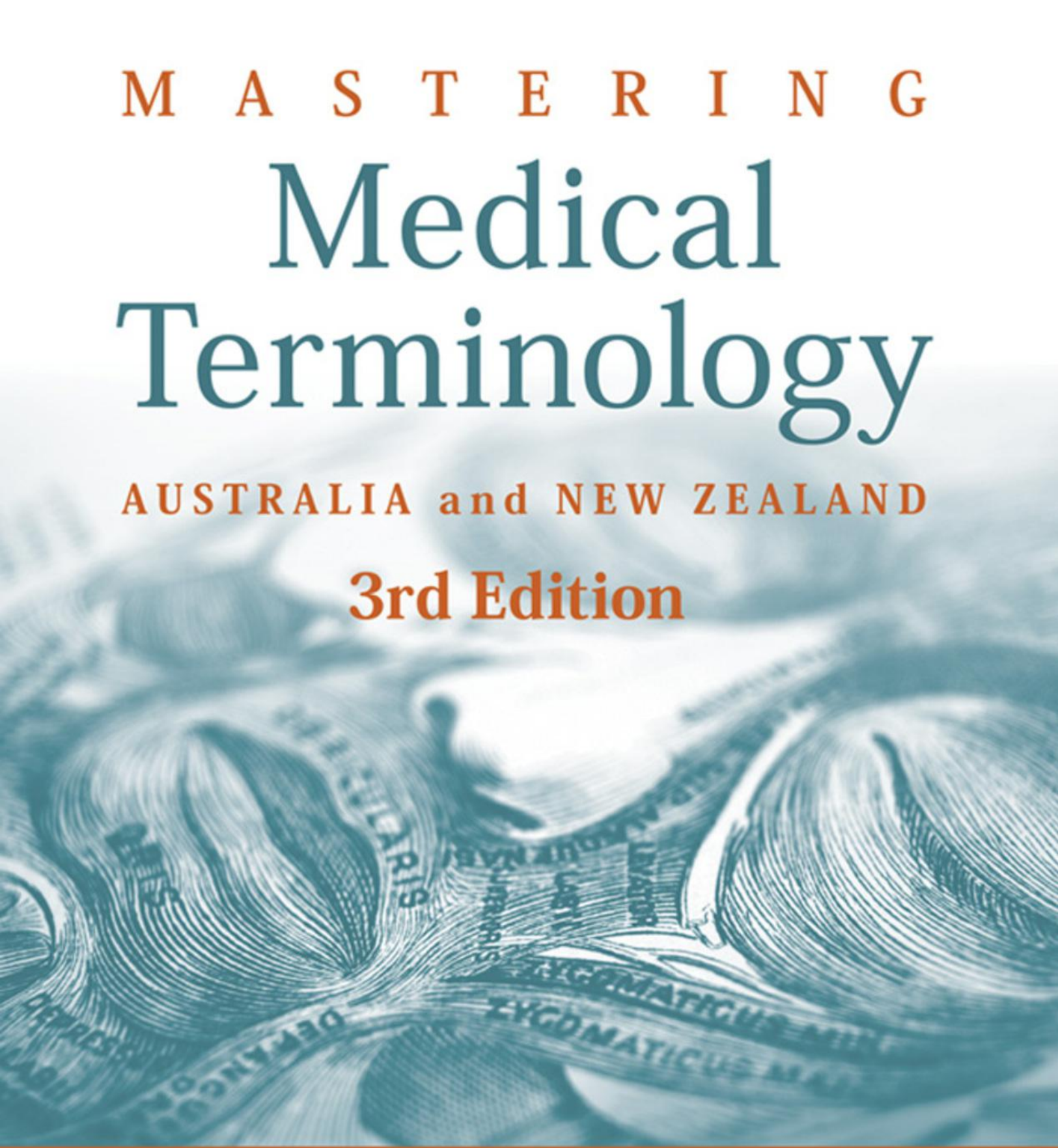
MASTERING
Medical Terminology
AUSTRALIA and NEW ZEALAND
3rd Edition



Sue Walker • Maryann Wood • Jenny Nicol

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MASTERING

Medical Terminology

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M A S T E R I N G

Medical Terminology

3rd edition

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Module 3: Internal Workings of the Body

Module 5: Special Applications

Preface

Welcome to *Mastering Medical Terminology: Australia and New Zealand, 3rd edition*. This text has been written to provide a medical terminology book that will be relevant to an audience in Australia and New Zealand. Australian terminology, perspectives, examples and spelling have been included and Australian pronunciation specified. Where appropriate, specific references to New Zealand examples have also been included.

The textbook provides instructional materials, a pronunciation guide and practice exercises to reinforce learning about each body system and specialty area. Examples and practical applications show medical terms in context. Diagrams and illustrations enhance understanding of the words you will read.

We hope this textbook will demonstrate the importance of the correct use of medical terminology in communicating information about clinical care. We have developed the textbook using British spelling as seen in Australian and New Zealand health care. It should be noted that many other textbooks incorporate American spelling. Both forms of spelling are equally correct but different countries prefer to use one form over the other. Most countries that have been part of the British Commonwealth at some point in their history choose to use British spelling.

There are two terms that cause a lot of confusion for students and practitioners alike. First, there seems to be a significant misunderstanding with the spelling of the medical term 'fetus'. Although many medical terms with the letter 'e' have the digraph 'oe' when spelled the British way, *fetus* is an exception. According to the *Chambers Guide to Grammar and Usage* by George Davidson (1998), the term originates from the Latin *ferare* meaning to conceive, and not *foetere* meaning to give birth, thus adding an 'o' to the word 'fetus' is actually a grammatical over-correction. To reiterate, the correct spelling is 'fetus'. 'Foetus' is incorrect. It would be useful to make a note of this now.

Similarly, there is often confusion about the correct use of the suffix *-cele*, the suffix *-coele* and the word root *coel/*. *-coele* and *coel/* mean a cavity of the body, while *-cele* refers to a hernia or swelling. Again, it would be useful to make a note of this information.

Where there has been any question about the appropriate spelling for a medical term, we have deferred to that recommended in *Mosby's Dictionary of Medicine, Nursing & Health Professions* (revised 3rd Australian and New Zealand edition) by Harris P, Nagy S and Vardaxis N.

Throughout *Mastering Medical Terminology*, review of medical terminology as it is used in clinical practice is highlighted. Features of the textbook include:

- simple, non-technical explanations of medical terms
- explanations of clinical procedures, laboratory tests and abbreviations used in Australian clinical practice, as they apply to each body system and specialty area
- pronunciation of terms and spaces to write meanings of terms
- exercises that test your understanding of terminology as you work through the text chapter by chapter
- ample space to write answers to exercises
- a comprehensive glossary and appendices for reference as you study and then later as you use medical terminology
- links to other useful references such as websites and textbooks.

Our goal in creating the third edition of *Mastering Medical Terminology* is to help students learn and to help instructors teach medical terms that are relevant to the Australian and New Zealand healthcare environments. Using an interactive, logical, interesting and easy-to-follow process of instruction, you will find that medical terminology comes 'alive' and begins to make sense. We cannot deny that studying medical terminology is like learning a foreign language. It requires commitment and hard work, but ultimately you will see the benefits. The knowledge that you gain will be valuable for your career in the health workplace and will help you for years to come.

Acknowledgments

We appreciate the guidance and support of our editorial team at Elsevier. It has been great to have you helping us and keeping us on track as we have worked through the revision of this textbook.

We extend our thanks to the reviewers of our work, whose interest in the text and constructive comments have been extremely useful in shaping the final product. We hope you will find the outcome beneficial in your own teaching and learning.

Finally, we would like to thank our families, friends and workmates for their support, encouragement, advice and good humour during the writing of the third edition of this textbook. It has been several years of hard work, but we think you will agree that it has been worthwhile.

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How to use this book

This book contains 24 chapters divided into five modules. The first module provides an introduction to medical terminology by looking at the basic structure of medical words and how medical terms can be constructed and deconstructed using word roots, prefixes, suffixes and combining vowels. Module 2 gives a general overview of the body as a framework, focusing on the body as a whole, followed by the musculoskeletal and integumentary systems. Module 3 covers each of the internal body systems. The order in which these chapters are completed is not critical. They can be studied in the sequence provided or in any other order, but we believe the structure of the book is in a logical format from an educational perspective. The fourth module provides details about systemic conditions, such as oncology and infectious diseases, followed by chapters relating to radiology and nuclear medicine, and pharmacology. The final module relates to special applications of medical terminology and provides glossaries of terms used for alternative and complementary therapies and in public health, epidemiology and clinical research. The appendices provide useful lists of abbreviations, a word element glossary, a glossary of medical terms and normal reference values for haematological testing.

To facilitate your learning within each body system chapter, the text has been divided into sections as is relevant to that system:

- Objectives
- Introduction
- New word elements
- Combining forms
- Prefixes
- Suffixes
- Vocabulary
- Abbreviations
- Functions and structure of the body system
- Pathology and diseases
- Tests and procedures
- Exercises.

This textbook should not be used as the only reference when learning medical terminology. You will need to use a comprehensive medical dictionary, such as *Mosby's Dictionary of Medicine, Nursing & Health Professions (revised 3rd Australian and New Zealand edition)* by Harris P, Nagy S & Vardaxis N. We also encourage students to be curious – to read more about the medical conditions and procedures in these books. We also recommend using the internet, although care needs to be taken to ensure websites used are current, trustworthy and reputable. Websites such as the Australian Government's *healthdirect* (www.healthdirect.gov.au) and the Victorian Government's Better Health Channel (www.betterhealth.vic.gov.au) are highly regarded.

Medical abbreviations can be confusing, so we suggest you refer to the Health Information Management Association of Australia's useful reference *The Australian Dictionary of Clinical Abbreviations, Acronyms and Symbols*, 7th edition (www.himaa.org.au).

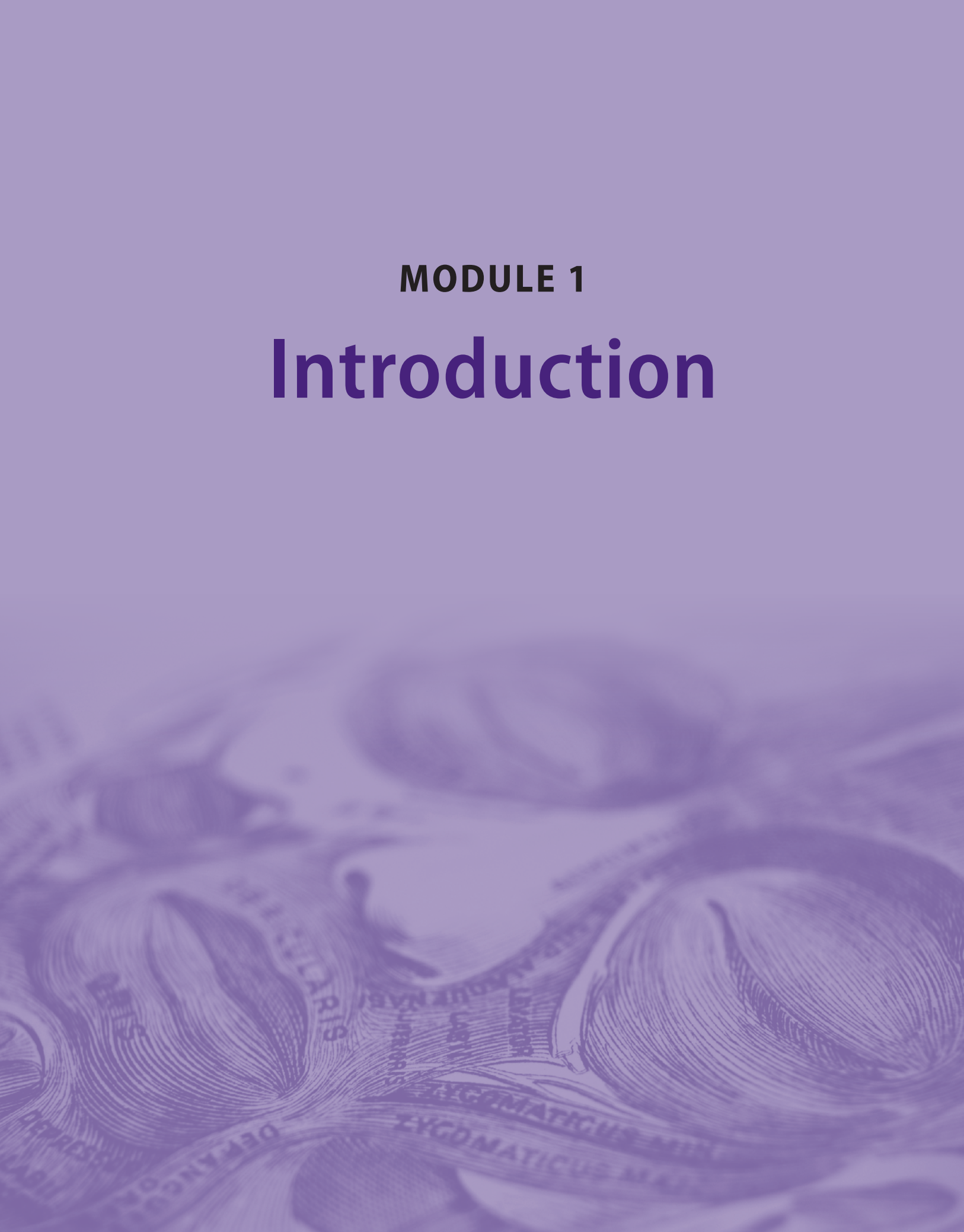
For additional information about therapeutic drugs and chemicals used in the Australian healthcare environment, we suggest accessing the *Monthly Index of Medical Specialties*, known as MIMS. This drug and product information reference is accessible in print, electronically and online (www.mims.com.au). MIMS contains detailed information about drug usage such as dosage, adverse reactions and drug interactions. New Zealand has an equivalent drug reference known as *MIMS New Zealand* (www.mims.co.nz).

It is important that students of medical terminology are diligent in their study. There is a lot to learn but, with repetition and practice, the basic medical terminology building blocks will fall into place. We recommend that students attempt to learn 10 word elements every day, rather than attempting to learn a whole chapter at once. Learning should become easier as you start to remember word elements and are able to create medical terms from them. There are four basic guidelines to keep in mind as you study medical terminology:

1. Analyse words by dividing into their component parts:
   - root
   - prefix
   - suffix
   - combining vowel
   - combining form.
2. Relate the medical terms to the structure and function of the human body.
3. Be aware of spelling inconsistencies, pronunciation problems and formation of plurals.
4. Practise reading, writing and pronouncing medical words at every opportunity.

MODULE 1

Introduction



CHAPTER 1

Basic Word Structure

Contents

Objectives

After completing this chapter, you should be able to:

1. identify and define the main word elements: word roots, prefixes, suffixes, combining vowels and combining forms
2. analyse the component parts of medical terms and be able to give their meaning
3. use word elements to build medical terms from definitions
4. understand the rules associated with the formation of medical terms
5. apply what you have learned by interpreting medical terminology in practice.

Demonstrate your knowledge of the basic word structure by completing the exercises at the end of this chapter.

INTRODUCTION

Medical terminology is the words that have been developed over many centuries to describe anatomical structures, diseases, procedures, treatments, medications and instruments associated with medicine. Medical terminology is the language used to facilitate communication in the medical field. Most medical terms have their origins in Latin and Greek, but there are some terms that come from Arabic, French, German and Anglo-Saxon origins.

Before learning about medical terminology today, it is probably useful to look at how it has developed over time. There are cave paintings from many ancient cultures that depict medical procedures and treatments. These could be described as the earliest forms of medical documentation. However, it was not until about 2700 BC in Egypt that the earliest written records of health care were created. These records were written on papyrus and described the treatments that were performed at the time as well as describing what the ancient Egyptians knew about diseases. By 500–400 BC in Greece there was a more scientific basis to medicine and the use of an appropriate language became more important. Basic medical terminology developed alongside medicine to describe diseases and the instruments and techniques used to treat illness and medical conditions.

Over the next millennium, Latin remained the common language of scholars. New terms to describe medical conditions and procedures continued to be developed in Latin or Greek. These are still the basis of the language of medicine today. It is important to remember that medical terminology is a dynamic, living language that changes and grows over time to meet the needs of each generation of scholars and clinicians and take account of advances in our understanding of medicine and surgery. Many medical terms in current common usage were not even thought of a century ago.

At first, studying medical terminology may seem overwhelming. The words may seem long and complex and totally unpronounceable. It may appear to be a foreign language. That's because it is! But do not be discouraged. Like any language, medical terminology adheres to a set of fairly simple rules.

Basic word elements occur repeatedly in various combinations and will soon become familiar. Most seemingly complex medical terms are simply combinations of much smaller subsets of word parts. These are much easier to learn than whole words. You do not have to remember all the words you come across. This is a critically important concept to understand. Learning the basic structure of medical terms allows you to break down and build up medical terms quite easily. Some rote learning will be required at first, but eventually it will get easier.

This book will give you the skills necessary to understand the terms, use them appropriately and finally demystify this complex but beautiful language called medical terminology.

BASIC WORD STRUCTURE

Understanding medical terminology will be much easier if you learn how to break down each word into its separate elements. If you know the meaning of each of the word elements you will be able to deduce the meaning of even the most complex words. Most medical terms consist of two or more parts. The meaning of each term is the 'sum of its parts'. These word parts will include two or more of the following fundamental elements:

- word root
- prefix
- suffix
- combining vowel
- combining form.

In general, each medical term is formed from one or more word roots. The word root normally provides an overall indication of what the word is about or specifies a part of the body. Added to the word root may be a prefix, which modifies the meaning of the medical term by providing information about location, place, time, shape, size or direction. A medical term may also contain a suffix after the word root. Adding a suffix also creates a new medical term, commonly indicating a disease action or type of test.

Word root

Most medical terms contain at least one word root. The root is the foundation of a word and conveys its central meaning. It is generally a noun or naming word. A word root can be found at the beginning of the medical term or it can form the basis to which a prefix and a suffix may be attached. For example, bronchitis can be divided into a word root and a suffix. The word root *bronch/* means bronchus and the suffix *-itis* means inflammation. Putting it all together, the whole word *bronchitis* means inflammation of the bronchus.

bronch	itis
W R	S

The word hemicolectomy can be divided into a prefix, word root and a suffix. The prefix *hemi-* means half, the word root *col/* means colon and the suffix *-ectomy* means excision or surgical removal. Putting it

all together, the whole word *hemicolectomy* means excision or surgical removal of half the colon.

hemi	col	ectomy
P	W R	S

In this book, a word root will be written with a slash (/) after it when a medical term is broken up into its component parts.

Prefix

A prefix is found at the beginning of the word, preceding the word root. It can never be used alone. It must always be used with a word root and/or suffix. It adds to or modifies the meaning of a word or creates a new word. Prefixes are similar to prepositions or adjectives – they tell you more about the word root, such as its location, place, time, shape, size or direction. For example, sublingual can be divided into a prefix, word root and a suffix. The prefix *sub-* means under or below, the word root *lingu/* means tongue and the suffix *-al* means pertaining to. Putting it all together, the whole word means pertaining to under the tongue.

sub	lingu	al
P	W R	S

Remember, not all medical terms will have a prefix.

In this book, prefixes will be documented with a hyphen after the prefix (-).

Suffix

A suffix follows the word root and is found at the end of the word. It is added to alter, modify or give essential meaning to a term. Suffixes generally refer to a type of condition, investigation or procedure and can help identify if a term is a noun or an adjective. For example, hysterectomy can be divided into a word root and a suffix. The word root *hyster/* means uterus and the suffix *-ectomy* means an excision or surgical removal. Putting it all together, the whole word *hysterectomy* means an excision or surgical removal of the uterus.

hyster	ectomy
W R	S

In this textbook, a suffix is written with a hyphen (-) before it.

Combining vowel

A combining vowel (sometimes called a connecting vowel) is a vowel that links parts of a word together. It may link a word root to a suffix or two word roots together. Its purpose is to aid pronunciation. The most common combining vowel is 'o', and 'i' is the next most common. When linking a word root with a suffix, it is normal practice to drop the combining vowel when the suffix starts with a vowel. For example, in the medical term opt/ic the suffix *-ic* begins with a vowel, therefore a combining vowel is not required. This rule does not apply when linking two word roots, the second of which starts with a vowel. For example, in the medical term oste/o/arthr/itis the combining vowel is retained at the end of *oste/o* even though the word root *arthr/* starts with a vowel. Note, however, that the combining vowel has been dropped at the end of *arthr/* because the suffix *-itis* starts with a vowel.

oste	o	arthr	itis
W R	C V	W R	S

Use the list of word elements at the end of this chapter to work out what the medical terms in the preceding paragraph mean. Check the meaning in your medical dictionary to confirm you are correct.

Combining form

A word root plus a combining vowel are known together as a combining form. When learning medical terminology, it is common to use combining forms rather than word roots and combining vowels individually. For example, the medical term erythrocyte can be divided into a word root plus a combining vowel (a combining form) and a suffix. The combining form *erythr/o* consists of the word root *eryth/* and the combining vowel *o*. This combining form means red. The suffix *-cyte* means cell. Putting it all together, the whole word *erythrocyte* means a (blood) cell which is red.

erythr	o	cyte
W R	C V	S
C F		

The word angioplasty can be divided into a word root plus a combining vowel (a combining form) and a suffix. The combining form *angi/o* means vessel (blood), and the suffix *-plasty* means surgical or plastic repair. Putting it all together, the word *angioplasty* means the surgical or plastic repair of a (blood) vessel.

angi	o	plasty
W R	C V	S
C F		

As you can see in these examples of combining forms, they are written with the word root followed by a slash (/) then the vowel.

Reading and interpreting a medical term

When giving the meaning of a medical term, the suffix is generally stated first. For example:

- mast/ectomy: *mast/* is a word root meaning breast, *-ectomy* is a suffix meaning excision or surgical removal. When used together, the term means an excision or surgical removal of the breast.
- psych/o/logy: *psych/* is a word root meaning mind, *o* is the combining vowel and *-logy* is a suffix meaning a study of. When used together the term means the study of the mind.
- dermat/itis: *dermat/* is a word root that means skin, *-itis* is a suffix meaning inflammation of. So the term *dermatitis* means an inflammation of the skin.

IMPORTANT POINTS TO NOTE ABOUT WORD ELEMENTS AND BASIC WORD STRUCTURE

A medical term need not contain all the word elements. For example:

- electr/o/cardi/o/gram: contains two word roots and a suffix. *Electr/o* means electricity, *cardi/o* means heart, *-gram* means a recording, so the whole term *electrocardiogram* means a recording of the electricity of the heart
- myel/oid: contains a word root and a suffix. *Myel/o* means bone marrow, *-oid* means derived from or resembling, so the term *myeloid* means derived from or resembling bone marrow
- par/enter/al: contains a prefix, a word root and a suffix. In this term, the prefix *par-* means apart from or other than, the word root *enter/* refers to the intestine and the suffix *-al* means pertaining to. The full term *parenteral* refers to something that is taken into the body other than through the digestive tract/intestine. For example, it might be a drug administered by injection under the skin or into a muscle.

The meanings of word elements do not change no matter how they are used. For example, the combining form *gastr/o* means stomach. It can be used with many different prefixes, suffixes and other combining forms to create different medical terms. Some examples are gastr/o/scopy (a process of viewing the stomach), epi/gastr/ic (pertaining to above the stomach) and gastro/enter/itis (inflammation of the stomach and intestine). It does not matter how or where the combining form *gastr/o* is used, the meaning remains identical. This is the same for all word elements.

Some combining forms have the same meaning but come from different origins. This is often because both Latin (L) and Greek (G) terms developed over time and are still in use. For example, *uter/o* (L), *hyster/o* (G) and *metr/o* (G) all mean uterus. It is important to note, however, that these combining forms are not always interchangeable. Experience and practice will teach you which to use in a particular context. If in doubt, refer to a medical dictionary.

It may be possible to sense the basic meaning of a term from analysing its component parts but not its specific meaning; for example, peri/card/itis. By analysing the meaning of all the word elements, this term literally means inflammation surrounding the heart. However, in a medical context it actually means inflammation of the pericardium – the membranous sac surrounding the heart. This demonstrates why it is important to make use of your medical dictionary when studying medical terminology.

When identifying the meaning of medical terms, the definition based on individual word elements, or origin, may seem to be at odds with the actual meaning. For example, the word artery comes from the Greek word *arteria*, which means windpipe. This is because the ancient Greeks, who could only examine bodies postmortem, thought that arteries were 'air ducts' because they do not contain blood after death. However, it is now known that arteries are responsible for carrying blood. Once again, this demonstrates why it is important to make use of your medical dictionary.

When identifying the meaning of medical terms, parts of the definition may be understood without being explicitly expressed. For example, when the word an/aem/ia is broken down, it literally means a condition of no blood. However, in a medical context, it really means a reduction in the number of erythrocytes in the blood.

In some circumstances, the order of the components determines the meaning of the term. For example:

haemat/ur/ia: condition of blood in urine

ur/aemia: condition of urea in blood

In these examples, the component parts of the terms are the same – *haem/* and *aem/* are word roots that mean blood, *ur/* is a word root that means urea or urine and the suffix *-ia* refers to a process or condition. The order in which the word parts are used changes the meaning of the term.

In other circumstances, however, the order of the word components does not alter the meaning of a term. For example, hysterosalpingectomy and salpingohysterectomy both mean excision of the uterus and fallopian tubes. Both contain the word roots salping/ (fallopian tube) and hyster/ (uterus) and the suffix -ectomy (excision or surgical removal). In this case the order of the word roots does not affect the meaning of the term – an excision of the uterus and one or both fallopian tubes.

Do not be too concerned about these inconsistencies at this stage. As you work through this textbook and become more familiar with medical terminology you should be able to recognise the most common format for terms.

NEW WORD ELEMENTS

Listed below are some commonly used word elements, their meanings and examples of medical terms using each of the word elements. Break down each medical term into its individual word elements. Write the meaning of the medical term in the space provided. You may need to check the meaning in a medical dictionary. As an example:

adenoma
aden/ = WR = gland
-oma = S = tumour, collection, mass or swelling
Meaning = tumour in a gland

Note: The combining vowel 'o' is dropped because the suffix starts with a vowel.

Most of the word elements which you will need to provide the meaning of the medical terms are in the lists below. If not, please refer to the Glossary of medical terms on page 561.

Combining forms

Combining Form	Meaning	Medical Term	Meaning of Medical Term
angi/o	vessel	haemangioma	
arteri/o	artery	arteriosclerosis	
arthr/o	joint	arthroscopy	
bronch/o	bronchus	bronchogenic	
cardi/o	heart	cardiomyopathy	
cephal/o	head	encephalograph	
cerebr/o	cerebrum, brain	cerebrospinal	
chondr/o	cartilage	chondrosarcoma	
cis/o	to cut	incision	
col/o	colon, large intestine	colectomy	
cyst/o	bladder, cyst, sac	cystoscopy	
cyt/o	cell	cytology	
derm/o **dermat/o**	skin	dermal dermatologist	
electr/o	electricity, electrical activity	electrocardiogram	
encephal/o	brain	encephalitis	
enter/o	intestine (usually small)	gastroenterologist	
erythr/o	red	erythroderma	
fibr/o	fibre	fibreoptic	
gastr/o	stomach	gastritis	
haem/o **haemat/o**	blood	haemostasis haematoma	
hepat/o	liver	hepatitis	
hyster/o	uterus	hysterectomy	
lapar/o	abdomen	laparoscopic	
lingu/o	tongue	lingual	
lymph/o	lymphoid tissue, lymph gland	lymphocytic	
mast/o	breast	mastectomy	
metr/o	uterus	metritis	
morph/o	form, shape	morphology	

Table continued

Combining Form	Meaning	Medical Term	Meaning of Medical Term
my/o	muscle	myocardial	
myel/o	bone marrow, spinal cord	myelogram	
nephr/o	kidney	nephritis	
neur/o	nerve	neural	
opt/o	eye, vision	optic	
oste/o	bone	ostectomy	
phleb/o	vein	phlebitis	
pneum/o **pneumon/o**	air, lungs, respiration	pneumoconiosis pneumonia	
psych/o	mind	psychology	
pyel/o	renal pelvis	pyelonephritis	
rhin/o	nose	rhinoplasty	
salping/o	fallopian tube, eustachian (auditory) tube	salpingectomy	
thorac/o	chest, thorax	thoracotomy	
trache/o	trachea	tracheotomy	
ur/o	urine, urinary tract, urea	urolithiasis	
uter/o	uterus	uterotomy	
vas/o	vessel, duct	vasoplasty	

Prefixes

Prefix	Meaning	Medical Term	Meaning of Medical Term
an-	no, not, without, absence of	anaemic	
ante-	before, forward	anteverted	
auto-	self	autosomal	
bi-	two, twice, double	bipolar	
circum-	around, about	circumcision	
di-	double, twice	dicephaly	
dia-	through, across	diarrhoea	
dys-	bad, painful, difficult	dyspnoea	
endo-	within, inside, inner	endometrium	
epi-	above, upon, on	epidermis	
hemi-	half	hemiplegia	
hyper-	above, excessive	hyperactive	
hypo-	below, under, deficient, less than normal	hypoglycaemia	
inter-	between	intercostal	
par-	aside, beyond, apart from, other than, near, against	parenteral	
peri-	around, surrounding	perinatal	
post-	after, behind	postoperative	
pre-	before, in front of	premature	

Table continued

Prefix	Meaning	Medical Term	Meaning of Medical Term
retro-	backward, behind	retrograde	
semi-	half	semicircular	
sub-	under, below	subcutaneous	
super-	above, excessive	supernumerary	
sym- **syn-**	together, with	symphysis syndactyly	
trans-	across, through, over	transverse	

Suffixes

Suffix	Meaning	Medical Term	Meaning of Medical Term
-aemia	blood (condition of)	hyperglycaemia	
-al	pertaining to, drug action	renal	
-algia	pain (condition of)	arthralgia	
-cyte	cell	erythrocyte	
-derma	skin	leucoderma	
-ectomy	excision, surgical removal	appendicectomy	
-genic	pertaining to formation, producing	carcinogenic	
-gram	record, writing	cardiogram	
-graph	instrument for recording	encephalograph	
-graphy	process of recording	pyelography	
-ia	process, condition	haematuria	
-iac	pertaining to	cardiac	
-ic	pertaining to, drug action	dyspeptic	
-ist	one who specialises in	gynaecologist	
-itis	inflammation	dermatitis	
-logy	study of	histology	
-oid	derived from, resembling	polypoid	
-oma	tumour, collection, mass or swelling	carcinoma	
-osis	abnormal condition	erythrocytosis	
-ous	composed of, pertaining to, relating to	mucinous	
-pathy	disease process	osteopathy	
-plasty	surgical, plastic repair	uteroplasty	
-scope	instrument to view	ophthalmoscope	
-scopy	process of viewing	endoscopy	
-sis	state of	diagnosis	
-tomy	incision, cut into	osteotomy	

Exercises

EXERCISE 1.1: WORD ANALYSIS

Break up the medical terms below into their component parts (prefixes, suffixes, word roots, combining vowels, combining forms). Use a slash (/) in between each word part.

Example:

chondr / o / clast / ic — pertaining to the destruction of cartilage
WR CV WR S
CF

splen / o / megaly — enlargement of the spleen
WR CV S
CF

peri / card / itis — inflammation around the heart (i.e. the pericardium)
P WR S

1. therm o graph ic	pertaining to the record of heat
2. gastr o enter itis	inflammation of stomach and intestines
3. bronch o scopy	visual examination of bronchus
4. an aesthes ia	condition of without feeling or sensation
5. angi o gram	record of a vessel
(Now it gets a bit harder … you need to divide the word up yourself!)	
6. laparotomy	incision into the abdominal wall
7. blepharoplasty	surgical repair of eyelid
8. atherosclerosis	hardening of blood vessels due to fatty plaque
9. hepatomegaly	enlargement of the liver
10. colostomy	process of creating a new opening into the colon

EXERCISE 1.2: IDENTIFYING PREFIXES

Identify the prefix in each of the medical terms below. Give the meaning of the term as a whole.

Example:

supramaxillary

supra/maxillary

supra = above

supramaxillary = above the maxilla (or upper jaw bone)

1. apnoea _____

2. anteflexion _____

3. postmenopausal _____

4. supernumerary _____

5. hemigastrectomy _____

6. transurethral _____

7. hypocalcaemia _____

8. epidermal _____

9. dysphagia _____

10. pericardium _____

EXERCISE 1.3: IDENTIFYING SUFFIXES

Identify the suffix in each of the medical terms below. Give the meaning of the term as a whole.

Example:
osteomalacia

osteo/malacia

malacia = condition of softening

osteomalacia = condition of softening of bone

1. arthralgia _____

2. cholecystitis _____

3. carcinoid _____

4. craniotomy _____

5. osteogenic _____

6. hyperglycaemia _____

7. cystoscopy _____

8. gastroscope _____

9. rhinoplasty _____

10. haematologist _____

EXERCISE 1.4: WORD ROOTS AND COMBINING FORMS

Select the correct response from the choices provided for each question.

1. Which vowel is the most common combining vowel?
   a) a
   b) e
   c) i
   d) o

2. The word root is the _____ of the word.
   a) foundation
   b) meaning
   c) ending
   d) modifier

3. Which word contains a combining vowel between two word roots?
   a) erythrocyte
   b) hysterectomy
   c) salpingitis
   d) gastroenterology

4. Which of the following combining forms means gland?
   a) aden/o
   b) lapar/o
   c) cephal/o
   d) lip/o

5. Chondroplasty is the surgical repair of a _____.
   a) nerve
   b) herniated disc
   c) vertebra
   d) cartilage

6. Which of the following means vein?
   a) vas/o
   b) phleb/o
   c) angi/o
   d) lymph/o

7. A myelogram is an x-ray of the _____ after injection of a contrast medium.
   a) spinal cord
   b) brain
   c) blood vessels
   d) nerves

8. Which word means pain in a nerve or nerves?
   a) neuralgia
   b) nephralgia
   c) fibralgia
   d) myalgia

9. The combining form erythr/o means _____.
   a) haemoglobin
   b) skin
   c) red
   d) brain

10. Cardiology is the study of the _____.
   a) heart
   b) brain
   c) kidneys
   d) urinary tract

11. Encephalitis refers to inflammation of the _____.
    a) brain
    b) head
    c) intestines
    d) eyes

12. Which word means an abnormal condition of the liver?
    a) hepatitis
    b) hepatosis
    c) arthritis
    d) arthrosis

13. Which test would be performed to visually diagnose a stomach ulcer?
    a) gastroscopy
    b) gastroscope
    c) bronchoscopy
    d) bronchoscope

14. A general term for an incision into bone is called a/an _____.
    a) craniotomy
    b) craniectomy
    c) osteoectomy
    d) osteotomy

15. Someone who specialises in the study of blood is a _____.
    a) haematologist
    b) haemologist
    c) phlebotomist
    d) cardiologist

EXERCISE 1.5: WORD BUILDING

Using the following table of word elements, build medical terms for the list of definitions.

Prefixes	Meaning	Suffixes	Meaning	Word Roots	Meaning
a-	no, not, without, absence of	**-aemia**	blood (condition of)	**cardi/o**	heart
an-	no, not, without, absence of	**-al**	pertaining to	**cephal/o**	head
brady-	slow	**-algia**	pain (condition of)	**cyst/o**	bladder, cyst, sac
dys-	bad, painful, difficult	**-ectomy**	excision, surgical removal	**dactyl/o**	fingers, toes
endo-	within, inside, inner	**-gram**	record, writing	**derm/o**	skin
epi-	above, upon, on	**-ia**	process, condition	**dermat/o**	skin
hypo-	below, under, deficient, less than normal	**-ic**	pertaining to	**electr/o**	electricity, electrical activity
oligo-	scanty, deficiency, few	**-ism**	state of	**encephal/o**	brain
post-	after, behind	**-itis**	inflammation	**enter/o**	intestine (usually small)
syn-	together, with	**-ium**	structure, tissue	**gastr/o**	stomach
		-logy	study of	**glyc/o**	sugar
		-meter	instrument used to measure, measurement	**haem/o**	blood
		-osis	abnormal condition	**haemat/o**	blood
		-pathy	disease	**hepat/o**	liver
		-scope	instrument to view	**therm/o**	heat
		-y	process, condition	**ur/o**	urine, urinary tract, urea

1. Record of the heart's electrical activity _____
2. Condition of two or more fingers or toes joined together _____
3. Condition of a painful intestine _____
4. Condition of a slow heart (rate) _____
5. Instrument for measuring temperature _____
6. Condition of scanty urine (output) _____
7. Instrument to view the bladder _____
8. Condition of low blood sugar _____
9. Inflammation of the skin _____
10. Study of blood _____
11. Abnormal condition of the liver _____
12. Condition of no blood _____
13. Disease of the brain _____
14. Surgical removal of the intestine _____
15. Pertaining to above the stomach _____
16. Tissue inside the heart _____
17. Pertaining to the head _____
18. Pain in the stomach _____
19. (An injection described as given) below the skin _____
20. Condition of urea in the blood _____

EXERCISE 1.6: CROSSWORD PUZZLE

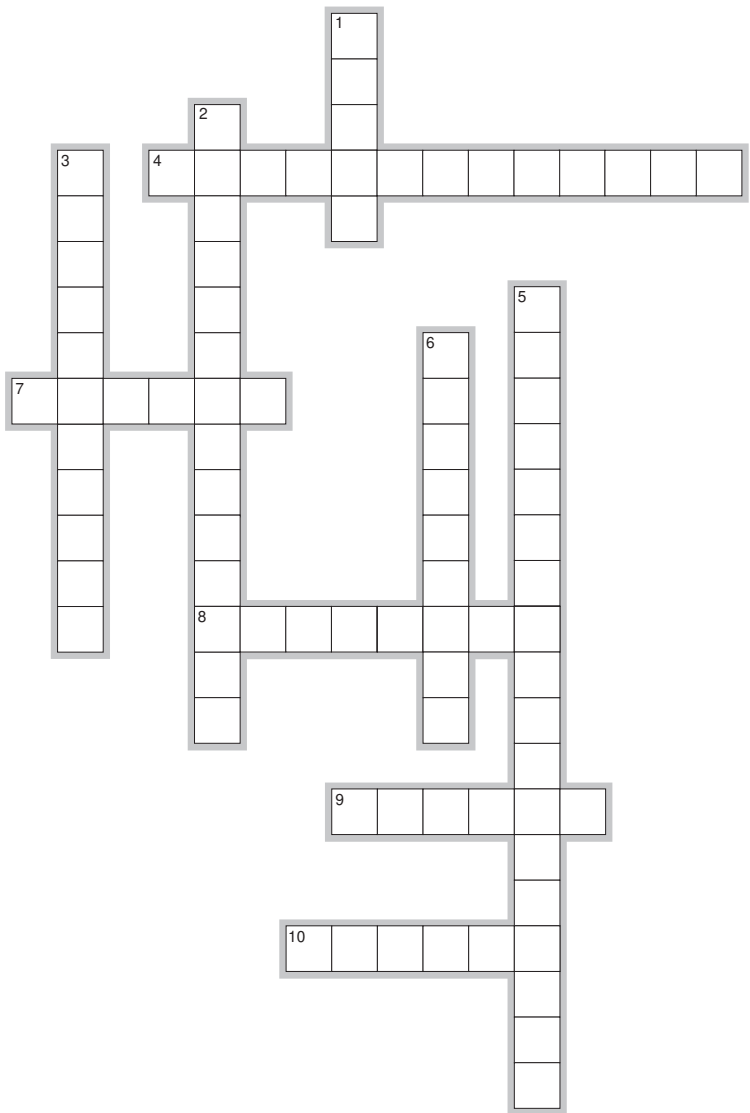
Complete the puzzle by providing the medical term for each of the clues below.

ACROSS

4. Word root plus a combining vowel (9, 4)
7. Found at the beginning of a word (6)
8. Foundation of a word (4, 4)
9. Found at the end of a word (6)
10. Pertaining to the skin (6)

DOWN

1. A language that is the foundation of medical terminology (5)
2. Links parts of a word together (9, 5)
3. Incision into the uterus (11)
5. Describes anatomical structures, diseases, procedures, treatments, medication and instruments associated with medicine (7, 11)
6. Flow or discharge through (9)



CHAPTER 2

Building a Medical Vocabulary

Contents

Objectives

After completing this chapter, you should be able to:

1. understand the rules of pronunciation and be able to pronounce medical terms correctly
2. understand spelling conventions specific to medical terminology
3. understand how to form plurals of medical terms
4. understand what an eponym is and be able to define some in common usage
5. understand the application of mnemonics to aid learning medical terminology
6. apply what you have learned by interpreting medical terminology in practice.

Demonstrate your knowledge of vocabulary building by completing the exercises at the end of this chapter.

INTRODUCTION

This chapter builds on what you learned in Chapter 1. Your skills in word analysis will be enhanced by introducing additional word elements and you will start to learn about word elements in practice.

Sometimes medical terms can seem very complex and consequently difficult to pronounce. This chapter provides some basic rules of pronunciation. It is important to understand these rules and to be able to apply them. In subsequent chapters, phonetic pronunciation of many medical terms will be given. Medical words can also be challenging to spell. This chapter contains some important spelling guidelines to help you. Forming plurals of medical terms can also be quite difficult at first. Specific guidelines on how to do this are provided.

The concept of eponyms in medical terminology will be discussed, and some of the more common ones will be identified. The concept of mnemonics as a method for remembering some aspects of anatomy and physiology will be explained and some examples provided.

PRONUNCIATION OF TERMS

When first confronted with a medical term, trying to pronounce it correctly can seem difficult. In this textbook, phonetic spelling has been provided to help you pronounce many of the medical terms that are included. Wherever lists of terms or medical conditions are provided, the pronunciation is also included. Each word or term is written using the correct spelling, followed by the phonetic spelling. The syllable on which the pronunciation stress falls is written in capital letters and the rest of the syllables are in lower case. You should practise pronouncing each term whenever you see the phonetic spelling provided.

For example:

biology is written phonetically as **bi-OL-o-jee**
endoscopy is written phonetically as **en-DOS-kop-ee**
cardiac is written phonetically as **KAH-dee-ak**
gastroenterology is written phonetically as **gas-tro-ENT-er-OL-o-jee**

While some medical terms are quite easy to pronounce, there are some that seem to be more difficult. The following rules of pronunciation will help you. As with anything, practice makes perfect, so remember to say all the terms out loud as you work through the book.

Pronunciation Rule	Examples
ae and ***oe*** are usually pronounced like ***ee***	anaemia, oestrogen
c is pronounced like an ***s*** before the letters ***e****, ***i*** and ***y*** (*exception: cephalic, which may be pronounced with a hard ***c*** sound like the letter ***k***)	cervix, cilia, cytoplasm
c is pronounced like a ***k*** before the letters ***a, o*** and ***u***	colon, cavity, cure
ch is sometimes pronounced like ***k***	chronic, chromosome
e at the end of a word is often pronounced as a separate syllable ***ee***	syncope, systole
es at the end of a word is often pronounced as a separate syllable ***eez***	nares, appendices
eu at the start of a word is pronounced ***yoo***	euphoria, euthanasia
g is pronounced like ***j*** before the letters ***e***, ***i*** and ***y**** (*exception: terms with the word root *gynae/* are pronounced with a hard ***g*** sound)	generic, giant, gyrus
g is pronounced with a hard ***g*** sound before the letters ***a***, ***o*** and ***u***	ganglion, gonad, gurgle
i at the end of a word (as a plural form) is often pronounced like ***eye***	alveoli, glomeruli
ph is pronounced like ***f***	phobia, physical
pn is pronounced like ***n***	pneumonia
ps is pronounced like ***s***	psychiatry, psoriasis
pt is pronounced like ***t***	ptosis, pterygium
rh and ***rrh*** are pronounced like ***r***	rheumatic, diarrhoea
x is pronounced like ***z*** when the first letter of a word	xanthoma, xenograft

Some medical terms can have more than one agreed pronunciation. For example, the term *cephalic* can be pronounced with either a soft or a hard *c* sound. Both are correct, and usage is often determined by where the health professional was educated. When in doubt about how to pronounce a word, use your dictionary, read through this textbook and review the pronunciation provided or ask a health professional.

SPELLING CONVENTIONS

Many medical terminology books are written using American spelling conventions. It is important to

realise that this textbook uses only Australian/British spelling conventions. Both forms of spelling are equally correct, but different countries prefer to use one form over the other. Most countries that have been part of the British Commonwealth at some point in their history choose to use British spelling. That is the case in Australia and New Zealand. The differences are too numerous to discuss here, but there are many sources available that discuss them.

Accurate spelling of medical words is an essential part of studying medical terminology. In some instances, correct spelling is extremely important to the meaning of the term. Sometimes words sound the same, or very similar, but have a completely different meaning. For example:

ilium	the hip bone	ileum	part of the small intestine
abduct	move away from	adduct	move towards
arteritis	inflammation of an artery	arthritis	inflammation of a joint
dysphagia	difficulty in swallowing	dysphasia	difficulty in speaking

This example demonstrates that by changing just one letter in a word, the meaning can be entirely different. Therefore, it is very important to get the spelling correct so the meaning of the word in context is also correct. If in doubt, always check the spelling in your medical dictionary. Many words have a Greek origin. Sometimes these words contain silent letters. For example, in the words pneumonia, ptosis and psychology, the letter *p* is silent but still must be included when the word is spelled.

As mentioned in Chapter 1, when joining a combining form with a suffix, as a general rule, if the suffix begins with a vowel, drop the combining vowel. For example:

haemat/o and -oma = haematoma

When a prefix ends in a vowel and a word root begins with one, options for joining them are to use one only, use both or hyphenate the two. For example:

microphthalmia
microorganism
retro-ocular

Check your medical dictionary to see which is correct or commonly used for a particular word. Sometimes more than one option is possible.

The prefixes *syn-* and *sym-* both mean together or with, but which is used in building a medical term depends on the first letter of the word root. *Sym-* is used before the letters *b*, *p* and *m*, for example in the words symbiosis, symphysis and symmetry. *Syn-* is used in most other circumstances – for example, in syndactylism and synthesis.

FORMING PLURALS

Forming plurals of medical terms can sometimes be challenging. Mostly plurals of medical terms are formed following normal English language conventions. For example, adding *s* or *es* to the end of a word (bone/bones) or changing the letter *y* to *ies* (biopsy/biopsies). However, there are exceptions. The following table demonstrates how to make plurals from singular terms based on word endings.

Singular Ending	Example of Singular Word	The Plural Rule	Example of Plural Word	Exceptions to the Rule
a	fibula	Retain the *a* and add an *e*	fibulae	
ax	thorax	Drop the *x* and add *ces*	thoraces	
en	lumen	Drop the *en* and add *ina*	lumina	
ex	index	Drop the *ex* and add *ices*	indices	
is	diagnosis	Drop the *is* and add *es*	diagnoses	iris/irides, epididymis/epididymides
ix	appendix	Drop the *ix* and add *ices*	appendices	
ma	carcinoma	Retain the *ma* and add *ta*	carcinomata	Can also add an *s* to form the plural – carcinomas
nx	phalanx	Drop the *x* and add *ges*	phalanges	

Table continued

Singular Ending	Example of Singular Word	The Plural Rule	Example of Plural Word	Exceptions to the Rule
on	ganglion	Drop the *on* and add *a*	ganglia	
um	diverticulum	Drop the *um* and add *a*	diverticula	
us	stimulus	Drop the *us* and add *i*	stimuli	virus/viruses, sinus/sinuses
y	deformity	Drop the *y* and add *ies*	deformities	
yx	calyx	Drop the *x* and add *ces*	calyces	

EPONYMS

In medical language an eponym is a disease, syndrome, body structure, instrument, procedure or test that is named after the person who first identified the disease, syndrome or structure or developed the instrument, procedure or test bearing the name. In the past, a possessive ('s) was included after the name of the person (for example, Crohn's disease), but this practice is slowly beginning to be dropped (for example, Down syndrome). This textbook reflects current common usage in Australia.

There are some significant problems with using eponyms. The name may be used to describe more than one entity, leading to confusion among health workers. The use of eponyms is not universal between countries and even between health facilities. This also leads to misunderstanding. The name is not descriptive, so it is difficult to derive the meaning or context of the eponym without prior knowledge.

Although using eponyms is discouraged, there are still many commonly in use today. Listed below are a small number of eponyms to raise your awareness of the concept.

Diseases and syndromes

Eponym	Pronunciation	Named after	Definition
Alzheimer's disease	ALZ-hy-merz diz-EEZ	Alois Alzheimer (1864–1915)	This degenerative disease was first described in 1906 by Dr Alois Alzheimer. It is characterised initially by the person's inability to acquire new facts. Ongoing symptoms include confusion, irritability, aggression, mood swings, language breakdown and long-term memory loss.
Burkitt's lymphoma	BURR-kitz lim-FOH-ma	Denis Parsons Burkitt (1911–1993)	Burkitt's lymphoma is a cancer of the lymphatic system first described in Africa in 1956 by Dr Denis Parsons Burkitt.
Creutzfeldt-Jakob disease (CJD)	KROYTZ-feld YAH-kob diz-EEZ	Hans Gerhad Creutzfeldt (1885–1964) and Alfons Maria Jakob (1884–1931)	CJD is a degenerative neurological disorder from the transmissible spongiform encephalopathies. It can be transmitted in contaminated harvested human growth hormone products, immunoglobulins, corneal grafts, dural grafts or electrode implants. It can also be inherited.
Crohn's disease	KROHNZ diz-EEZ	Burrill Bernard Crohn (1884–1983)	Crohn's disease is an autoimmune disease in which the body's immune system attacks the gastrointestinal tract causing inflammation that results in abdominal pain, diarrhoea, vomiting and weight loss.
Cushing's syndrome	KOOSH-ingz SIN-drohm	Harvey Cushing (1869–1939)	Cushing's syndrome is a hormone disorder caused by high levels of cortisol in the blood, resulting from taking glucocorticoid drugs, or by tumours that produce cortisol or adrenocorticotropic hormone. It results in hyperglycaemia, hypertension, obesity and facial oedema.

Table continued

Eponym	Pronunciation	Named after	Definition
Down syndrome	down SIN-drohm	John Langdon Down (1828–1896)	Down syndrome is also known as trisomy 21. It is a chromosomal abnormality that results in distinctive physical abnormalities such as sloping forehead, flat nose, low-set ears and retarded growth, as well as mild to severe mental retardation. It results from the presence of all or part of an additional 21st chromosome.
Hodgkin lymphoma	HOJ-kin lim-FOH-ma	Thomas Hodgkin (1798–1866)	Previously known as Hodgkin's disease, Hodgkin lymphoma is a type of lymphatic cancer characterised by the presence of large cells called Reed-Sternberg cells. Symptoms of the disease include lymphadenopathy, splenomegaly and enlargement of other lymphoid tissue.
Parkinson's disease	PAH-kin-sonz diz-EEZ	James Parkinson (1755–1824)	Parkinson's disease is a degenerative disease of the central nervous system characterised by impairment of cognitive processes and motor skills.

Body structures

Eponym	Pronunciation	Named after	Definition
Bartholin's glands	BAH-thol-inz glandz	Caspar T Bartholin (1655–1738)	The Bartholin's glands are a pair of glands next to the vaginal opening. They produce lubricating secretions.
Cowper's gland	KOW-purrs gland	William Cowper (1666–1709)	Also known as the bulbourethral gland, the Cowper's gland is located beneath the prostate gland in a male. It produces a secretion that makes up part of the semen.
Fallopian tubes	fa-LOH-pee-an tyoobz	Gabriele Falloppio (1523–1562)	The fallopian tubes carry ova from the ovaries to the uterus.

Procedures or tests

Eponym	Pronunciation	Named after	Definition
Nissen fundoplication	NISS-en fun-doh-pli-KAY-shun	Rudolph Nissen (1896–1981)	A Nissen fundoplication is a surgical procedure used to treat GORD (gastro-oesophageal reflux disease) and hiatus hernia. The upper part of the stomach (gastric fundus) is wrapped around the lower end of the oesophagus and stitched in place to reinforce the lower oesophageal sphincter.
Papanicolaou (Pap) smear (test)	pap-a-NIK-a-loh smeer	George Nicholas Papanicolaou (1883–1962)	The Pap smear or test is a gynaecological screening test to detect pre-malignant or malignant cells in the ectocervix.
Shirodkar suture	sheer-ODD-kar soo-cha	Vithalrao Shirodkar (1899–1971)	A Shirodkar suture is inserted into the cervical canal to prevent a spontaneous abortion in women with a history of an incompetent cervix.

Instruments

Eponym	Pronunciation	Named after	Definition
Penrose drain	PEN-roze drayn	Charles Penrose (1862–1925)	A Penrose is a type of drain inserted into a surgical wound to remove fluids to reduce the risk of infection.
Wrigley's forceps	RIG-leez for-sepz	Arthur Wrigley (1904–1984)	Wrigley's forceps are used to deliver a baby when its head is on the perineum and only a small amount of traction is needed.

MNEMONICS

A mnemonic (nem-ON-ik) is a learning technique for aiding memory. It assists in information retention by linking what needs to be remembered with clues for its recall. Common techniques used include creating acronyms or memorable phrases. These work on the principle that we more easily remember spatial, personal or humorous information than abstract or impersonal information. You may find this a useful learning technique as you work towards building your knowledge of medical terminology. Below are several examples of mnemonics, but you can also create your own.

What we are trying to remember	Mnemonic	Translation
Order of parts of the small and large intestines (proximal to distal)	Dow Jones Industrial Average Closing Stock Report	Duodenum Jejunum Ileum Appendix Colon Sigmoid Rectum
Cranial bones	Pest of 6 (the six represents the six bones)	Parietal Ethmoid Sphenoid Temporal Occipital Frontal
Respiratory passages	(Airflow is prominent in) mouthy people who are loud talkers	Mouth Pharynx Larynx Trachea
Divisions of the spinal column	Charlie Thomas likes sweet chocolates	Cervical Thoracic Lumbar Sacral Coccygeal
Number of vertebrae in sections of the spinal column	Breakfast (7 am), Lunch (12 noon) and Dinner (5 pm)	Cervical 1–7 Thoracic 1–12 Lumbar 1–5

Exercises

EXERCISE 2.1: SPELLING

Select the correctly spelled term from the choices provided for each question.

1. An elderly man was diagnosed with _____, which is characterised by abnormal hardening of the arteries.
    a) venosclerosis
    b) angiosclerosis
    c) arteriosclerosis

2. A five-year-old boy was admitted for the surgical removal of his tonsils. The procedure is called a _____.
    a) tonsilectomy
    b) tonsillectomy
    c) tonsilloectomy

3. An injection into a muscle can also be called an _____ injection.
    a) intermuscular
    b) intramuscular
    c) inmuscular

4. An _____ was performed to bypass an intestinal obstruction.
    a) ilieostomy
    b) iliotomy
    c) ileostomy

5. An increased level of urea in the blood is called _____.
    a) haematuria
    b) ureemia
    c) uraemia

6. The period before birth is termed the _____ period.
    a) antenatal
    b) antinatal
    c) antnatal

7. The 59-year-old woman was experiencing urinary tract symptoms. She underwent a _____, which revealed a normal functioning urinary bladder.
    a) cytography
    b) cystography
    c) cholecystography

8. A surgical puncture of the abdominal cavity to remove excess fluid is termed an _____.
    a) adbominocentesis
    b) abdomenocentesis
    c) abdominocentesis

9. A patient who has undergone removal of half of their stomach has had a _____.
    a) hemigastrectomy
    b) hemigastrotomy
    c) semigastroectomy

10. _____ lymph nodes are located in the armpits.
    a) auxillary
    b) ancillary
    c) axillary

EXERCISE 2.2: SPELLING AND CONTEXT

Some medical terms are very similar in spelling and pronunciation but have different meanings. It is very important to use the correct word in the correct context. Define the following pairs of similar terms.

Medical Term	Meaning	Medical Term	Meaning
haematuria		uraemia	
ilium		ileum	
ureter		urethra	
stomatitis		infected stoma site	
poliomyelitis		osteomyelitis	

EXERCISE 2.3: FORMING PLURALS AND SINGULAR TERMS

Provide the plural or singular form of each of the medical terms below.

Medical Term Singular	Medical Term Plural
bacterium	
calyx	
phalanx	
calculus	
ecchymosis	
chalazion	
sinus	

Medical Term Plural	Medical Term Singular
spermatozoa	
ova	
varices	
metastases	
ganglia	
epididymides	
rhonchi	
vertebrae	

EXERCISE 2.4: EPONYMS – WHAT AM I?

Provide the meaning for each of the eponyms below.

1. Foley catheter _____

2. Parkinson's disease _____

3. Snellen chart _____

4. Bell's palsy _____

5. Colles' fracture _____

6. Alzheimer's disease _____

7. APGAR score _____

8. Legionnaires' disease _____

9. Daltonism _____

10. Papanicolaou smear _____

EXERCISE 2.5: PRONUNCIATION AND COMPREHENSION

Read the following paragraph aloud to practise your pronunciation. Using your textbook and a medical dictionary, find the meanings of the underlined medical terms.

Mrs Xavier was 41 years old when admitted with a 6-week history suggestive of hypoadrenalism of unclear cause – query due to inadequate Fludrocortisone replacement. She was first diagnosed as having Addison's disease in 2001. She had a previous history of thyrotoxicosis 20 years ago managed with medication, with normal thyroid function tests since then. She also had an anterior myocardial infarction in 2004 due to a coronary artery spasm. Over the past 6 weeks she has become progressively more lethargic and weak, culminating in this requirement for admission. There has been no history of fevers or any suggestion of infection.

EXERCISE 2.6: ANAGRAMS

Work out each medical term from the jumbled letters below. Then, using the letters in brackets, determine the medical term that matches the description given.

1. gadahsypi	__ __ __ __ (__) __ __ __ __	difficulty in swallowing
2. tcdbau	__ (__) __ __ __ __	move away from
3. npmeyo	__ __ (__) __ __ __	a term named for the person who discovered it
4. zeersimlah	(__) __ __ __ __ __ __ __ __ __	a form of dementia
5. muiil	__ __ (__) __ __	part of the hip
6. wpseroc	__ __ __ (__) __ __ __	a gland on the side of the prostate

Rearrange the letters in brackets to form a word that means 'an obsessive irrational fear of a specific object or situation'.

__ __ __ __ __ __

EXERCISE 2.7: CROSSWORD PUZZLE

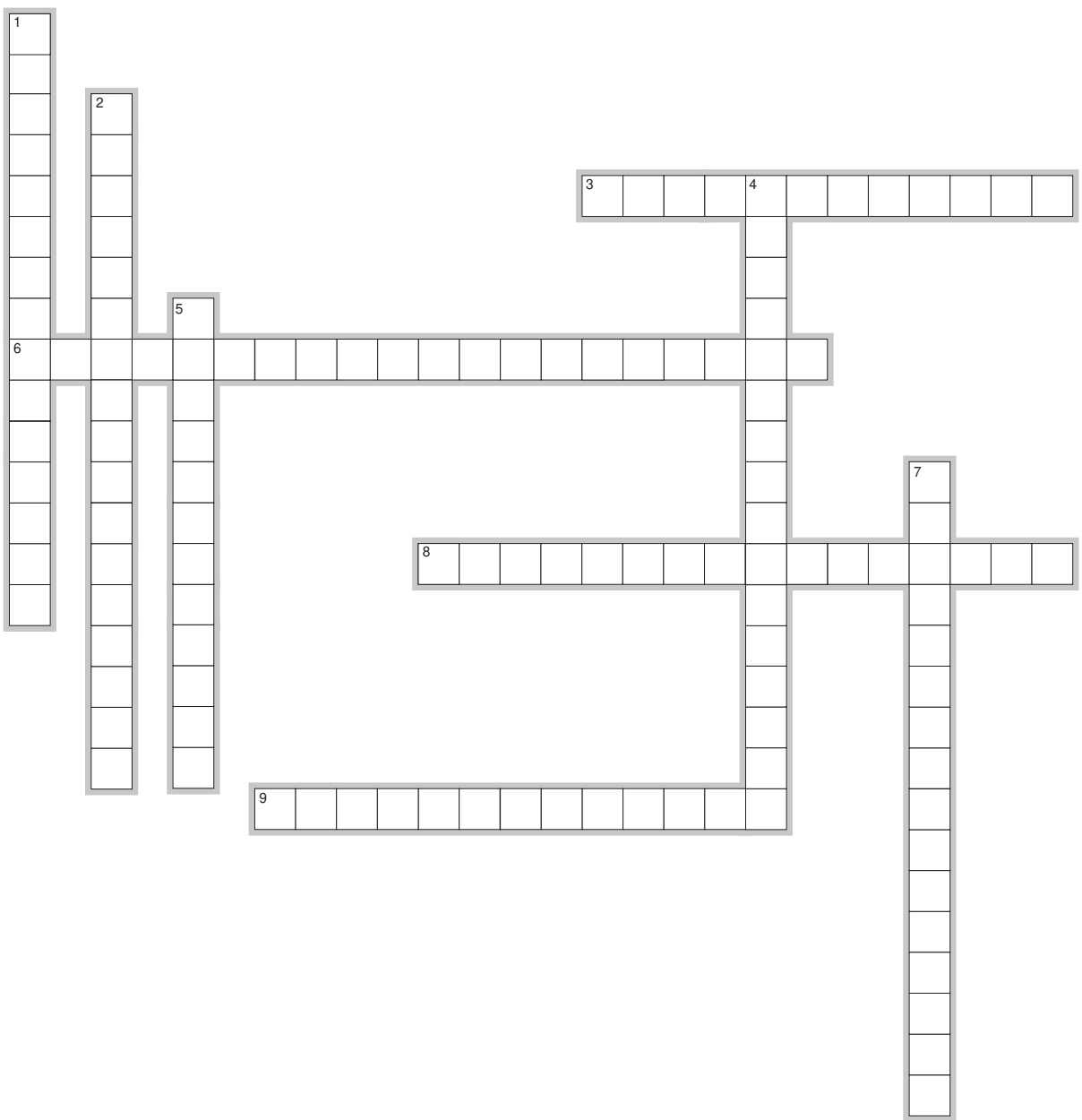
Complete the puzzle by providing the medical term for each of the clues below.

ACROSS

3. Also known as trisomy 21 (4, 8)
6. A procedure used to treat GORD (6, 14)
8. Hormone disorder caused by high levels of cortisol in the blood (8, 8)
9. An inflammatory disease of the intestines (6, 7)

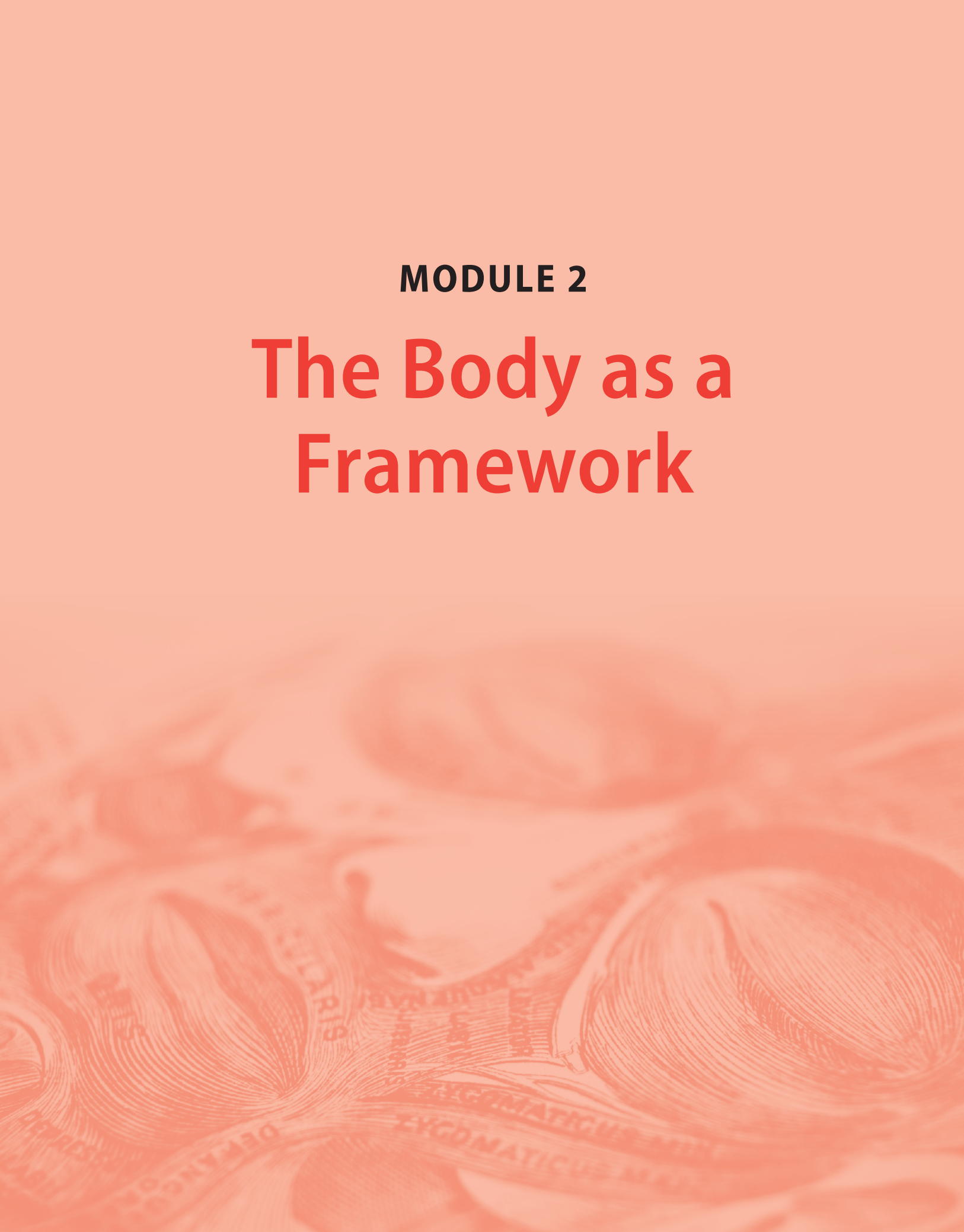
DOWN

1. Gland that produces lubricating secretions (10, 5)
2. Degenerative disease of the central nervous system (10, 7)
4. Suture to prevent spontaneous abortion (10, 6)
5. Drain inserted into a surgical wound (7, 5)
7. A cancer of the lymphatic system (8, 8)



MODULE 2

The Body as a Framework



CHAPTER 3

The Human Body

Contents

Objectives

When you have completed this chapter, you should be able to:

1. describe the structural organisation of the body
2. identify the location of the body cavities and be able to name the structures in each cavity
3. name the regions and quadrants of the abdominopelvic cavity
4. identify the divisions of the spinal column
5. understand the terms relating to body position and direction
6. identify the body planes
7. apply what you have learned by interpreting medical terminology in practice.

Demonstrate your knowledge of the human body by completing the exercises at the end of this chapter.

INTRODUCTION

Medical terms that are used to describe the structure of the human body are essential knowledge in medical terminology. Some of these terms should be very familiar to you because they are in common English usage, but others will be new and will require learning.

These terms will describe the basic structure of the body, the different body cavities, regions and quadrants and the divisions of the spinal column. There are also specific terms that describe position, direction and the planes of the body.

The purpose of this chapter is to demonstrate the structure of the human body as a whole. It is essential that you understand this before moving on to the subsequent chapters, which discuss specific body systems and specialty areas.

NEW WORD ELEMENTS

Here are some word elements related to the human body as a whole. To reinforce your learning, write the meanings of the medical terms in the spaces provided. Use the Glossary of medical terms on page 561 to help you work out the meanings. You may also need to check the meaning in a medical dictionary, but make an attempt yourself first.

Combining forms

Combining Form	Meaning	Medical Term	Meaning of Medical Term
abdomin/o	abdomen	abdominoplasty	
aden/o	gland	adenitis	
adip/o	fat	adiponecrosis	
aeti/o	cause	aetiology	
anter/o	front	anterior	
bi/o	life	biology	
blast/o	embryonic, developing cell	blastocyte	
caud/o	tail, downward	caudal	
cephal/o	head	cephalic	
cervic/o	neck, cervix uteri	cervicogenic	
chondr/o	cartilage	chondrofibroma	
coccyg/o	coccyx	coccygodynia	
crani/o	cranium, skull	craniotomy	
dist/o	away, far, distant	distal	
dors/o	back of body	dorsolateral	
fibr/o	fibre	fibromyalgia	
granul/o	granules	granuloma	
hist/o **histi/o**	tissue	histology histiocytosis	
iatr/o	physician, medicine, treatment	iatrogenic	
ili/o	ilium, hip	iliac	
infer/o	below	inferolateral	
inguin/o	groin	inguinal	
kary/o	nucleus	karyocyte	
later/o	side	lateral	
leuc/o **leuk/o** *(Note that the CF leuk/o is used in Australia for the word leukaemia (and derivative terms) only)*	white	leucocyte leukaemia	

Table continued

Combining Form	Meaning	Medical Term	Meaning of Medical Term
lip/o	fat	lipoma	
lumb/o	loins, lower back	lumbar	
lymph/o	lymphoid tissue, lymph gland	lymphadenitis	
medi/o	middle	medial	
melan/o	black	melanoderma	
my/o	muscle	myocardium	
necr/o	death, dead	necrosis	
neur/o	nerve	neurogenic	
o/o **ov/i** **ov/o**	egg, ovum	oocyte ovicide ovoid	
oste/o	bone	osteoarthritis	
path/o	disease	pathology	
pelv/i	pelvis	pelvic	
poster/o	behind, back	posteroanterior	
proxim/o	near, nearest	proximal	
sacr/o	sacrum	sacroiliac	
sarc/o	flesh	sarcoidosis	
somat/o	body	somatomegaly	
sperm/o **spermat/o**	spermatozoa, sperm	aspermia spermatolysis	
spin/o	spine, thorn	spinal	
stom/o **stomat/o**	mouth	stomal stomatitis	
super/o	above, excessive	superior	
thorac/o	thorax, chest	abdominothoracic	
tox/o **toxic/o**	poison, toxin	toxaemia toxicology	
troph/o	nourishment, development	trophoblastic	
umbilic/o	umbilicus, navel	umbilical	
ventr/o	front, belly side	ventral	
vertebr/o	vertebra, spinal column	vertebrocostal	
viscer/o	internal organs	visceral	

Prefixes

Prefix	Meaning	Medical Term	Meaning of Medical Term
ab-	away from	abnormal	
ad-	towards	adrenal	
anti-	against	antibiotic	
bi-	two, twice, double	bilateral	
infra-	inferior to, below	infracostal	
macro-	large	macrocytic	
meta-	beyond, change	metamorphosis	

Table continued

Prefix	Meaning	Medical Term	Meaning of Medical Term
micro-	small	microcytic	
neo-	new	neoplasia	
poly-	many, much	polycystic	
uni-	one	unilateral	

Suffixes

Suffix	Meaning	Medical Term	Meaning of Medical Term
-blast	embryonic or developing cell	osteoblast	
-cyte	cell	lymphocyte	
-gen	producing, originating, causing	antigen	
-genesis	pertaining to formation, producing	pathogenesis	
-iasis	condition or state	hypochondriasis	
-ior	pertaining to	inferior	
-lysis	separation, destruction, breakdown, dissolution	histolysis	
-oma	tumour, collection, mass, swelling	haematoma	
-ose	pertaining to, full of, sugar	adipose	
-osis	abnormal condition	leucocytosis	
-pathy	disease process	myopathy	
-plasia	formation, development, growth	hypoplasia	
-plasm	growth, formation, substance	neoplasm	
-trophy	nourishment, development	hypertrophy	

VOCABULARY

The following list provides many of the medical terms used for the first time in this chapter. Pronunciations are provided with each term. As you read the rest of the chapter, make sure you identify each of these terms and understand their meanings.

Term	Pronunciation
abdominopelvic	ab-DOM-in-oh-PEL-vik
anterior	an-TEER-ee-a
cell membrane	sel MEM-brayn
central nervous system	SEN-tral NER-vus sis-tem
cervical	ser-VYK-el
chromosome	KROME-oh-some
coccygeal	kok-si-JEE-al

Table continued

Term	Pronunciation
connective tissue	kon-NEK-tiv TISH-oo
cranial	KRAY-nee-al
cytoplasm	SY-toh-plazm
distal	DIS-tel
deoxyribonucleic acid (DNA)	dee-OK-see-ry-boh-nyoo-KLEE-ik A-sid
dorsal	DAW-sal
epigastric region	ep-ee-GAS-trik REE-jen
epithelial	ep-ee-THEEL-ee-al
fascia	FASH-ee-a
frontal	FRUN-tal
hypochondriac region	hy-poh-KON-dree-ak REE-jen
hypogastric region	hy-poh-GAS-trik REE-jen

Table continued

Term	Pronunciation
inferior	in-FEER-ee-a
inguinal region	IN-gwin-al REE-jen
intervertebral	in-ter-VER-te-bral
lateral	LAT-er-al
ligament	LIG-a-ment
lumbar	LUM-bah
medial	MEE-dee-al
mitochondria	my-toh-KON-dree-ah
nucleus	NYOO-klee-us
peripheral nervous system	pe-RIF-er-al NER-vus SIS-tem
pituitary gland	pit-YOO-it-ar-ee gland
posterior	pos-TEER-ee-a
prone	prohn
proximal	PROK-sim-al
quadrants	KWAD-rantz
sacral	SAK-ral
sagittal	SAJ-it-al
spinal cord	SPY-nal kord
superficial	soo-per-FISH-al
superior	soo-PEER-ee-a
supine	SOO-pyn
tendon	TEN-don
thoracic	thaw-RAS-ik
transverse	TRANZ-vers
umbilical region	um-BIL-ee-kel REE-jen
ventral	VEN-tral
vertebra	VERT-e-bra

ABBREVIATIONS

The following abbreviations are commonly used in the Australian healthcare environment. Because some abbreviations can have more than one meaning, check the context in which the abbreviation is used before assigning a meaning to it.

Abbreviation	Definition
C	cervical – there are 7 cervical vertebrae: C1–C7
L	lumbar – there are 5 lumbar vertebrae: L1–L5
LLQ	left lower quadrant
LUQ	left upper quadrant
RLQ	right lower quadrant

Table continued

Abbreviation	Definition
RUQ	right upper quadrant
S	sacral – the sacrum consists of 5 fused vertebral bones: S1–S5
T	thoracic – there are 12 thoracic vertebrae: T1–T12

STRUCTURAL ORGANISATION OF THE BODY

The human body is made up of classes of structures, ranging from the smallest units of the body called cells, through to groups of cells called tissues, to arrangements of related tissues into organs and finally to groups of organs with specific functions, known as body systems. These are the body systems covered in this textbook:

- cardiovascular system
- digestive system
- respiratory system
- musculoskeletal system
- integumentary system
- endocrine system
- urinary system
- lymphatic system
- immune system
- nervous system
- reproductive systems (male and female).

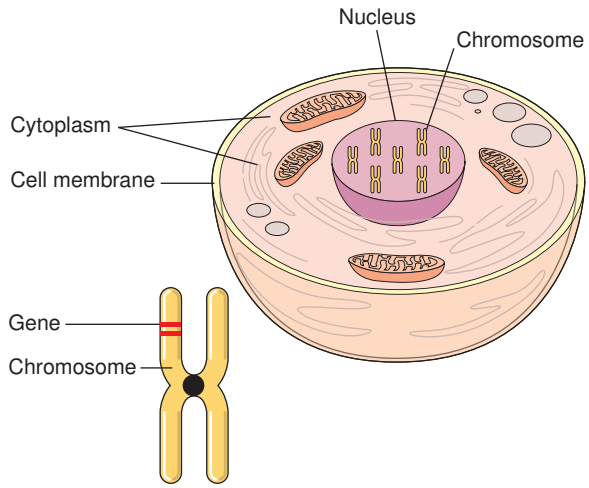
In this textbook, you will find a chapter relating to each body system and detailed information about the organs and their functions and the terminology associated with each system.

Cells

Cells are generally considered the smallest living units of the human body and constitute every part of it. They are formed from atoms that bond to create molecules, which in turn combine to form cells. In the human body, there are around 100 trillion cells, each of which is invisible to the eye. Although there are many types of cells, they all have much the same basic structure. Each cell is specialised to perform a particular function.

All cells are surrounded by cell membranes. The membrane has several important functions: it holds the contents of the cell together but it also functions to identify the type of cell to other cells and to selectively allow substances, such as those produced by the body or drugs introduced into it, to pass into and out of the interior of the cell. The two major parts of the inside of the cell are the cytoplasm and the nucleus (Fig. 3.1).

Figure 3.1 Parts of a human body cell



The cytoplasm is a clear substance with a jelly-like consistency. It consists mainly of water but also includes enzymes, salts, organelles such as mitochondria and ribosomes and certain organic molecules. Its principal activities are to dissolve wastes created by the cell and to move materials around inside the cell. It also permits the cells to carry out their specialised functions such as transmitting impulses or storing fats and is therefore vital to effective functioning of the human body. The various organelles contained in the cytoplasm are responsible for maintaining the cell. The mitochondria in the cytoplasm are the site of cellular respiration, which generates energy to enable the cell to function. Within the cytoplasm of most cells are a series of membranous channels known as the endoplasmic reticulum. The role of the endoplasmic reticulum relates to the production, processing and transport of proteins and lipids. The membranes of the endoplasmic reticulum differ in size and structure from cell to cell. For example, some cells, such as erythrocytes, do not have any endoplasmic reticulum, whereas other cells, particularly those that have an important role in synthesising proteins, need more endoplasmic reticulum.

The nucleus acts as the centre for administration and information and regulates the activities of the cell. In humans the nucleus also contains the chromosomal materials (deoxyribonucleic acid or DNA) and controls cell growth and reproduction. There are 46 chromosomes, consisting of 23 matched pairs, in all cells of the body except for the egg cells in the female and sperm cells in the male. These two types of cells have 23 chromosomes, which combine at the time of conception.

The chromosomes contain large numbers of genes in a specific order. The genes contain information about the composition of particular cells in the body to instruct them to grow in a specific way. Genes pass inherited materials to offspring, corresponding to various biological traits. Examples of such hereditary traits are blood type, hair and eye colour. If something goes wrong with a gene or the way it behaves, this is known as a mutation. Some genes that have mutations are responsible for causing defects and illnesses in the body. If the gene mutation exists in either an ovum or a sperm cell or both, the defect may be passed on to, or be inherited by, a child whose parents have the mutated gene. Diseases can occur due to a defect in a single gene or in a set of genes.

Tissues

A group of cells from the same origin that work together to carry out a particular function in the body is known as body tissue. There are four types of tissue in the human body: epithelial tissue, muscle tissue, nervous tissue and connective tissue.

- **Epithelial tissue** covers all external surfaces of the body. It also lines internal body cavities and organs and forms the basis for certain glands. Epithelial tissue has several important roles, including protecting underlying body tissues, secreting various chemicals and hormones into the blood and recognising sensation. Epithelial tissue provides a selective permeable membrane and all substances that enter the body or organ must pass through it.
- **Muscle tissue** can be classified into three types: skeletal, smooth and cardiac muscle. The primary functions of muscle tissues are to provide motion, maintain the body's posture and produce heat.
- **Nervous tissue** is responsible for controlling and coordinating body functions. Nervous tissue senses stimuli and sends impulses to different parts of the body to create a response. Nervous tissue makes up the central nervous system, which consists of the brain and spinal cord, and the peripheral nervous system, which covers all other nervous tissue. The function of the peripheral nervous system is to gather signals from all parts of the body and send them to the central nervous system, which then determines an appropriate reaction to the signal and responds back through the peripheral nervous system, directing a particular action.
- **Connective tissue** is found between the cells, acting to connect, support, insulate and stabilise organs of the body. Made primarily of collagen, there are four types of connective tissue: loose connective tissue, dense connective tissue, cartilage and other tissue. Loose connective tissue is the most common type, and it has a role in connecting epithelial tissue to underlying

structures, surrounding blood vessels and nerves and holding organs in fixed positions. This type of tissue is found underneath mucous membranes in areas such as the digestive tract and can also be found at the point of connection between skin and muscles. Dense connective tissue is made up of flexible collagen fibres and is very strong. Tendons, ligaments and fascia are examples of dense connective tissue. Cartilage is made up of various percentages of chondrocytes, elastin and collagen. Its purpose is to provide structure and support to other tissues. It also provides a form of padding in the joints. The other category of connective tissue includes bone or osseous tissue, blood and lymphatic tissue.

Organs

Organs are the next level of organisation in the body. Organs are composed of several different types of tissue that work together to perform a special function. There are many organs within the body, such as the heart, lungs, kidneys and skin.

Body systems

Two or more organs that perform collaboratively to undertake a common function are called a body system. This is the highest level of organisation in the human body and is the way that it is generally studied. As an example, the digestive system is responsible for receiving and digesting food and excreting waste. It consists of several organs from the mouth down to the anus including the stomach, small and large intestines, the pancreas, liver and gall bladder.

THE ANATOMICAL POSITION

This is a standard point or frame of reference that describes the human body when it is standing erect, facing forward, feet flat on the floor pointing forward and slightly apart, the arms slightly raised from the sides with the palms facing forward. When the position of an organ or body structure is described, the body is always considered as being in the anatomical position. When an organ is described as being on the right, it refers to the right side from the perspective of the person in the anatomical position. Similarly, something described as being on the left refers to the left of the body when it is in the anatomical position (Fig. 3.2).

BODY CAVITIES

The inside of the human body consists of five cavities or hollow spaces located within two main cavities, called the dorsal cavity and the ventral cavity. Each of the cavities contains specific organs. The dorsal cavities are at the back of the body and are also called the posterior cavities. Included here are the cranial cavity, which contains the brain and the pituitary gland, and the spinal cavity, containing the nerves of the spinal cord (Fig. 3.3).

The ventral or anterior cavities are at the front of the body. The three ventral cavities are the thoracic cavity, the abdominal cavity and the pelvic cavity. The thoracic cavity contains the heart, lungs, oesophagus, trachea, bronchi, thymus gland and the aorta. Within the abdominal cavity are the peritoneum, stomach, intestines, spleen, pancreas, liver, kidneys and gall bladder. The pelvic cavity contains small parts of the intestines, the rectum, bladder, urethra and ureters. In females, the uterus and vagina also form part of the pelvic cavity. The abdominal and pelvic cavities are frequently considered together and are called the abdominopelvic cavity.

ABDOMINOPELVIC REGIONS AND QUADRANTS

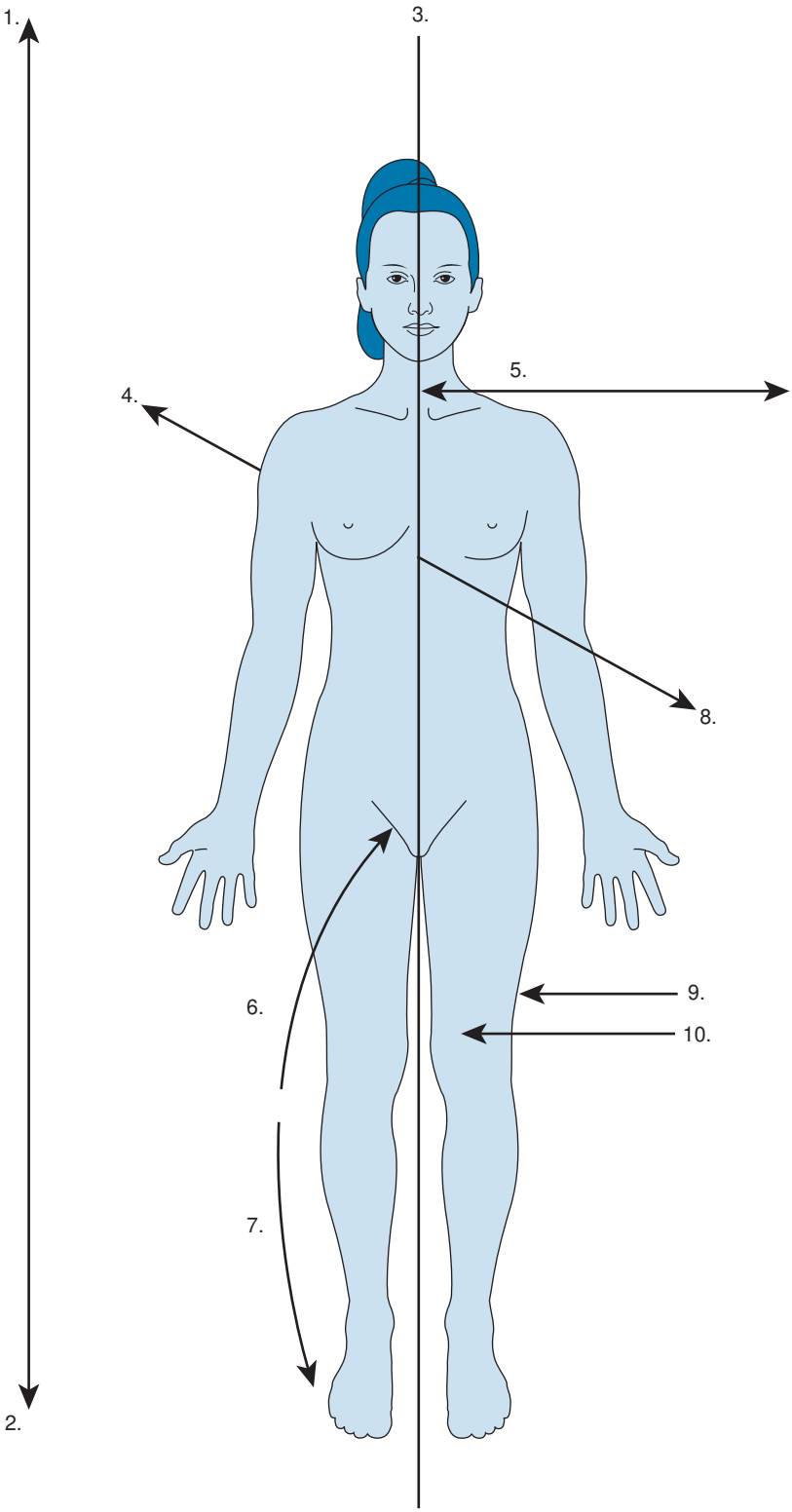
Because of the location of various organs within the abdominopelvic cavity, clinicians often divide the cavity into quadrants (quarters), each of which contains specific organs and therefore may be affected by particular diseases. This assists with making a provisional diagnosis. The quadrants are the right upper quadrant (RUQ), right lower quadrant (RLQ), left upper quadrant (LUQ) and left lower quadrant (LLQ) (Fig. 3.4).

To more specifically locate diseased organs, the abdominopelvic region can be further divided into a grid, with nine regions (Fig. 3.5). Remember that right and left refer to the body when it is in the anatomical position.

The regions are:

Region	Location
umbilical region	middle of the abdomen, surrounding the umbilicus
epigastric region	above (superior to) the stomach and umbilical region
hypogastric region	below (inferior to) the stomach and umbilical region
right inguinal (or right iliac) region	right side of the hypogastric region
right hypochondriac region	right of the epigastric region
left hypochondriac region	left of the epigastric region

Figure 3.2 Anatomical position



1. Superior
2. Inferior
3. Median line
4. Posterior/dorsal – back
5. Medial – lateral
6. Proximal
7. Distal
8. Anterior/ventral – front
9. Superficial
10. Deep

Figure 3.3 Body cavities

(Based on Salvo 2007)

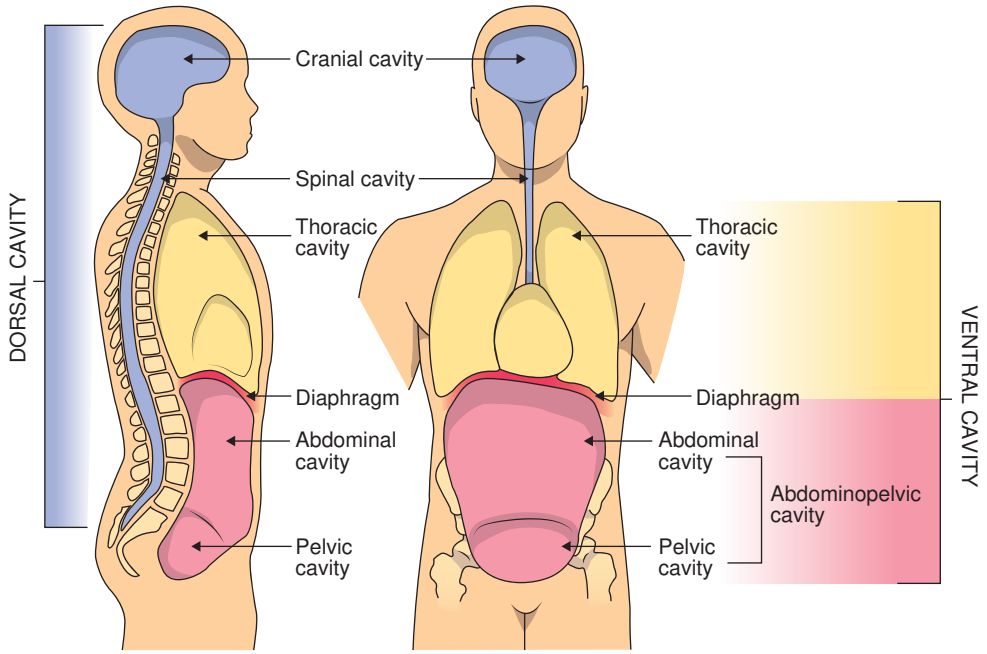


Figure 3.4 Abdominopelvic quadrants

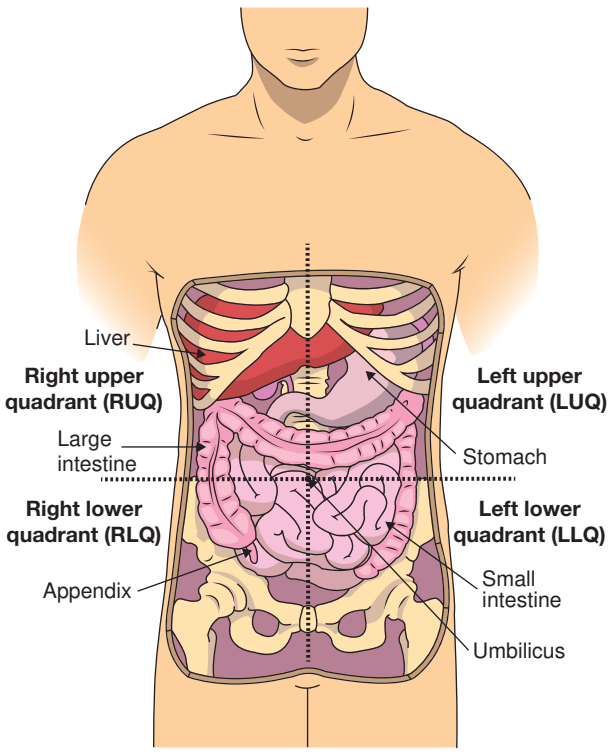


Figure 3.5 Abdominopelvic regions

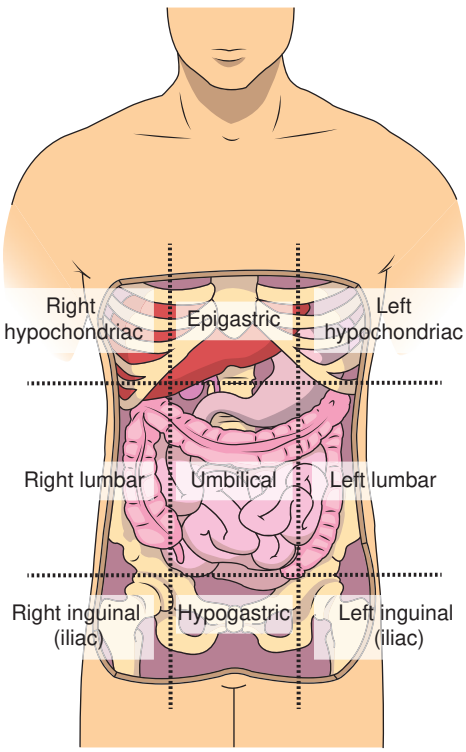


Table continued

Region	Location
left inguinal (or left iliac) region	left side of the hypogastric region
right lumbar region	lateral to the umbilical region on the right side
left lumbar region	lateral to the umbilical region on the left side

DIVISIONS OF THE SPINAL COLUMN

The spinal column consists of 33 bones, some of which are fused. Each spinal bone is known as a vertebra (plural: vertebrae). The spinal column is generally considered to consist of five divisions (Fig. 3.6). The divisions are:

cervical	Consists of 7 vertebrae, labelled C1–C7 and located in the neck region
thoracic	Consists of 12 vertebrae, labelled T1–T12 and located in the chest region Each of the 12 pairs of ribs is attached to a thoracic vertebra
lumbar	Consists of 5 vertebrae, labelled L1–L5 and located in the flank region (the area between the ribs and the hip bone)
sacral	Consists of 5 vertebrae, labelled S1–S5 These bones are fused to form the sacrum
coccygeal	Consists of 4 fused bones that form the coccyx or tailbone

It is important to make a distinction between the spinal column, which is made up of bone tissue, and the spinal cord, which consists of nervous tissue.

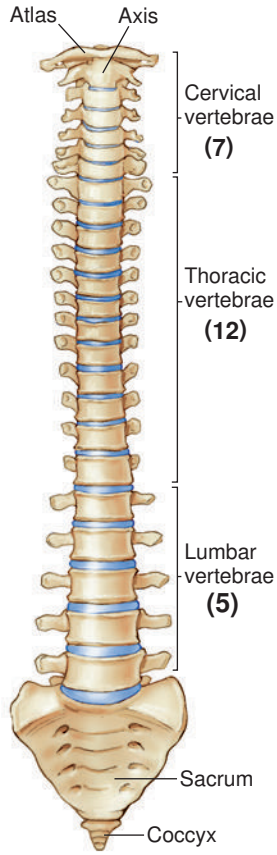
Each vertebra is separated by an intervertebral space which contains a small disc made up of water and cartilage. The purpose of the disc is to act as a cushioning mechanism for the vertebrae as well as a stabiliser, and to ensure flexibility and movement of the spinal column. An intervertebral space is labelled or identified based on the location of the vertebrae either side of the space. For example, intervertebral space T12/L1 is the space between the last thoracic vertebra (T12) and the first lumbar vertebra (L1).

POSITIONAL AND DIRECTIONAL TERMS

Provided below is a list of common terms used in medical terminology to describe the location of an organ or body structure in relation to another.

Figure 3.6 Divisions of the spinal column

(Mosby's Dictionary 2014)



Remember that when describing positions or directions the body is considered to be in the anatomical position. Refer back to Fig. 3.2 for guidance in understanding the terms. The terms have been paired with their opposing term to also aid in your understanding.

Position	Explanation	Example
anterior	Also known as ventral and refers to being in front of an organ or at the front of the body.	The nose is on the anterior side of the body.
posterior	Also known as dorsal and refers to being behind an organ or at the back of the body.	The rectum lies posterior to the uterus.
deep	Refers to being further or well away from the surface of the body.	The knife penetrated deep into the thoracic cavity.

Table continued

Position	Explanation	Example
superficial	Refers to on or close to the surface of the body.	The patient sustained superficial cuts to the hands which did not require sutures.
proximal	Refers to locations that are close to the point of origin of a structure or attachment to the body.	The tibia and fibula articulate proximally with the femur at the knee.
distal	Refers to locations that are further away from the point of origin of a structure or attachment to the body.	The ulna and radius are distal to the humerus.
inferior	Refers to organs or structures that are below another.	The heart lies inferior to the head.
superior	Refers to organs or structures that are above another.	The liver lies superior to the bladder.
medial	Refers to organs or structures closer to the midline of the body.	The heart lies medial to the arms.
lateral	Refers to organs or structures that are further away from the midline of the body.	The ears lie lateral to the nose.
supine	Refers to a person lying face up.	The supine position allows for palpation of the abdomen and testing the effect of leg raising during a physical examination.

Table continued

Position	Explanation	Example
prone	Refers to a person lying face down.	The patient was placed in the prone position to allow for a better examination of the back wound.

PLANES OF THE BODY

Often sections of the body are referred to in terms of anatomical planes, which are imaginary lines that are drawn through a body in the anatomical position. Use Fig. 3.7 to guide you in understanding the following terms.

Plane	Explanation
frontal	A vertical line that runs lengthwise through the body, dividing the body or structure into anterior and posterior sections; also known as the coronal plane.
sagittal	A vertical line that runs lengthwise through the body, dividing the body or structure into left and right sides. The mid-sagittal plane divides the body into equal right and left halves; also known as the lateral plane.
transverse	A plane that runs horizontally through the body or structure and divides it into superior and inferior sections; also known as the axial or cross-sectional plane.

Figure 3.7 Planes of the body