. To this end, each chapter is co-authored by a scientist and an expert clinician, given that few individuals possess both the scientific and clinical expertise in any one field.

ORGANISATION OF THE TEXT

The book is organised into parts covering body system pathophysiology. The first part of the book contains chapters examining major pathophysiological concepts, such as cellular adaptations, inflammation and neoplasia, as well as the determinants of health and illness.

Chapters are structured with a consistent content framework for ease of accessing information about specific disorders associated with a particular body system. This is best reflected in the sequencing of chapter subheadings for each disorder, which are as follows: aetiology and pathophysiology, epidemiology, clinical manifestations, then clinical diagnosis and management.

NEW FOR THIS EDITION

The content of this textbook has been reviewed with respect to the recent literature, as well as current clinical practices and guidelines at the time of writing. In some sections the ordering of chapters has changed, and some chapters have been amalgamated to increase the readability for students.

NEW CHAPTER: DETERMINANTS OF HEALTH AND ILLNESS

The social determinants of health play a significant role in the full assessment and management of a person's illness by health professionals. In this edition a new chapter on the sociocultural, economic, biomedical and behavioural factors that affect health and the development of illness are discussed.

INDIGENOUS HEALTH FAST FACTS AND CULTURAL CONSIDERATIONS

The Indigenous health fast facts have been expanded to include a separate section called 'Cultural considerations'. The focus in this section is on social and cultural issues associated with the chapter content. This responds to reviewer feedback requesting the inclusion of more of the qualitative influence of indigeneity on health and wellness.

NEW IMAGES

A significant number of new images have been produced for this edition. These images provide clearer understanding or representation of either new or reconceptualised content. Several new clinical snapshots have also been constructed to accommodate new best practice, to clarify previously included material, or to expand on content not previously addressed.

LANGUAGE AND TERMINOLOGY

The use of correct scientific and clinical language is important in order to prepare student health professionals for the workplace. However, preparatory textbooks need to be accessible and readable for students developing their knowledge base. We believe that we have struck a good balance in writing style that does not compromise the integrity of the scientific and clinical disciplines.

By their nature, pathophysiology textbooks contain jargon terms that pertain to the science and to the clinical practice. It is important for students to have ready access to definitions of this terminology. In this book, key terms are printed in bold type. All of these terms are defined in the glossary; many are described within the chapter text.

Shane Bullock and Majella Hales

Acknowledgements

We sincerely thank all those people who have contributed to the development of this textbook. We are grateful to the contributors who have worked closely with us to create high-quality and very readable chapters. We also thank the reviewers for their thoughtful and extremely valuable comments and suggestions on the text.

Shane would like to acknowledge that his family carries on living interesting and fulfilling lives around him while he labours through the book writing and production period. You would think that they would prefer to suffer with him. Nevertheless, they always provide a place of quietude to escape the hurly burly outside. Again it was a pleasure to write with Majella on this edition, and her good humour, visually creative talent and love of sloths enlivened this project. Thanks also to his friend and colleague Anna-Marie Babey, who is ever vigilant for important content that should be added or deleted from the text.

Majella would like to give many thanks to her dear friend, mentor and business partner Robin Fisher, who, despite her unique capacity to become air-borne in a vehicle not designed for flight (resulting in quite serious injuries), managed to find the effort and inclination to engage in rigorous intellectual debate to ensure the accuracy and quality of selected chapters. Majella would also like to thank Eun Jeong Roh (friend and business partner) for her incredible illustration skills on several new images. Thanks also to Bonnie Waite (her sister), who worked vigorously on cataloguing images for this edition. Although her remittance seemed to inflate from 'good coffee' in the last edition to frequent Coffee Club visits this edition, her determined efforts were well worth it. Finally, Majella would like to acknowledge the stoicism of her co-author. Shane's display of prodigious humour and the patience akin to a bonsai tree gardener ultimately ensured the completion of this edition.

It has been a pleasure to work with the team at Pearson Australia. They have shown us tremendous support, flexibility, patience, encouragement, good humour and cajoling in equal measure. Our thanks to Mandy Sheppard, Anna Carter, Bernadette Chang, Lisa Woodland and Katy Murenu. We are also grateful to Kate Stone (and her canine assistant) and Katie Millar for their excellent copyediting and proofreading.

CONTRIBUTORS

The authors would like to thank the following contributors for their input to the first edition:

Judith Applegarth
Ralph Arwas
Anna-Marie Babey

Melanie ('Lainie') Cameron
Trisha Dunning
Elizabeth Manias

Anita Westwood
Alison Williams

REVIEWERS

Dr Matthew Barton – Griffith University
Dr Lisa Chilton – James Cook University
Dr David Good – Australian Catholic University
Mrs Courtney Hayes – University of Canberra
Dr Snezana Kusljic – The University of Melbourne
Mrs Anne Marks – Western Sydney University
Ms Gayle McKenzie – La Trobe University
Dr Nicole Reinke – University of the Sunshine Coast

Dr David Simcock – James Cook University
Ms Kate Smith – Curtin University
Associate Professor Louise Ward – La Trobe University
Mr Grant Williams-Pritchard – Griffith University
Reviewer of Indigenous cultural considerations content
Machellee Kosiak – Australian Catholic University

Reviewer of exercise science content in Health professional connections

Dr Peter Le Rossignol – Australian Catholic University

Reviewer of physiotherapy content in Health professional connections

Mrs Allison Kloehs – Australian Catholic University

Features of the text

WHAT YOU SHOULD KNOW BEFORE YOU START THIS CHAPTER

- Can you name the main structures of the cell and their functions?
- Can you describe how molecules are transported across the cell membrane?
- Can you describe the cell cycle?
- Can you define cellular metabolism?
- Can you identify the major types of tissues and their functions?

CLINICAL BOX 9.2

Mnemonic for remembering causes of ALOC

With so many possible causes of ALOC, a helpful mnemonic for clinical practice is AEIOU TIPS.

A Alcohol/Arrhythmia* /Anoxia	T Trauma/Temperature
E Epilepsy/Electrolytes/Encephalopathy	I Infection
I Insulin (blood glucose level ↓ or ↑)	P Pulmonary embolus/Psychosis
O Overdose	S Stroke/Space-occupying lesion/Seizure/Sodium
U Uraemia	

*Generally referred to as 'dysrhythmia' in this book.



INDIGENOUS HEALTH FAST FACTS AND CULTURAL CONSIDERATIONS

- Poor nutrition contributes to approximately 19% of the burden of disease for Aboriginal and Torres Strait Islander peoples.
- Estimations of food costs in rural and remote communities are considered to be approximately 30% higher than in major cities, which probably contributes to the very low fruit and vegetable intake described among Aboriginal and Torres Strait Islander groups.
- Poor nutrition results in the birth of low-birth-weight babies almost twice as frequently in Aboriginal and Torres Strait Islander women than in non-Indigenous women.
- Food security is a greater issue for Aboriginal and Torres Strait Islander peoples, with 22% of people reporting that at least one person went without food when the household ran out of food, compared to 3.7% in non-Indigenous Australian households.
- Māori or Pacific Islander babies are less likely than European New Zealand children to be breastfed.
- Based on a set of predetermined risk factors, Māori children make up 66% of children at risk of developing poor outcomes later in life, compared to 21% of European New Zealand children, 12% of Pacific Islander children and only 2.1% of Asian New Zealand children.
- European New Zealand babies are, on average, given their first solids at approximately 5½ months of age. Māori babies are more likely to be given solids before 4 months of age.

Sources: Australian Bureau of Statistics (2015); Australian Health Ministers' Advisory Council (2017); Australian Indigenous HealthInfoNet (2017); National Health and Medical Research Council (2013); New Zealand Ministry of Health (2017).

What you should know before you start this chapter

These questions ensure that students review the basic bioscience principles and concepts that provide the foundation for the pathophysiological knowledge they will gain in the chapter.

Clinical boxes

This feature highlights considerations specific to the successful clinical application of relevant knowledge to reduce the theory–practice gap.

Indigenous health fast facts and cultural considerations

Important health concerns for Aboriginal and Torres Strait Islander peoples, Māori and Pacific Islander people are highlighted in relation to the issues presented in each chapter. A new feature expanding selected information is presented in the separate section of Cultural considerations. This responds to the reviewer feedback requesting inclusion of more of the qualitative influence of indigeneity on health and wellness.

Lifespan issues

Important health concerns or age-related principles specific to individuals across the age continuum—from neonates and children to older adults—are highlighted.



CHILDREN AND ADOLESCENTS

- Assessment of a child's quadriceps femoris for atrophy or hypertrophy is a good clinical indicator of the need to continue investigations for the presence of neuromuscular disease.
- Hormonal changes from transition through growth stages can influence a child's tissue. Tonsils can hypertrophy during childhood and atrophy after puberty; many other tissues hypertrophy as a result of puberty (e.g. secondary sex characteristics).

OLDER ADULTS

- As an individual ages, significant atrophy occurs in most major organs. These changes result in the increased need to observe for drug toxicities, hydration status, malnutrition and changes to strength and balance.
- Exercise can moderate age-related muscular atrophy to some degree.
- Hyperplasia of the prostate gland occurs as a direct result of ageing, and can negatively affect an older man's urological and sexual function.

Clinical snapshots

These concept maps are designed to demonstrate the critical links between pathophysiology, clinical manifestations and management. They are a key feature for integrating the science and clinical practice components of the text. Ideal for visual learners, the boxes in the diagrams are colour-coded—pink (pathophysiology), blue (clinical manifestations) and yellow (management)—for quicker understanding and application.

Key clinical issues

This is a summary of the significant principles in each chapter that are central to providing safe, informed, clinical practice.

Chapter review and Review questions

A summary of the key content essential to understanding the pathophysiological knowledge in each chapter is provided. Questions enable the student to assess, review and consolidate what they have learnt in the chapter.

Health professional connections

This feature enables students to understand the roles and importance of the various health professionals with whom they will work in an inter-professional team. This information is presented in the context of the management of the specific disorders discussed in each chapter.

Case studies

Clinically accurate and realistic scenarios allow students to apply, synthesise and evaluate their knowledge, and in some instances predict clinical outcomes.

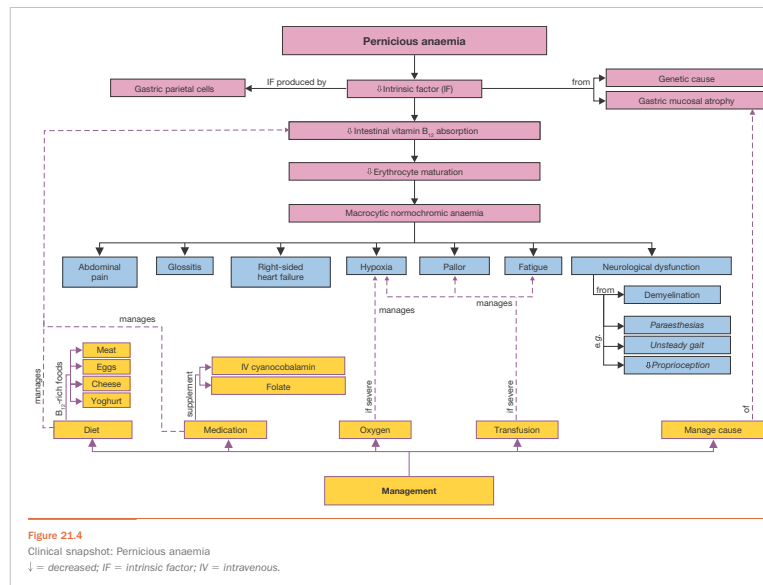


Figure 21.4 Clinical snapshot: Pernicious anaemia
↓ = decreased; IF = intrinsic factor; IV = intravenous.

KEY CLINICAL ISSUES

- Following trauma or surgery excessive inflammation can result in life-threatening neuromuscular compromise. Immediate Request neuromuscular assessment distal to the site of injury. Observe for changes in colour, warmth, movement and sensation.
- Appropriate positioning to promote venous return and lymphatic drainage will assist in reducing oedema.
- Oedema can result in challenges to site integrity. Ensure that pressure area care is undertaken frequently in individuals with excessive inflammation.
- Use of non-steroidal anti-inflammatory drugs (NSAIDs) in the control of inflammation can be beneficial; however, NSAID therapy can also reduce gastric stores, photosensitivity and kidney failure, depending on the dose and the duration of treatment. Use of NSAIDs in certain groups can be dangerous. Individuals with asthma have an increased risk of serious adverse reactions, and the use of aspirin in children is associated with Reye's syndrome.

CHAPTER REVIEW

- The purpose of inflammation is to neutralise an agent of injury and stop further damage. It also prepares the site of injury for healing.
- The cardinal signs of inflammation are swelling, redness, warmth, pain and loss of function. The signs representing an inflammatory condition is site.
- A range of chemicals released into the site of tissue injury mediate the induction and magnitude of the process of inflammation. The key pro-inflammatory chemical mediators are prostaglandins, histamine, leukotrienes, nitric oxide, cytokines, platelet-activating factor, thromboxanes, nitric oxide and neutrophils.
- The vascular phase of acute inflammation comprises tissue vasodilation and increased capillary permeability. Three important cascading reactions contribute to the inflammatory response: the complement system, coagulation and the kinin-kallikrein system.
- The cellular phase involves the movement of immune cells to the site of the inflammation in order to neutralise the agent of injury and prepare the site for healing. The phagocytic cells, monocytes/macrophages and neutrophils play a key role in this phase.
- The fluid that accumulates in the site of inflammation is called an exudate. The four main types of exudate are: serous, fibrinous, purulent and haemorrhagic.
- Chronic inflammation is defined as the persistence of the response for more than two weeks. Chronic inflammation can be distinctly different from the acute response. When this occurs, neutrophils die out and lymphocytes can infiltrate the site along with monocytes/macrophages—these become the dominant cell types in the site. In this stage, there is little evidence of the vascular phase of the acute inflammatory response.
- The definition of acute and chronic inflammation can be simplistic and arbitrary in inflammation, a complex interplay between static factors, which means that aspects of acute inflammation can be present during chronic states, and significant cell damage is not limited to only the chronic form.
- Chronic inflammatory processes may damage parenchymal cells, which are replaced by fibrous connective tissue produced by local fibroblasts. This fibrosis can lead to significant scarring and deformity. Walsall off

REVIEW QUESTIONS

- Identify and define the pathophysiological processes underlying each of the following cardinal signs of inflammation:
 - a swelling
 - b pain
 - c increased warmth
- Determine the body tissue affected in the following inflammatory conditions (Hint: 'You may have to do some research!').
 - a laryngitis
 - b cellulitis
 - c lymphatic
 - d abscess
- What are the roles for each of the following pro-inflammatory chemical mediators?
 - a histamine
 - b cytokines
 - c nitric oxide
 - d leukotrienes
- In what ways does the complement system contribute to inflammation?
 - a osmosis
 - b osmotic
 - c adhesions
 - d fibrinolysis
- Which type of neutrophil is particularly associated with inflammation?
 - a eosinophils
 - b basophils
 - c mast cells
 - d platelets
- Arrange the following in the correct sequence of processes:
 - a scar formation
 - b wound contraction
 - c epithelialisation
 - d debridement
 - e regeneration
- Compare and contrast first and second intention wound healing.
- How can movement and poor blood flow affect wound healing?

HEALTH PROFESSIONAL CONNECTIONS

Midwives Intrauterine inflammation can occur as a result of microbial invasion of the amniotic cavity (IAC). As a result, the risk of preterm labour is increased, and foetal tissue reacting to high temperatures are also amplified. Premature rupture of membranes increases the risk of IAC, and therefore preterm labour. These women are more likely to develop chorioamnionitis. The presence of microbes (or colonisation) alone will not necessarily result in poorer clinical outcomes; however, a fetal inflammatory response may occur which will influence gestation time and premature delivery. Microbial colonisation can occur by ascending through the cervix or, less commonly, as a haematogenous dissemination, or from instrumentation from invasive procedures such as amniocentesis. Midwives should be familiar with the signs of IAC, and ensure that they seek assistance from other members of the health care team to ensure a positive outcome.

Physiotherapists/Exercise scientists Exercise can reduce C-reactive protein and inflammatory cytokines. It is well established that exercise can have anti-inflammatory effects; however, some important considerations—such as the type, duration and intensity of the exercise—can influence this effect. Exercise science can reduce pro-inflammatory mediators as well as anti-inflammatory cytokines. It is important to understand the influence of short-term strenuous exercise and also prolonged exercise on the immune system and the inflammatory response. Exercise professionals assisting clients with inflammatory disorders must ensure that the individual effects of the disease process are considered when developing an exercise or rehabilitation program.

All allied professionals Inflammation can be a sign of infection. It is important that when working with a client, all observations of inflammation are reported to other members of the health care team so that further investigation and management can be instituted. Early treatment will often result in a less serious clinical outcome, reducing morbidity and mortality risks. Open communication with all members of the health care team will result in the provision of a better service.

CASE STUDY

Mrs Linda Carter is a 35-year-old woman (UR number 654238). She has been admitted for management of cellulitis on her right calf. She suspects the original insult was a spider bite, although she never saw the spider. However, she did see two small puncture marks when she first noticed the wound. Over the next few days, the site became red and inflamed, a red line began tracking up the inside of her right thigh, and she developed bilateral inguinal lymphadenopathy. Her observations were as follows:

Temperature	Heart rate	Respiration rate	Blood pressure	SpO ₂
38°C	80	20	127/76	98% (RA*)

*RA = room air.

Mrs Carter was commenced on intravenous antibiotics, paracetamol q6h PRN and daily dressings as necessary. Although no pus was observed, a swab was taken of the lesion. Her admission pathology results have returned as shown overleaf.

Educator resources

A suite of learning resources is provided to assist with delivery of the content, as well as to support teaching and learning.

TEST BANK

The Test Bank provides a wealth of accuracy-verified testing material. Updated for the new edition, each chapter offers a wide variety of question types, arranged by learning objective and tagged by NMBA standards. Questions can be integrated into Blackboard, Canvas or Moodle Learning Management Systems.

DIGITAL IMAGE POWERPOINT SLIDES

All the diagrams and tables from the course content are available for lecturer use.

SOLUTIONS MANUAL

The Solutions Manual provides educators with detailed, accuracy-verified solutions to in-chapter and end-of-chapter problems in the book.