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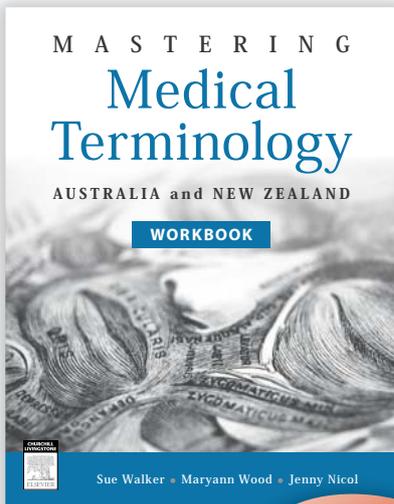
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Preface

Welcome to *Mastering Medical Terminology: Australia and New Zealand*. This publication has been written to provide a medical terminology book that will be of relevance to an audience in Australia and New Zealand. Australian terminology, perspectives, examples and spelling have been included and Australian pronunciation specified.

The textbook is accompanied by a self-help workbook and electronic support materials. Together, these products provide instructional materials, practice exercises and review activities to reinforce learning about each body system and speciality area. Examples and practical applications show medical terms in context. Diagrams and illustrations enhance understanding of the words that you will read.

We hope that the book will demonstrate the importance of the correct use of medical terminology in communicating information about clinical care. We have developed this textbook using British spelling as seen in Australian and New Zealand healthcare. 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. Where there has been any question about the appropriate spelling for a medical term, we have deferred to that recommended in Harris P, Nagy S and Vardaxis N (Editors) (2010) *Mosby's Dictionary of Medicine, Nursing & Health Professions Australian and New Zealand Edition*, 2nd edition: Mosby Elsevier, Sydney.

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

- Simple, non-technical explanations of medical terms
- Workbook format with ample spaces to write answers
- Explanations of clinical procedures, laboratory tests and abbreviations used in Australian clinical practice, as they apply to each body system and speciality area
- Pronunciation of terms and spaces to write meanings of terms
- Practical applications sections
- Exercises that test your understanding of terminology as you work through the text chapter by chapter
- Review activities that pull together terminology to help you study
- 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 this textbook, *Mastering Medical Terminology: Australia and New Zealand*, is to help students learn and to help instructors teach medical terms that are relevant to the Australian healthcare environment. 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 can't 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.

ACKNOWLEDGEMENTS

We appreciate the guidance and support of our editorial team, Rebecca Cornell, Melinda McEvoy and Amanda Simons. It has been great to have you helping us and keeping us on track as we have worked through the development of these materials.

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 that you will find the results 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 this textbook. It has been several years of hard work, but we think you will agree that it has been all 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 basic medical word structures and how medical terms are built 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 has been designed to cover each of the internal body systems. The order in which these chapters is completed is not critical. They can be studied in sequence or in any order but we believe the structure of the book is in a logical format from an educational perspective. The fourth module provides detail about systemic conditions, such as oncology and infectious diseases, followed by chapters relating to radiology, nuclear medicine and pharmacology. The final module relates to special applications of medical terminology, and provides glossaries of terms used in alternative and complementary therapies and public health, epidemiology and clinical research. The appendices give useful lists of abbreviations, word element glossaries and haematological test values.

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
- Review activities
- Word element review
- Vocabulary review

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 Harris P, Nagy S and Vardaxis N (Editors) (2010) *Mosby's Dictionary of Medicine, Nursing & Health Professions Australian and New Zealand Edition*, 2nd edition: Mosby Elsevier, Sydney.

We also encourage students to be curious – to read more about the medical conditions and procedures

in these books. Use of the internet is recommended although care needs to be taken to ensure that websites are trustworthy and reputable. Websites such as the Australian Government's Health Insite (<http://www.healthinsite.gov.au>) and the Victoria Government's Better Health Channel (<http://www.betterhealth.vic.gov.au/>) are highly regarded.

Medical abbreviations can be confusing so we suggest that you refer to the Health Information Management Association of Australia's useful reference: HIMAA (2009) *The Australian Dictionary of Clinical Abbreviations, Acronyms and Symbols*, 5th edition: HIMAA: North Ryde.

For additional information about therapeutic drugs and chemicals used in the Australian healthcare environment, we suggest access to the Monthly Index of Medical Specialties, known as MIMS. This drug and product information reference is accessible in print, electronically and online: (<http://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: (<http://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 words and are able to create them using word elements. 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.

CHAPTER 4

Musculoskeletal system

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Objectives

After completing this chapter you should be able to:

1. state the meanings of the word elements related to the musculoskeletal system
2. build words using the word elements associated with the musculoskeletal system
3. recognise, pronounce and effectively use medical terms associated with the musculoskeletal system
4. expand abbreviations related to the musculoskeletal system
5. describe the structure and functions of the musculoskeletal system including the bones, joints, tendons and muscles
6. describe common pathological conditions associated with the musculoskeletal system
7. describe common laboratory tests, diagnostic and surgical procedures associated with the musculoskeletal system
8. apply what you have learned by interpreting medical terminology in practice.

It is recommended that you demonstrate your knowledge of the musculoskeletal system by completing the relevant chapter in the *Mastering Medical Terminology Workbook*.



INTRODUCTION

Musculoskeletal is a general term which is defined as relating to muscles and the bones of the skeleton. The musculoskeletal system comprises bones, joints, cartilage, bursae, tendons, muscles and ligaments. It is the system that moves the body and maintains its form. Study of this system consists of osteology (the study of bones), arthrology (the study of joints), and myology (the study of muscles).

The musculoskeletal system does not work in isolation. It is closely linked with many other systems in the body, including the nervous system, genitourinary system, circulatory system, immune system, respiratory system, digestive system and endocrine system.

Sometimes the musculoskeletal system is considered as two separate body systems – muscles and bones – but

because they work very closely together, they will be studied in the same chapter in this textbook.

Other than the Tests and Procedures section, all topics in this chapter related to the musculoskeletal system have been divided into three sections: those pertaining to bones, those pertaining to joints and those pertaining to muscles.

BONES

New word elements relating to bones

To reinforce your learning, write the meanings of the medical terms in the spaces provided. You may need to check the meaning in a medical dictionary.

Combining forms relating to bones

Combining form	Meaning	Medical term	Meaning of medical term
calc/o	calcium	hypercalcaemia	
calc/i		calcinosis	
condyl/o	condyle	condyloid	
kyph/o	humpback	kyphoscoliosis	
lamin/o	lamina	laminotomy	
lord/o	curve, swayback	lordosis	
lumb/o	loins, lower back	lumbosacral	
myel/o	bone marrow, spinal cord	myelopoiesis	
orth/o	straight, upright	orthopaedic	
osse/o	bone	osseous	
oste/o	bone	osteomyelitis	
scoli/o	crooked, bent	scoliosis	
spondyl/o (used for disorders)	vertebra	spondylitis	
vertebr/o (used for structures)	vertebra	vertebrocostal	

The following combining forms refer to specific bones in the body. As well as knowing the meanings of each of the combining forms, make sure you can identify

the location of each of the bones on a picture of the skeleton, as in Figure 4.1.

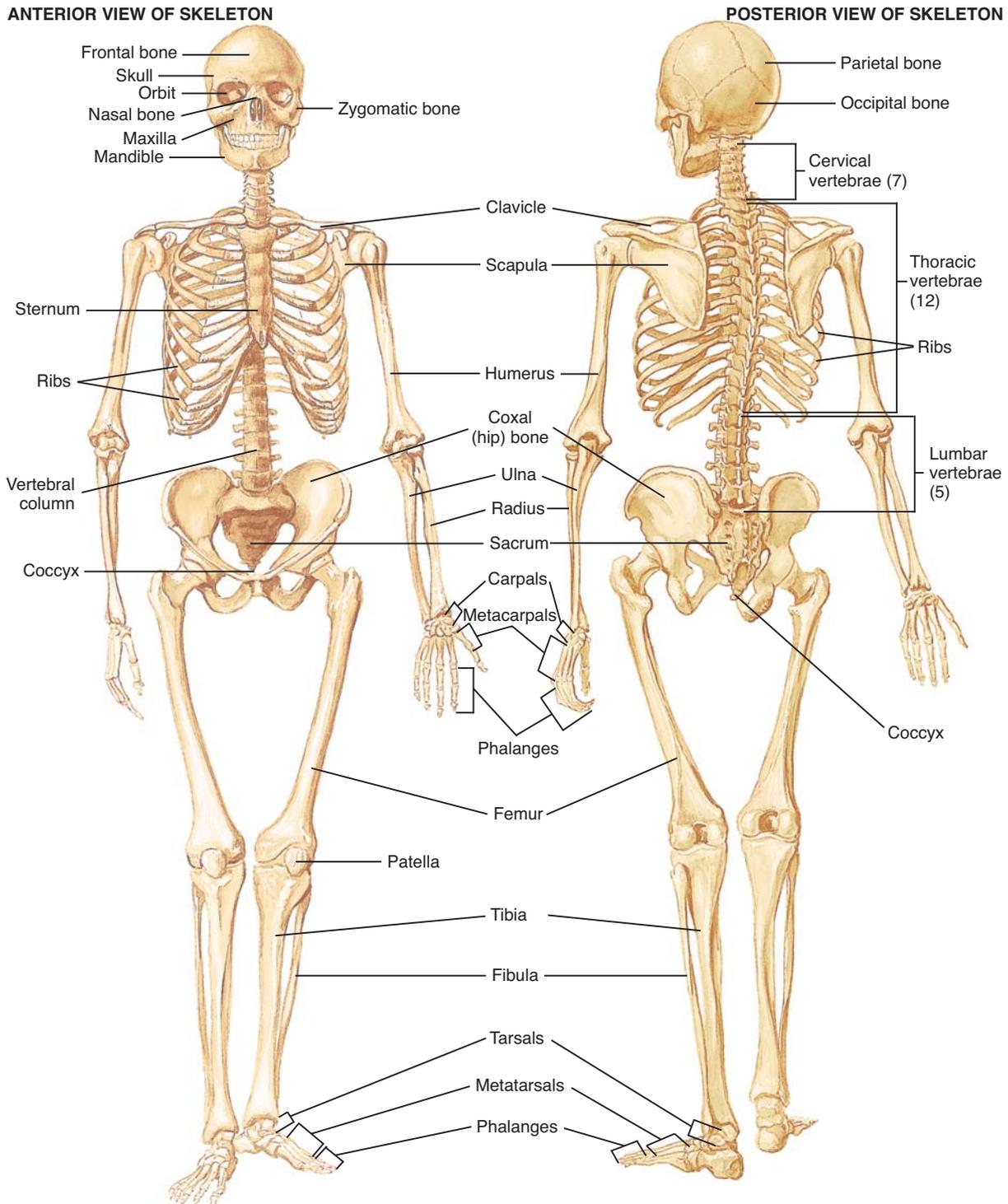
Combining form	Meaning	Medical term	Meaning of medical term
acetabul/o	acetabulum	acetabular	
brachi/o	arm	brachium	
calcane/o	calcaneus	calcaneodynia	
carp/o	carpals	carpectomy	
cervic/o	neck (or cervix uteri)	cervicothoracic	
clavicul/o	clavicle	supraclavicular	
cleid/o		cleidocostal	
cost/o	ribs	intercostal	
crani/o	cranium, skull	craniotomy	
dactyl/o	fingers, toes	syndactyly	
disc/o	intervertebral disc	discectomy	
femor/o	femur	femoral	
fibul/o	fibula	fibular	
humer/o	humerus	humeroradial	
ili/o	ilium, hip	iliac	
ischi/o	ischium	ischial	
malleol/o	malleolus	malleolar	
mandibul/o	mandible, lower jaw	submandibular	
maxill/o	maxilla, upper jaw	maxillofacial	
metacarp/o	metacarpals	metacarpophalangeal	
metatars/o	metatarsals	metatarsalgia	
olecran/o	olecranon	olecranal	
patell/o	patella	patellectomy	
pelv/i	pelvis	pelvimetry	
phalang/o	phalanges	phalangeal	
pub/o	pubis	pubiotomy	
radi/o	radius	radial	
scapul/o	scapula	scapular	
stern/o	sternum	sternocleidomastoid	
tars/o	tarsals	tarsalgia	
thorac/o	thorax, chest	thoracic	
tibi/o	tibia	tibial	
uln/o	ulna	ulnar	

Suffixes relating to bones

Suffix	Meaning	Medical term	Meaning of medical term
-blast	embryonic or developing cell	osteoblast	
-clast	to break	osteoclast	
-listhesis	slip or slide	retrolisthesis	
-lysis	separation, destruction, breakdown, dissolution	osteolysis	
-malacia	condition of softening	osteomalacia	
-physis	growth	diaphysis	
-tome	instrument to cut	osteotome	

Figure 4.1 Bones of the body

(Mosby's Dictionary, 2009)



Vocabulary relating to bones

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. A review of the vocabulary is found at the end of the chapter.

Term	Pronunciation
appendicular skeleton	a-pen-DIK-yoo-lah skel-e-ton
axial skeleton	AKS-ial skel-e-ton
cancellous bone	KAN-sel-us bohn
collagen	KOL-a-jen
compact bone	KOM-pakt bohn
fracture	FRAK-sha
herniated intervertebral disc	HER-nee-ay-ted in-ter-VER-teb-ral disk
kyphosis	ky-FOH-sis
lordosis	lor-DOH-sis
osseous tissue	OS-ee-us TISH-oo
ossification	os-if-i-KAY-shun
osteomalacia	os-tee-oh-ma-LAY-see-a
osteoporosis	os-tee-oh-pe-ROH-sis
scoliosis	sko-lee-OH-sis



Abbreviations relating to bones

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

Abbreviation	Definition
AKA	above knee amputation
BKA	below knee amputation
C1–C7	cervical vertebrae 1–7
Ca	calcium
fx, #	fracture
L1–L5	lumbar vertebrae 1–5
NOF	neck of femur
OA	osteoarthritis
ORIF	open reduction internal fixation (of fracture)
POP	plaster of paris
RIF/LIF	right iliac fossa/left iliac fossa
S1–S4	sacral vertebrae 1–4
T1–T12	thoracic vertebrae 1–12

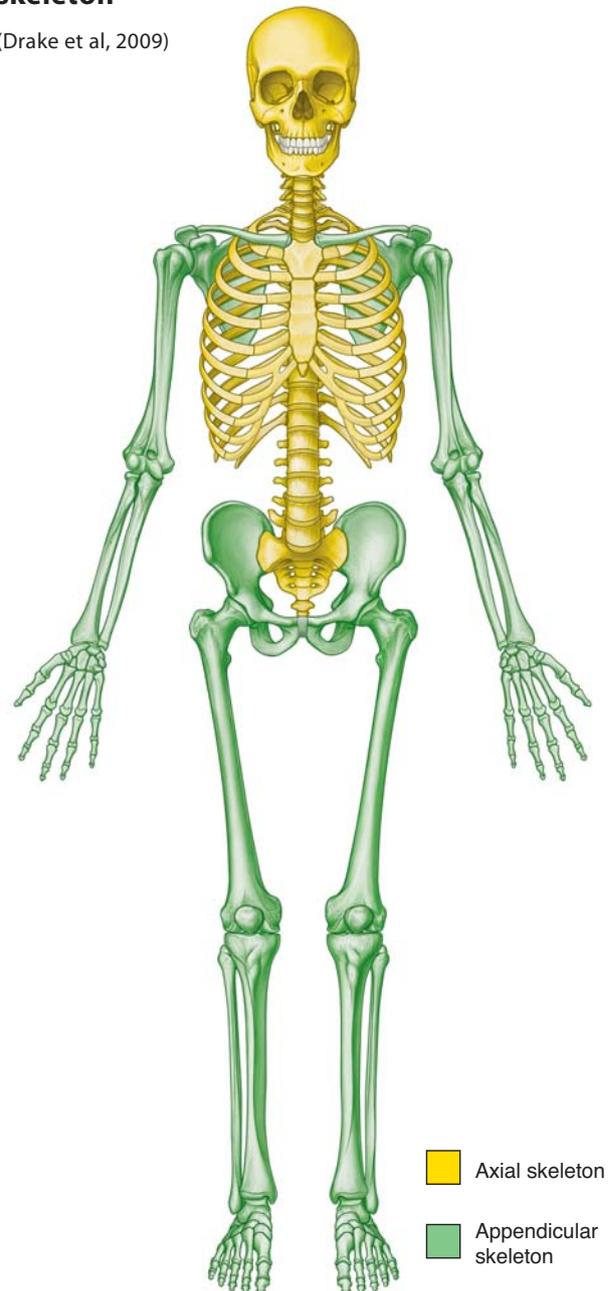


Functions and structure of bones

The adult human body has 206 bones. Prior to birth, the skeleton is made up of flexible cartilage. As the body grows, ossification takes place as the cartilage is replaced by hard deposits of calcium, phosphorus and collagen, which make up the bones. In newborn babies the body has 270 bones but many of these fuse as the child grows. The smallest bones are the ossicles in the inner ear and the largest bones are the right and left femur, or thigh bones. Around 30–40% of the body's total weight is

Figure 4.2 The axial and appendicular skeleton

(Drake et al, 2009)



made up of the bones. There are certain differences in the bones of males and females, primarily in the pelvic region because of the requirement of the female pelvis to accommodate pregnancy and childbirth.

The two main divisions of the bones of the body are called the axial skeleton and the appendicular skeleton. The axial skeleton is made up of the skull, rib cage and vertebral column. The remainder of the skeleton, including the extremities, is known as the appendicular skeleton. Bones are classified into five types: long bones (such as femur, tibia, humerus, radius), short bones (such as the bones in the ankles and wrists), flat bones (sternum, cranium, scapula, ribs), irregular bones (vertebrae, hips, bones of the face) and sesamoid bones (round bone masses embedded in tendons, such as the patella).

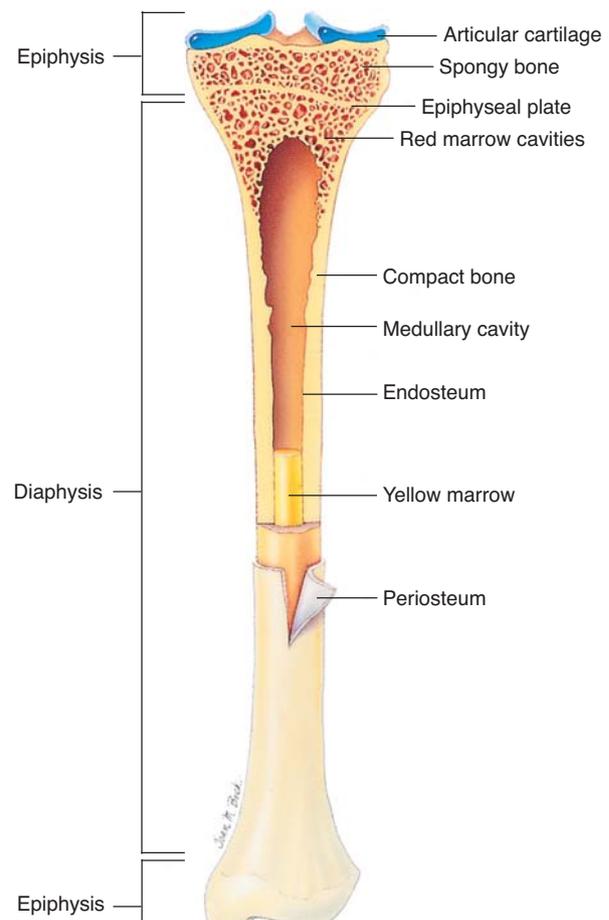
The functions of bones are:

- to provide a framework to shape and support the body and a place for tendons and muscles to attach;
- to enable movement, by acting as levers in collaboration with muscles and joints;
- to provide protection for the body's most vital and delicate organs – the brain, heart and lungs amongst others;
- to create blood cells by a process called haematopoiesis – this takes place in the bone marrow;
- to store minerals such as calcium and iron;
- to help regulate certain hormones including those that assist with maintenance of blood sugar levels and deposition of fats.

There are two types of osseous tissue making up bones: compact or hard bony tissue (also known as cortical tissue) and cancellous or spongy tissue. The difference lies in the denseness of the cells. Hard bones have closely packed cells which have thin canals running through them for blood vessels to pass through. Compact tissue is usually located on the outside of bones and gives bones their characteristic hard, smooth, white appearance. Cancellous bones have spaces in between their cells, giving them a lattice-like appearance. This

Figure 4.3 Bone structure

(Thibodeau & Patton, 2010)



type of osseous tissue is generally found on the inside of bones, is highly vascular and generally houses the bone marrow where haematopoiesis takes place.

Pathology and diseases relating to bones

The following section provides a list of some of the most common diseases and pathological conditions relevant to the bones.

Curvature of the spine

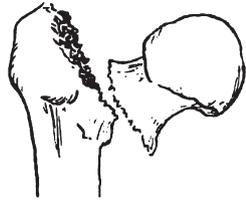
Term	Pronunciation	Definition
kyphosis	ky-FOH-sis	Kyphosis is an abnormal convex or posterior curvature of the thoracic spine. It is also called hunchback or humpback.
lordosis	lor-DOH-sis	Lordosis is an abnormal concave or anterior curvature of the lumbar spine. It is also called a sway back.
scoliosis	skol-ee-OH-sis	Scoliosis is a lateral S-shaped curvature of the spine.

Fractures

Term	Pronunciation	Definition
fracture	FRAK-sha	<p>A fracture is a break or crack in a bone. Fractures are caused by trauma such as a fall or motor vehicle accident, through overuse or repetitive movements as may occur in athletes, or as a result of a disease process such as osteoporosis that weakens the bones. Fractures are classified by type and whether they are open or closed.</p> <p>Open fracture: a fracture in which there is an open wound communicating with the fracture exposing the underlying bone. There is an increased risk of infection with an open fracture.</p> <p>Closed fracture: the bone is broken but there is no open wound.</p> <p>Different types of fractures:</p> <p>Avulsion: a closed fracture that occurs when a strong muscle contraction pulls a tendon free resulting in a fragment of bone being broken off. Avulsion commonly occurs in athletes.</p> <p>Complete: bone fragments at the fracture site are completely separated.</p> <p>Complicated: involves injury to bones and other organs such as blood vessels, brain, lungs, etc.</p> <p>Compound: another name for an open fracture.</p> <p>Compression: a closed fracture that occurs when bones are forced into each other crushing them. It commonly occurs to the bones of the spine and may be caused by landing on the feet or falling into a sitting position, or as a result of advanced osteoporosis.</p> <p>Comminuted: bone is broken into multiple fragments.</p> <p>Greenstick: an incomplete break, a bending of the bone. Most often occurs in children.</p> <p>Impacted: A closed fracture which occurs when force is applied to both ends of a bone, driving them into each other.</p> <p>Incomplete: bone fragments at the fracture site are partially joined.</p> <p>Pathological: a fracture that is caused because bones have been weakened by a disease process such as osteoporosis, metastatic neoplasm, Paget's disease. Usually, no significant trauma or injury occurs to cause the fracture. A gentle bump or rolling over in bed may be enough force to cause the diseased bone to fracture.</p> <p>Simple: a closed nondisplaced fracture that does not require manipulation.</p> <p>Spiral: part of the bone has been twisted. The fracture runs around the long axis of the affected bone.</p> <p>Stress: a closed fracture, often just a hairline crack that occurs as a result of repetitive movements that cause strain on a body part. It is common in athletes such as runners and ballet dancers.</p> <p>Transverse: the fracture is in a straight line across the affected bone.</p> <p>Fractures are diagnosed by clinical history, x-ray and sometimes by CT scan or MRI. Treatment involves administration of analgesic medication, immobilisation by a plaster cast or splint and sometimes surgery.</p>

Figure 4.4 Types of fractures

(Griffith, 1994)



Hip Fracture Through Trochanter of Femur



Hip Fracture Through Neck of Femur



Greenstick



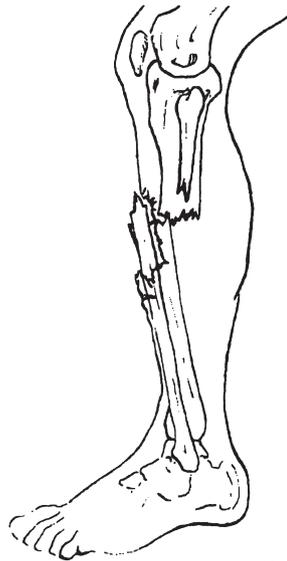
Spiral



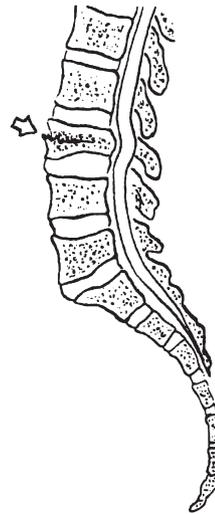
Comminuted



Transverse



Compound



Compression

Other conditions

Term	Pronunciation	Definition
herniated intervertebral disc	HER-nee-ay-ted in-ter-VER-teb-ral disk	<p>An intervertebral disc is located between the vertebrae of the spine. Sometimes as a result of an acute injury to the spine or because of degenerative wear and tear to the disc, it splits or ruptures. When this happens, the inner gel-like substance (nucleus pulposus) leaks out into the spinal canal. This is called a herniation of the nucleus pulposus – or a herniated disc.</p> <p>A herniated disc is often referred to as a <i>slipped disc</i> but this terminology is erroneous as a disc cannot actually slip. The most common site for a herniated disc is in the lumbar spine especially at L4–L5. Symptoms will vary depending on the site and degree of the herniation but can include paraesthesia, sciatica and back pain. Some patients will not experience any pain at all. Many cases will resolve spontaneously with bed rest, analgesics and physiotherapy, but if the condition persists, more invasive treatment such as discectomy or laminectomy may be required.</p>
osteomalacia	os-tee-oh-ma-LAY-see-a	<p>Osteomalacia is a softening of the bones due to a lack of vitamin D or a problem with the body's ability to metabolise and absorb this vitamin. Adequate amounts of vitamin D are essential for the body to be able to absorb calcium and phosphorous into the bloodstream. Vitamin D deficiency may be caused by a lack in the diet, limited exposure to sunlight which produces vitamin D in the body or malabsorption by the intestines. Treatment involves vitamin D, calcium and phosphorous supplements. In children, osteomalacia is called rickets.</p>
osteoporosis	os-tee-oh-pe-ROH-sis	<p>Osteoporosis occurs when there is a decrease in bone density due to bones losing minerals, such as calcium, more quickly than the body can replace them. Bones become porous and brittle resulting in an increased likelihood of fractures. While any bone can be affected by osteoporosis, the most common sites for osteoporotic fractures are the hip, spine, ribs, pelvis, wrist and upper arm. While it is most frequently seen in postmenopausal women due to decreased levels of oestrogen, osteoporosis can occur in younger women and in men.</p>

JOINTS

New word elements relating to joints

To reinforce your learning, write the meanings of the medical terms in the spaces provided. You may need to check the meaning in a medical dictionary.

Combining forms relating to joints

Combining form	Meaning	Medical term	Meaning of medical term
ankyl/o	crooked, bent, stiff	ankylosis	
arthr/o	joint	haemarthrosis	
articul/o	joint	articular	
burs/o	bursa	bursitis	
chondr/o	cartilage	chondrodysplasia	
ligament/o	ligament	ligamental	
menisc/o	meniscus, crescent	meniscectomy	
rheumat/o	watery flow	rheumatology	
synov/o	synovial membrane or fluid	synovectomy	
synovi/o		synoviosarcoma	

Suffixes relating to joints

Suffix	Meaning	Medical term	Meaning of medical term
-clasis	break	arthroclasis	
-desis	to bind, surgical fixation, fusion	arthrodesis	
-stenosis	narrowing, stricture	craniostenosis	

Vocabulary relating to joints

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. A review of the vocabulary is found at the end of the chapter.

Term	Pronunciation
arthritis	arth-RY-tis
articulation	ah-tik-yoo-LAY-shun
ball and socket joint	ball and SOK-et joynt
bunion	BUN-yun
bursitis	bur-SY-tis
cartilage	KAH-til-aj
cartilaginous joint	kah-til-AJ-en-us joynt
condyloid joint	KON-di-loyd joynt
coronal suture	kor-OH-nal SOO-cha
dislocation	dis-loh-KAY-shun
fibrous joints	FY-brus joynt
gouty arthritis (gout)	GOW-tee arth-RY-tis
hinge joint	hinj joynt
lambdoid suture	lam-DOYD SOO-cha
meniscus tear	me-NISS-kus tear
osteoarthritis	os-tee-o-arth-RY-tis
pivot joint	PIV-ot joynt
rheumatoid arthritis	ROO-ma-toyd arth-RY-tis
rotator cuff syndrome	roh-TAY-ta kuf SIN-drohm
saddle joint	sa-del joynt
sagittal suture	SAJ-i-tel SOO-cha
sprain	sprayn
synovial fluid	sy-NOH-vee-al FLOO-id
synovial joints	sy-NOH-vee-al joynt
synovial membrane	sy-NOH-vee-al MEM-brayn



Abbreviations relating to joints

The following abbreviations are commonly used in the Australian healthcare environment. As some

abbreviations can have more than one meaning it is suggested that you carefully check the context in which the abbreviation is used before assigning a meaning to it.

Abbreviation	Definition
ACL	anterior cruciate ligament
CTS	carpal tunnel syndrome
DJD	degenerative joint disease
OA	osteoarthritis
RA	rheumatoid arthritis
ROM	range of movement
THR	total hip replacement
TKR	total knee replacement
TMJ	temporomandibular joint



Functions and structure of joints

Joints are the location where two or more bones come together to create body movement or articulation. The three types of joints are fibrous, cartilaginous and synovial, classified according to the amount of movement they permit.

Fibrous joints are fixed and unable to move because thick membranous collagen fibres hold the bones together. Also known as sutures, this type of joint is found in the skull where the coronal suture joins the frontal and parietal bones; the sagittal suture joins the two parietal bones from the front to the back and the lambdoid suture joins the parietal bones with the occipital bone.

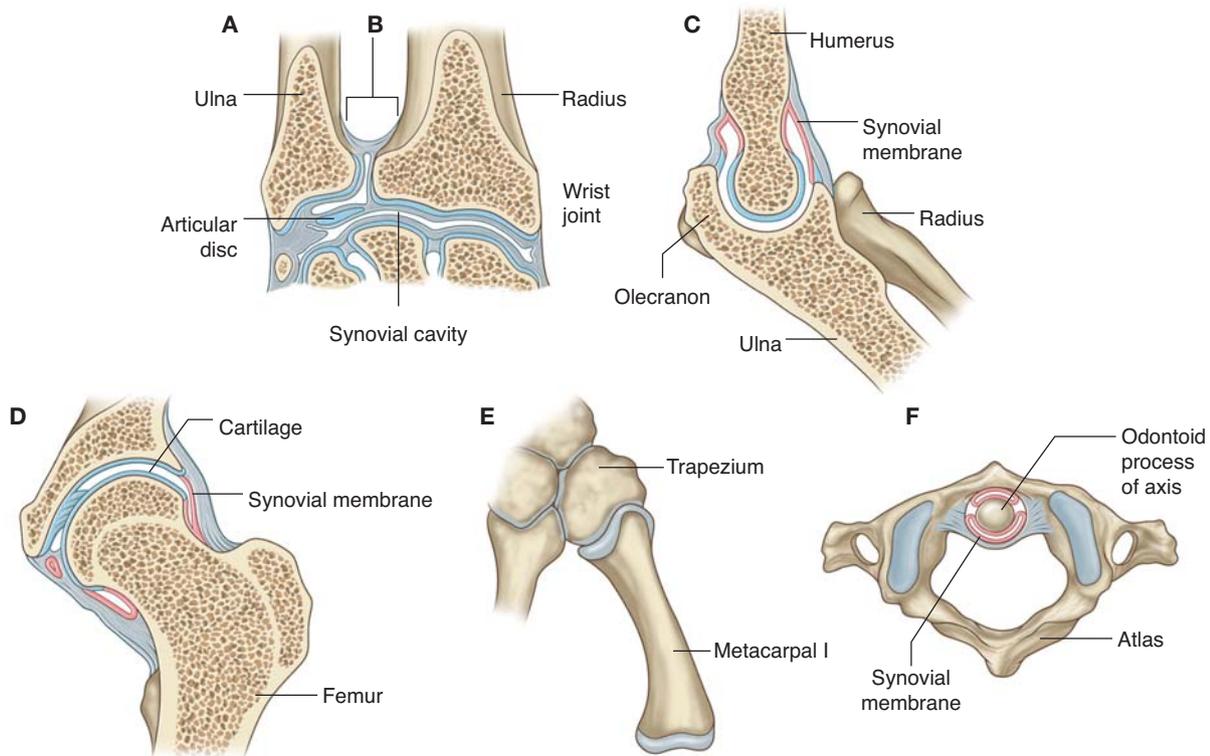
As the name suggests, cartilaginous joints have cartilage between them. Although they allow movement, this is far more restricted than the movement of synovial joints. The joints of the vertebral column and the pelvis are examples of this type of joint.

Synovial joints permit the greatest range of movement. In between the bones are spaces covered with synovial membrane, which fill with synovial fluid. This fluid lubricates and protects the bones as they move. Synovial joints include ball and socket joints (such as the shoulders and hips), hinge joints (such as

Figure 4.5 Types of joints

A. Condylar (wrist); **B.** Gliding (radioulnar); **C.** Hinge or ginglymus (elbow); **D.** Ball and socket (hip); **E.** Saddle (carpometacarpal of thumb); **F.** Pivot (atlanto-axial)

(Drake, 2009)



the ulnar part of the elbows and the knees), gliding joints, which allow bones to glide across each other (such as in the ankles and wrists), condyloid joints, which allow movement but not rotation (such as in the jaw or the fingers and toes), pivot joints, which allow both rotation and twisting (such as in the radius part of the elbow and the neck) and saddle joints, which permit

side to side and forward and backward movement but not rotation (such as in the thumb).

Pathology and diseases relating to joints

The following section provides a list of some of the most common diseases and pathological conditions relevant to joints.

Term	Pronunciation	Definition
arthritis	arth-RY-tis	Arthritis is inflammation of a joint resulting in pain, swelling and alteration to structure and function. There are several types of arthritis with different aetiologies.
– osteoarthritis (OA)	os-tee-o-arth-RY-tis	Osteoarthritis is a progressive, degenerative joint disease characterised by loss of articular cartilage, the presence of osteophytes and hypertrophy of bone. This leaves the ends of the bones unprotected, and the joint loses its ability to move smoothly and becomes painful and stiff. Osteoarthritis occurs mainly in the hips and knees. It is diagnosed by clinical history and x-ray. Treatment consists of analgesic medication such as aspirin and physiotherapy. As the disease progresses, joint replacement surgery may be necessary.

Table continued

Term	Pronunciation	Definition
Figure 4.6 Osteoarthritis of the knee		
<p>Normal Advanced osteoarthritis</p> <p>Coronal view schematic of osteoarthritis of the knee</p>		
<p>– rheumatoid arthritis (RA)</p>	<p>ROO-ma-toyd arth-RY-tis</p>	<p>Rheumatoid arthritis is a chronic autoimmune disease in which the body's immune system attacks the synovium, the thin membrane that lines the joints. As a result, fluid builds up in the joints causing pain and inflammation. Joint deformity and stiffness often results. The hands, feet and knees are most commonly affected. There is no cure but RA can be managed with NSAID medication to reduce pain, DMARDs to stop disease progression and physiotherapy. Complementary therapies such as acupuncture and massage may help some patients.</p>
<p>– gouty arthritis (gout)</p>	<p>GOW-tee arth-RY-tis</p>	<p>Gouty arthritis is caused by hyperuricaemia (a build-up of uric acid in the blood) resulting in the formation of tiny crystals of urate in body tissues. When the crystals form in joints, acute arthritis results. The feet, ankles, wrists and fingers can be affected but the big toe is the most common site. Repeated bouts of gouty arthritis can damage the joint and lead to chronic arthritis. A diet high in fats and alcohol and a family history are possible causes of gout. Men are more likely to develop gouty arthritis than are women. While gout is a progressive disease, there are effective treatments to lower uric acid levels and prevent inflammation. Dietary restrictions to reduce intake of fats and alcohol are required.</p>

Table continued

Term	Pronunciation	Definition
bunion	BUN-yun	A bunion (hallux valgus) is an abnormal swelling of the medial aspect of the joint between the big toe and the first metatarsal bones. It is a common disorder that is caused by degenerative joint disease, pressure from poorly fitting shoes or can be hereditary. Treatment involves wearing wide-toed shoes with cushioned lining. If the bunion is severe, a bunionectomy may be performed.
bursitis	bur-SY-tis	Bursitis is inflammation of a bursa (a fibrous fluid-filled sac between a tendon and bone). Normally, the bursa provides a slippery surface that assists movement and reduces friction. When a bursa becomes inflamed it results in joint pain, stiffness and swelling around the affected joint. Bursitis is caused by chronic overuse, trauma and infection. The most commonly affected joints are the shoulder, elbow, knee and hip. Treatment consists of administering NSAIDs such as ibuprofen, physiotherapy and rest as required. In some cases an injection of a corticosteroid into the joint is required.
dislocation	dis-loh-KAY-shun	A dislocation (also called a luxation) is the displacement of two bones from their normal position where they articulate in a joint. It usually occurs as the result of trauma. Ligaments in the joint are usually injured as well. A subluxation is a partial dislocation. An x-ray is required to identify if a fracture has also occurred. Any dislocation needs to be reduced urgently to prevent complications such as ischaemia.
meniscus tear	men-IS-kus tear	A tear to the meniscus may be a traumatic injury, commonly seen in athletes, when a knee joint is bent then twisted. It often occurs in conjunction with an anterior cruciate and medial cruciate ligament tear. It can also be part of the degenerative process in older patients who have more brittle cartilage. The most common symptoms of a meniscus tear are: swelling and pain in the knee, tenderness on palpation of the meniscus, popping or clicking within the knee and limited motion of the knee joint. A tear is diagnosed by MRI or by an arthroscopy. Treatment consists of ice packs and rest (conservative treatment) or meniscus repair.
rotator cuff syndrome	roh-TAY-ta kuf SIN-droh-m	Rotator cuff syndrome occurs when there is a tear or impingement of the tendons or muscles in the shoulder. The supraspinatus tendon is the most common one to tear. This is often as a result of an acute trauma or age-related degeneration. In some patients there is no pain, in others it feels like a dull ache in the shoulder and may make it difficult to sleep while others experience severe debility. Impingement syndrome may cause pain when raising the arm in front or to the side. Conservative treatments such as analgesic medication, rest, hot/cold packs and physiotherapy are the initial treatment options. If the condition persists, a surgical procedure called a rotator cuff repair may be performed.
sprain	sprayn	A sprain occurs when a ligament is overstretched or torn due to trauma to the joint. The most common site affected is the ankle. There is no fracture or dislocation present. It can result in pain, swelling, joint instability and loss of function. Rest, application of ice and a compression bandage are effective treatments.

MUSCLES

New word elements relating to muscles

To reinforce your learning, write the meanings of the medical terms in the spaces provided. You may need to check the meaning in a medical dictionary.

Combining forms relating to muscles

Combining form	Meaning	Medical term	Meaning of medical term
clon/o	turmoil	clonic	
dors/o	back (of body)	dorsodynia	
fasci/o	fascia (a band)	fasciectomy	
fibr/o	fibre	fibromyalgia	
fibros/o	fibrous connective tissue	fibrosis	
kinesi/o	movement, motion	kinesiologist	
lei/o	smooth	leiomyoma	
muscul/o	muscle	muscular	
my/o	muscle	myofascial	
myos/o		myositis	
plant/o	sole of the foot	plantar	
rhabd/o	rod shaped, striated (skeletal)	rhabdomyosarcoma	
tax/o	order, coordination	ataxia	
ten/o	tendon	tenorrhaphy	
tend/o		tendolysis	
tendin/o		tendinitis	
ton/o	tone, tension, pressure	myotonia	
tort/i	twisted	torticollis	

Prefixes relating to muscles

Prefix	Meaning	Medical term	Meaning of medical term
ab-	away from	abductor	
ad-	toward	adductor	
dorsi-	back	dorsiflect	
poly-	many, much	polymyalgia	

Suffixes relating to muscles

Suffix	Meaning	Medical term	Meaning of medical term
-asthenia	weakness	myasthenia	
-trophy	development, nourishment	atrophy	

Vocabulary relating to muscles

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. A review of the vocabulary is found at the end of the chapter.

Term	Pronunciation
aponeurosis	ap-on-yoo-ROH-sis
cardiac muscle	KAH-dee-ak MUS-el
fascia	FASH-ee-a
fibromyalgia	fy-broh-my-AL-jee-a
involuntary muscle	inn-VOL-un-terry MUS-el
muscular dystrophy	MUS-kyoo-lah DIS-troh-fee
myasthenia gravis	my-as-THEEN-ee-ah GRA-vis
polymyositis	pol-ee-my-oh-SY-tis
skeletal muscle	ske-LEE-tal MUS-el
smooth muscle	smooth MUS-el
strain	strayn
striated	stry-AY-ted
tendon	TEN-don
voluntary muscle	VOL-un-terry MUS-el



Abbreviations relating to muscles

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

Abbreviation	Definition
DMARD	disease-modifying anti-rheumatic drugs
DMD	Duchenne's muscular dystrophy
EMG	electromyogram
IM	intramuscular
NSAID	non-steroidal anti-inflammatory drug



Functions and structure of muscles

There are more than 650 muscles in the human body, which together compose around half of the body weight of the average human. Muscle tissue is made

up of cells that are called fibres. Depending on their purpose, the size and shape of the fibres differs. The fibres are surrounded by connective tissue and are enclosed in fascia, a type of strong connective tissue. As the muscle fibres contract and relax, they produce movement in the body. Many body movements are a result of several muscles working collaboratively. Muscles are often grouped in pairs, where a contraction of one muscle moves a bone in a particular direction, and a contraction of the other muscle moves it in the opposite direction. The biceps and triceps muscles of the upper arm are a good example of this mechanism. When the central nervous system instructs the biceps muscle to contract, a corresponding impulse relaxes the triceps muscle, and vice versa. Occurring at the same time, these impulses allow for movement in both directions.

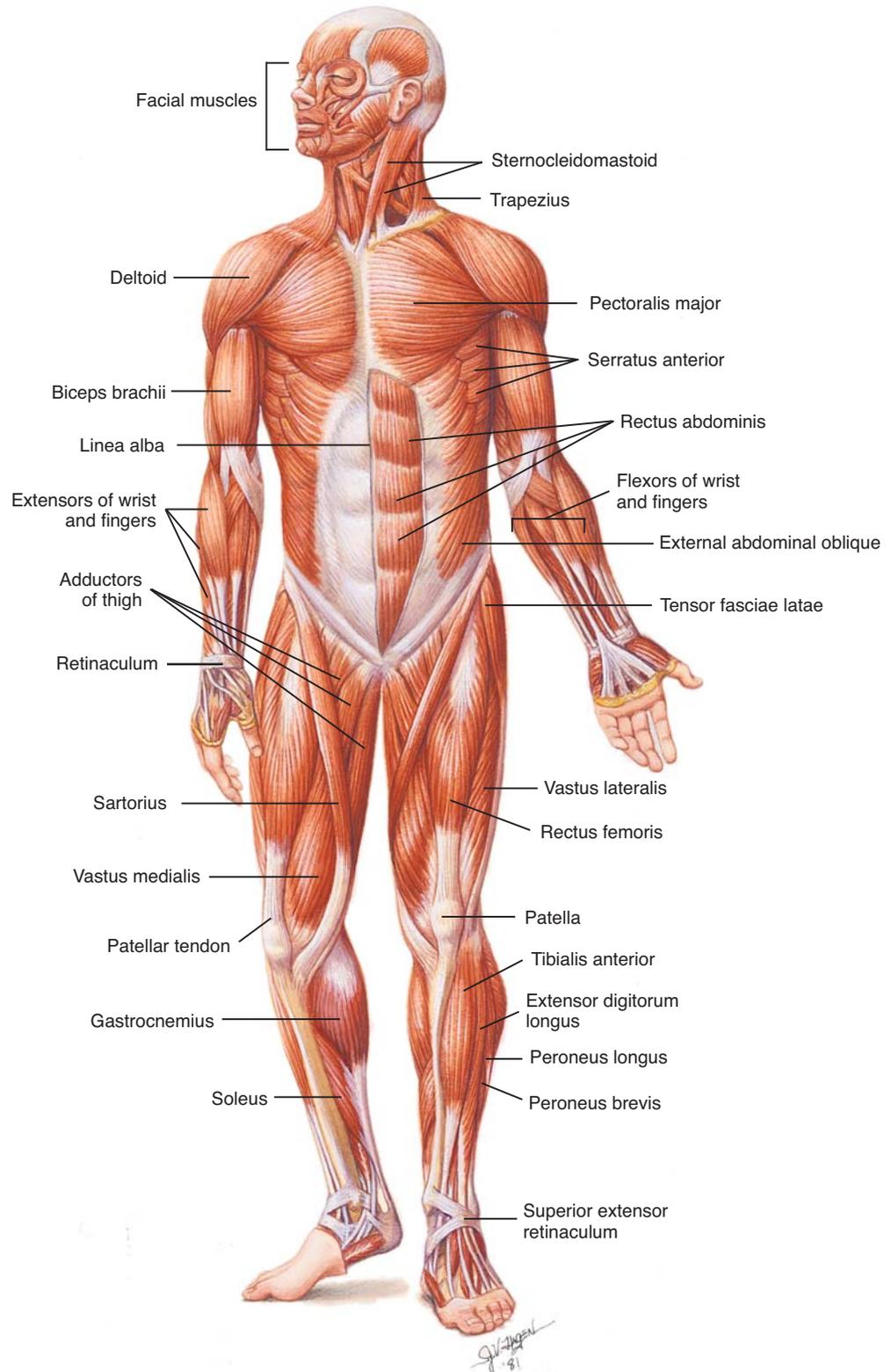
Muscles can be attached to bones, to skin or to other muscles by tendons and aponeuroses. Tendons are thick fibrous bands of tissue, whereas aponeuroses are more like flat ribbons, having fewer blood vessels and nerves than tendons. The body regions with aponeuroses are in the ventral abdominal region, the dorsal lumbar region, and in the palm of the hand.

Humans have three different kinds of muscle:

Skeletal muscle attaches to bones by tendons across a connecting joint, which allows the muscles to pull on bones and create movement. Skeletal muscle is striated in appearance; that is, the cell fibres have alternating light and dark bands (known as striations). Skeletal muscles are under the conscious control of the body – in other words they are voluntary muscles. These muscles hold the skeleton together, give the body shape, and help it with everyday movements by contracting or tightening. Skeletal muscles vary considerably in size, shape and arrangement of fibres. The smallest muscles in the body are found in the inner ear and the largest and most bulky is the muscle in the buttock.

Smooth muscles are commonly involved in involuntary movements – in other words, movements over which we have no conscious control. Smooth muscles are formed from thin layers or sheets made up of cells and are found in the walls of the internal organs, such as the stomach, intestine, bladder and blood vessels (excluding the heart).

Cardiac muscles are unique in that they are striated in appearance but involuntary in action. As the name implies, cardiac muscles are found in the myocardium of the heart and largely make up the heart wall. This type of muscle contracts to force blood out of the heart into the blood vessels, and relaxes to allow the heart to fill with blood.

Figure 4.7 Muscles of the body*(Mosby's Dictionary, 2009)***ANTERIOR VIEW**

POSTERIOR VIEW

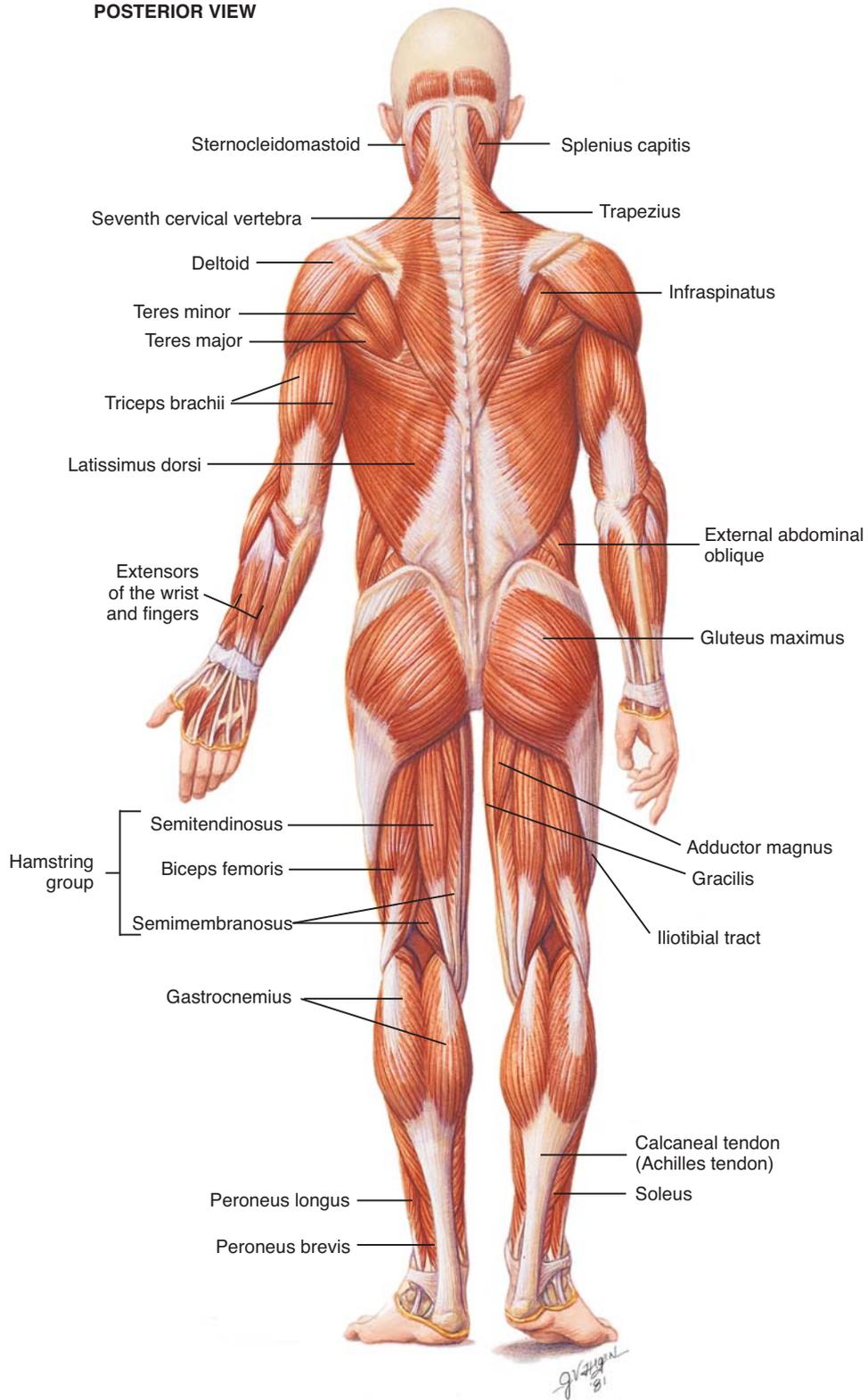
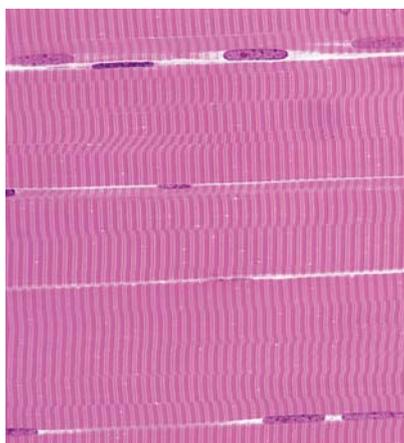
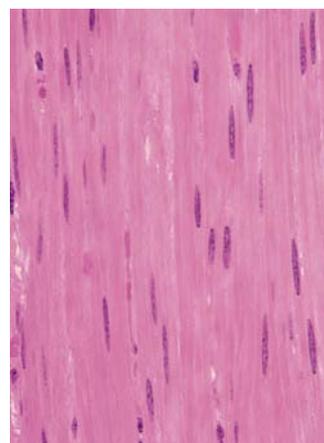


Figure 4.8 Types of muscle tissue

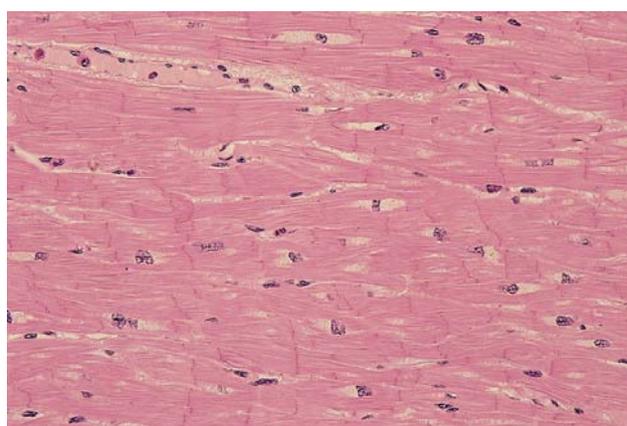
(Thibodeau, 2003)



Skeletal muscle



Smooth muscle



Cardiac muscle

Pathology and diseases relating to muscles

The following section provides a list of some of the most common diseases and pathological conditions relevant to the muscles.

Term	Pronunciation	Definition
fibromyalgia	fy-bro-my-AL-jee-a	Fibromyalgia is a term used to describe a common syndrome in which people experience long-term, widespread pain and tender points in joints, muscles, tendons and other soft tissues. It also results in disturbed sleep and exhaustion. The cause is unknown but possible triggers include viral infection, physical and emotional stress. It tends to be more common in people with pre-existing Lupus, rheumatoid arthritis, or ankylosing spondylitis. There is no cure but symptomatic treatment can help some patients.

Table continued

Term	Pronunciation	Definition
muscular dystrophy	MUS-kyoo-lah DIS-troh-fee	<p>Muscular dystrophy (MD) refers to a group of hereditary diseases that weaken different muscle groups in various ways. A person affected with MD has a genetic mutation that prevents the repair of muscle tissue. This occurs gradually over time. Symptoms may start at any time from infancy through to adulthood.</p> <p>The most common form of muscular dystrophy is Duchenne muscular dystrophy (DMD). It is caused by a genetic defect, which results in the body's failure to produce a specific protein called dystrophin. It predominantly affects boys between the ages of two and six years. By age ten to twelve years these children will often be in a wheelchair. This disease also affects other body systems so patients need regular respiratory and cardiac assessment. It is likely that these patients will eventually need a ventilator to breathe. People with DMD usually do not survive beyond their late teens or early adulthood.</p>
myasthenia gravis	my-as-THEEN-ee-a GRA-vis	<p>Myasthenia gravis is an autoimmune, neuromuscular disorder that causes weakness of the voluntary (skeletal) muscles. The flow of impulses between nerves and muscles is compromised. It can occur at any age but predominantly affects young women and older men. Muscle weakness becomes worse with activity but improves with rest. Patients with myasthenia gravis will experience dyspnoea, dysphasia, dysphagia, facial paralysis, diplopia, blepharoptosis and general fatigue. There is currently no cure but treatment can help alleviate some of the symptoms. Medications, plasmapheresis, intravenous immunoglobulins and lifestyle adjustments to allow for more rest can all improve quality of life.</p>
polymyositis	pol-ee-my-oh-SY-tis	<p>Polymyositis is an inflammatory muscle disease that results in muscle weakness. The cause is unknown; however it is thought to be triggered by environmental agents such as viruses. Other research indicates an autoimmune or genetic aetiology. Polymyositis is often associated with autoimmune diseases such as rheumatoid arthritis and lupus erythematosus. It is more common in females than males and tends to develop between the ages of 50 and 70 years.</p> <p>Most patients experience an improvement of their symptoms with treatment such as corticosteroids, although there may be some long-term muscle weakness. It is rarely fatal, but it has been linked with respiratory and cardiac conditions, as well as an increased risk of certain cancers, such as bladder cancer and non-Hodgkin's lymphoma.</p>
strain	strayn	<p>A strain occurs when a muscle and/or tendon is overstretched or torn. There is no fracture or dislocation present. Pain, weakness and muscle spasms are common symptoms experienced after a strain occurs. Rest, application of ice and a compression bandage are effective treatments.</p>

TESTS AND PROCEDURES

The following section provides you with a list of common diagnostic tests, procedures and clinical and surgical interventions that are undertaken for the musculoskeletal system.

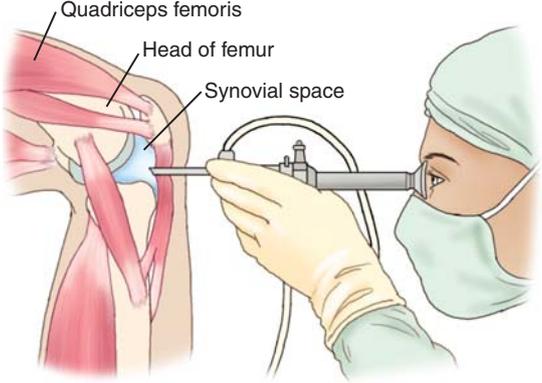
Test/Procedure	Pronunciation	Definition
amputation	amp-yoo-TAY-shun	An amputation is the surgical or traumatic removal/excision of an extremity (arm, hand, finger, leg, foot, toe). In addition to traumatic amputations, some of the common reasons leading to the need for amputation include diabetes, peripheral vascular disease and cancer.
antinuclear antibody test (ANA)	an-tee-NYOO-klee-a AN-tee-bod-ee test	An ANA is a diagnostic test used in patients with systemic lupus erythematosus (SLE) to detect antibodies present in the patient's serum.
arthrocentesis	arth-roh-sen-TEE-sis	An arthrocentesis is also known as joint aspiration. A needle is inserted into the joint to withdraw synovial fluid for the purpose of relieving joint pain and swelling or for analysis to identify conditions such as infection, rheumatoid arthritis and gout.
arthrography	arth-ROG-raf-ee	An arthrography involves the injection of contrast material containing iodine into the joint to allow for an x-ray called a fluoroscopy to be performed. It is used to identify abnormalities with the function and structure of a joint and to determine the need for further treatment and surgery.
arthroplasty	ARTH-roh-plas-tee	An arthroplasty is a surgical procedure that leads to the reconstruction or replacement of joint structures with artificial devices. The procedure is performed to relieve the symptoms of pain from conditions such as osteoarthritis. Arthroplasty of the knee or hip are the most common. Total or partial replacement may be performed, e.g. a hemiarthroplasty is commonly performed for a fractured neck of femur.
arthroscopy	arth-ROS-kop-ee	An arthroscopy is a procedure to view a joint using an arthroscope. The procedure is used both as a diagnostic process and as a method of entry to allow for more complex procedures such as a meniscectomy. Figure 4.9 Arthroscopy (Leonard, 2005) 
bone density test	bohn DEN-sit-ee test	A bone density test is a diagnostic procedure used to identify decreased bone density. The test identifies conditions such as osteoporosis and osteopenia. Generally x-rays of the spinal column, pelvis and wrist are taken to measure the density of the bones.

Table continued

Test/Procedure	Pronunciation	Definition
bone scan	bohn skan	A bone scan is a diagnostic test used to identify abnormalities in bones resulting from conditions such as primary bone cancers, bony metastases and bone inflammation. The patient receives an injection of a small amount of radioactive material and then is scanned using a gamma camera. Bones with an abnormality will have a greater uptake of the radioactive material.
<p>Figure 4.10 technetium-99m bone scan showing an area of increased radioactive uptake on the right tibia that indicates a bone tumour.</p> <p>(Orkin et al, 2009)</p>		
		
computed tomography (CT)	kom-PYOO-ted to-MOG-raf-ee	A CT is a diagnostic test performed to identify disorders of the soft tissues, bone and muscle. Cross-sectional images are taken using a computer in conjunction with x-ray beams.
electromyography (EMG)	ee-LEK-troh-my-OG-raf-ee	An EMG is a diagnostic test used to identify neuropathic and myopathic disorders. Electrodes are placed on the muscle and are used to record motor unit activity at rest and also during muscle contraction.
erythrocyte sedimentation rate (ESR)	e-REETH-roh-syt SED-ee-men-TAY-shun rayt	ESR is a measure to determine the rate at which erythrocytes settle out of plasma in a test tube. In diseases such as infections, joint inflammation and tumours that increase the immunoglobulin content of blood, the sedimentation rate is altered.
joint injection	joynt in-JEK-shun	A joint injection is a method of treatment using a hypodermic needle to inject anti-inflammatory agents into a joint to treat such conditions as arthritis, gout and tendonitis.

Table continued

Test/Procedure	Pronunciation	Definition
laminectomy	lam-in-EK-tom-ee	A laminectomy is a surgical procedure that involves incising a vertebra to allow access to the spinal cord to remove herniated intervertebral discs and tumours. It is also used to relieve pressure on a spinal nerve.
magnetic resonance imaging (MRI)	mag-NET-ik REZ-on-ans IM-a-jing	An MRI is a diagnostic test that creates images of soft tissue using radio waves and a magnetic field.
meniscectomy	men-i-SEK-toh-mee	A meniscectomy is a surgical procedure that involves removal of damaged meniscal tissue in the knee. The route for entry is generally via arthroscopy.
muscle biopsy	MUS-el BY-op-see	A muscle biopsy is a diagnostic procedure involving the excision of a sample of muscle for laboratory examination.
reduction and fixation	re-DUK-shun and fik-SAY-shun	This group of procedures generally refers to the manipulation of a bone or joint following a dislocation or fracture and the subsequent process of securing the structure with screws, wires, pins or plates. The reduction can be accomplished either as a closed (non-surgical incision) procedure or open (a surgical incision is required to access the fracture or dislocation) procedure. For those fractures and dislocations that require fixation, the procedure can involve internal or external fixation. Internal fixation involves the use of fixators such as pins, bone screws, wires, rods and plates that are used to support the structure whilst healing occurs. External fixation involves the placement of pins and screws which are then secured to a frame on the outside of the skin.
rheumatoid factor test (RF)	ROO-ma-toyd FAK-ta test	An RF test is a diagnostic test used in patients with rheumatoid arthritis to detect antibodies present in the patient's serum.
serum calcium (Ca)	SEE-rum KAL-see-um	A serum Ca test is a diagnostic test to identify the levels of calcium in serum used to identify the presence of hypercalcaemia or hypocalcaemia.
serum creatine kinase (CK)	SEE-rum kree-AT-in KY-naze	A serum CK test is a diagnostic test to identify increased levels of the enzyme creatine kinase in serum which is present in the conditions polymyositis, muscular dystrophy and traumatic muscular injuries.

REVIEW ACTIVITIES

The following activities are designed to assist you in reviewing the content that you have covered in this chapter. The activities contained here will reinforce your understanding of the terms used throughout the chapter.

Combining forms

Combining form	Meaning	Combining form	Meaning
ankyl/o		calc/o, calc/i	
arthr/o		chondr/o	
articul/o		clon/o	
burs/o		condyl/o	

Word element review

In the section below you need to attempt to provide a meaning in the space provided. This should initially be attempted without referring back to the content of the chapter or to any other material such as dictionaries. Once you have completed the activity, refer to the chapter or the glossary to check your responses.

Table continued

Combining form	Meaning	Combining form	Meaning
dors/o		orth/o	
fasci/o		osse/o	
fibr/o		oste/o	
fibros/o		plant/o	
kinesi/o		rhabd/o	
kyph/o		rheumat/o	
lamin/o		scoli/o	
lei/o		spondyl/o	
ligament/o		synov/o, synovi/o	
lord/o		tax/o	
lumb/o		ten/o, tend/o,	
menisc/o		tendin/o	
muscul/o		ton/o	
my/o, myos/o		tort/i	
myel/o		vertebr/o	

Prefixes

Combining form	Meaning	Combining form	Meaning
ab-		dorsi-	
ad-		poly-	

Suffixes

Combining form	Meaning	Combining form	Meaning
-asthenia		-lysis	
-blast		-malacia	
-clasis		-physis	
-clast		-stenosis	
-desis		-tome	
-listhesis		-trophy	

Vocabulary review

In this section you will be testing your understanding of the vocabulary you have developed from this chapter and your understanding of the terminology in this chapter. For each term write the meaning of the term in the space provided. Initially attempt the exercise

without making reference to the content of the chapter. Once you have the meaning, check your response by referring to the page number beside the term. You may then wish to cover the terms and, looking at your definition, try and write down what you think is the correct term.

Term	Meaning	Term	Meaning
aponeurosis [44]		lordosis [35]	
appendicular skeleton [35]		meniscus tear [42]	
arthritis [40]		muscular dystrophy [48]	
articulation [39]		myasthenia gravis [48]	
axial skeleton [35]		occipital bone [34]	
ball and socket joint [39]		osseous tissue [35]	
bunion [42]		ossification [34]	
bursitis [42]		osteoarthritis [40]	
cancellous bone [35]		osteomalacia [38]	
cardiac muscle [44]		osteoporosis [36, 38]	
cartilage [31]		parietal bone [33]	
cartilaginous joints [39]		pivot joint [40]	
collagen [34]		polymyositis [48]	
compact bone [35]		rheumatoid arthritis [41]	
condyloid joint [40]		rotator cuff syndrome [42]	
coronal suture [39]		saddle joint [40]	
dislocation [42]		sagittal suture [39]	
fascia [44]		scoliosis [35]	
fibromyalgia [47]		skeletal muscle [44]	
fibrous joints [39]		smooth muscle [44]	
fracture [36]		sprain [42]	
frontal bone [34]		strain [48]	
gouty arthritis (gout) [41]		striated [44]	
herniated intervertebral disc [38]		synovial fluid [39]	
hinge joint [39]		synovial joints [39]	
involuntary muscle [44]		synovial membrane [39]	
kyphosis [35]		tendon [31]	
lambdoid suture [39]		voluntary muscles [44]	