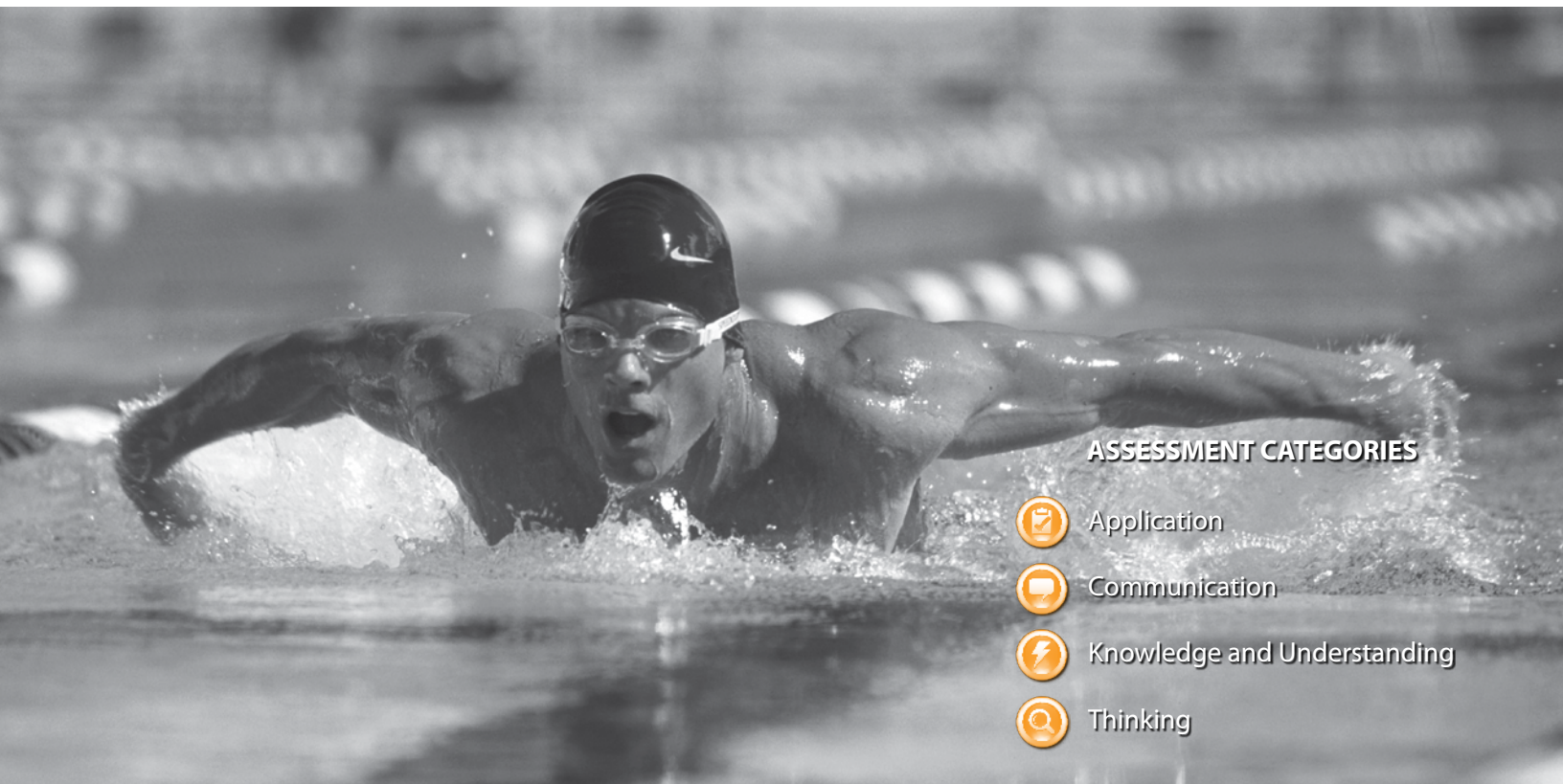






THE PIECES OF THE BODY PUZZLE

A Regional Approach



ASSESSMENT CATEGORIES

-  Application
-  Communication
-  Knowledge and Understanding
-  Thinking

Activities in this chapter:

1

The Axial Skeleton 32

Review Your Key Terms
Head and Neck Region
Back Region

2

The Appendicular Skeleton 36

Review Your Key Terms
Pectoral Girdle
Muscles of the Scapulohumeral Region
Upper Limb

3

Check Your Understanding 51

Pelvic Girdle
Bones of Lower Limb
Muscles of the Lower Limb
Joints of the Lower Limb

4

Chapter Culminating Assignment 53

1

THE AXIAL SKELETON (Textbook pages 56-63)

4.1.1 Review Your Key Terms

atlas
axis
calvaria
cervical vertebrae
coccyx
costal cartilage
erector spinae muscles
external oblique
false ribs
floating ribs
foramen
frontal bone
internal oblique

intervertebral discs
lacrimal bone
linea alba
lumbar vertebrae
mandible
manubrium
maxilla
nasal bone
occipital bone
orbicularis oculi
orbicularis oris
parietal bone
rectus abdomini

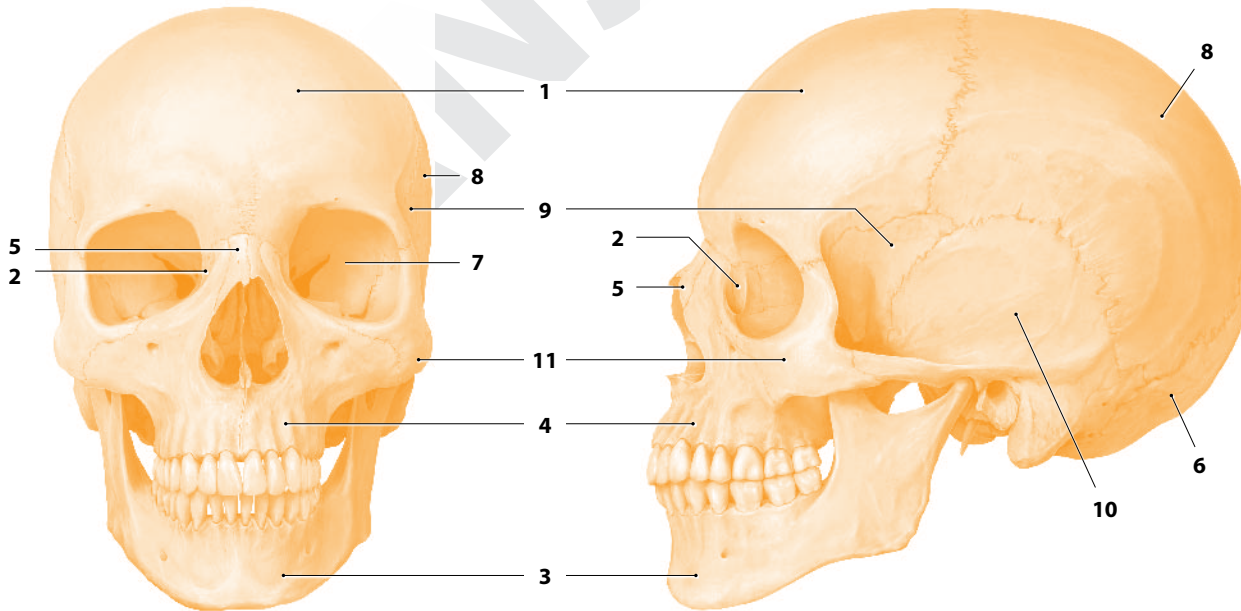
ribs
sacrum
sphenoid bone
sternal body
sternocleidomastoids
sternum
temporal bone
thoracic vertebrae
transversus abdominis
true ribs
xiphoid process
zygomatic bone

4.1.2 Head and Neck Region

(A) Anterior and Lateral Views of the Skull

Fill in the appropriate numbers on the figures below using the list of labels provided.

- | | | | |
|-----------------|------------------|-----------------|-------------------|
| 1 frontal bone | 4 maxilla | 7 orbit | 10 temporal bone |
| 2 lacrimal bone | 5 nasal bone | 8 parietal bone | 11 zygomatic bone |
| 3 mandible | 6 occipital bone | 9 sphenoid bone | |

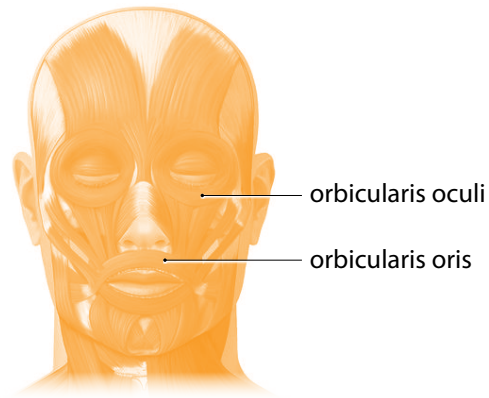


The curved flat bones of the skull form the *calvaria*, which is represented by labels 1, 6, 8, 9, and 10 above. The most fragile of these bones is the *temporal*.

(B) Facial Muscles

Two important facial muscles to remember are the orbicularis *oris* and the orbicularis *oculi*, which allow you to blink and chew, respectively.

Label these muscles on the figure to the right.



4.1.3 Back Region

(A) Regions of the Spinal Column

In the spaces provided, label the segments of the spinal column indicated on the figure to the right.

- 1 Cervical vertebrae
- 2 Thoracic vertebrae
- 3 Lumbar vertebrae
- 4 Sacrum
- 5 Coccyx

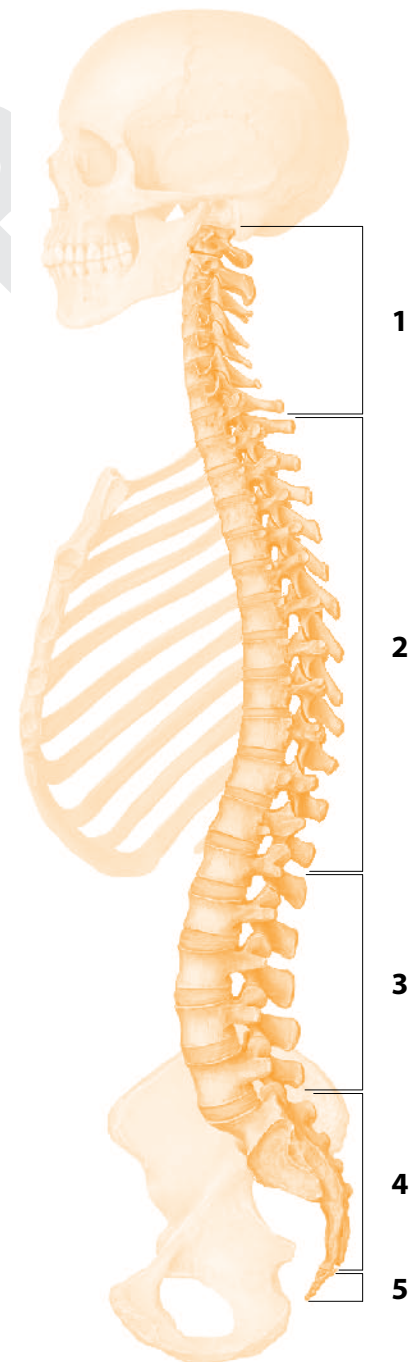
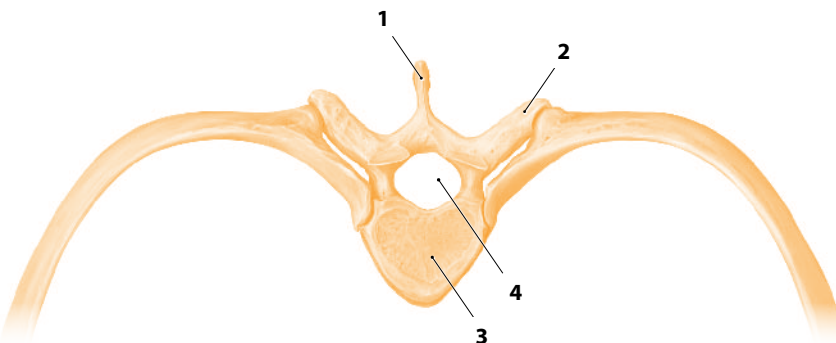
The vertebrae that make up the vertebral column are examples of which of the following types of bone (shape)?

- Flat
 Sesamoid
 Long
 Irregular
 Short

The *atlas* and *axis* are the first two *cervical* vertebrae. Colour them in the figure on the right.

Fill in the appropriate labels below illustrating the structure of a typical thoracic vertebra. Can you locate these structures in the figure on the right?

- 1 spinous process 3 vertebral body
- 2 transverse process 4 vertebral foramen



(B) The Rib Cage

From the list of labels provided, fill in the appropriate numbers on the figures of the rib cage below. The breastbone, represented by labels 5, 6, and 8, is also known as the sternum.

1 costal cartilage

3 floating ribs

5 manubrium

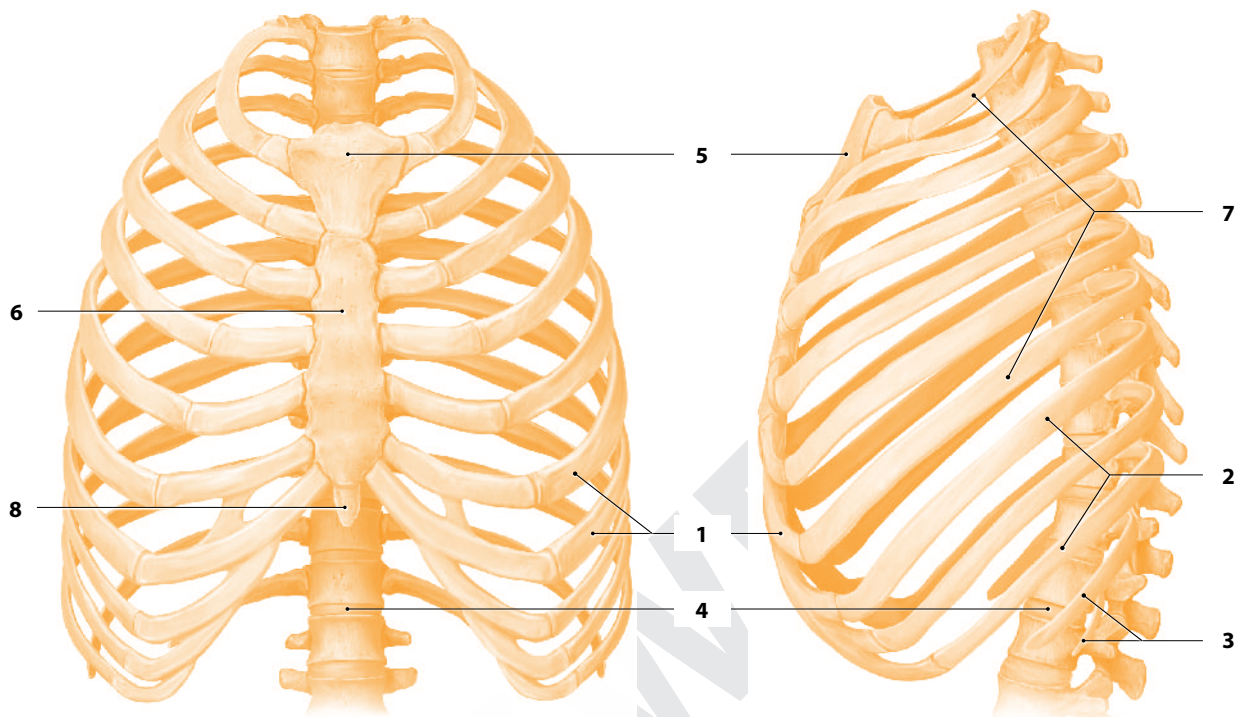
7 true ribs

2 false ribs

4 intervertebral disc

6 sternal body

8 xiphoid process

**(C) Muscles of the Neck and Back**

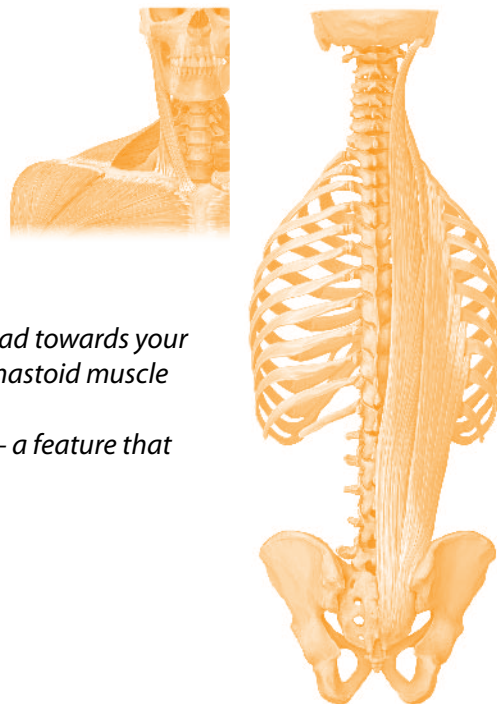
The anterior pair of neck muscles that allows you to flex your head towards your chest is the sternocleidomastoids.

The large muscle mass that spans the back from the skull to the sacrum is called the erector spinae.

Briefly explain why these muscles are important for human movement.

Acting together, the sternocleidomastoid muscles allow you to flex your head towards your chest and to get up from a supine position. Individually, each sternocleidomastoid muscle tilts the face up and towards the opposite side.

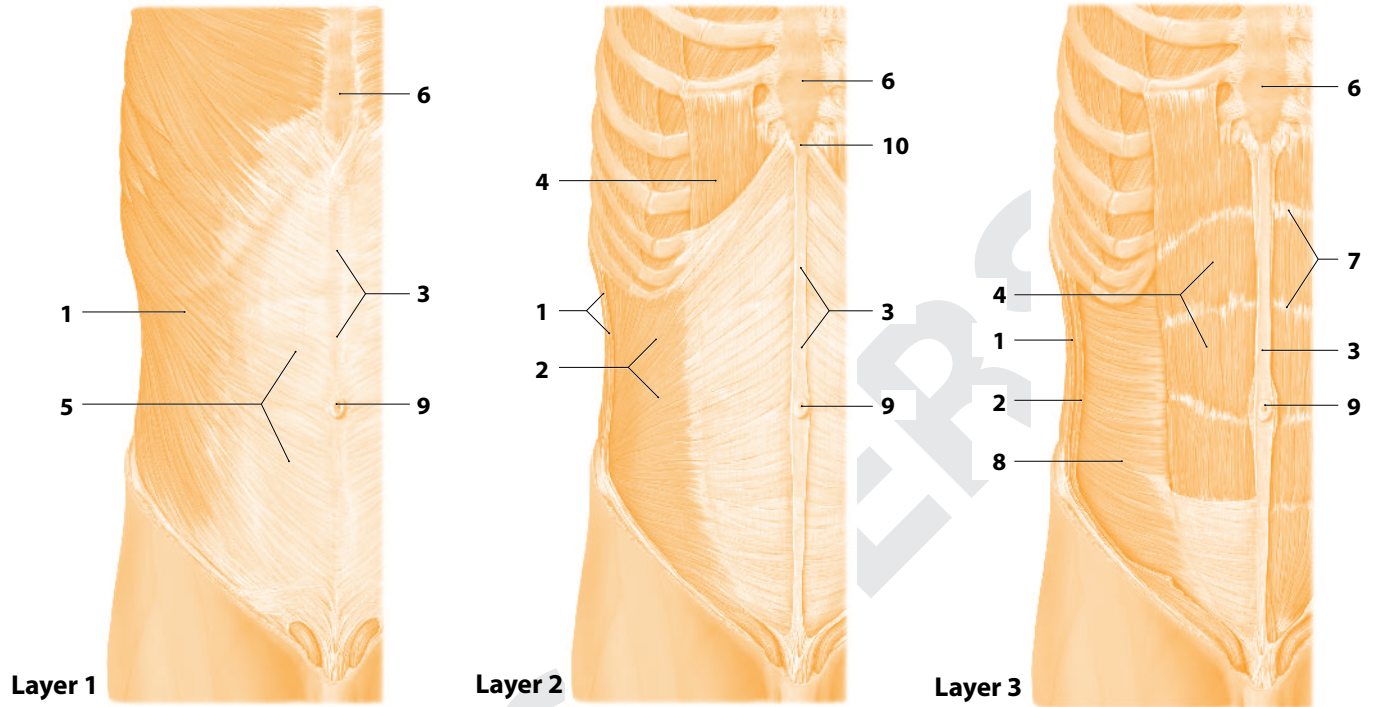
The erector spinae muscles allow us to stand erect and walk on two feet – a feature that sets us apart from most other animal species.



(D) Muscles of the Abdomen

Complete the figures of the anterior abdominal wall below using the following labels.

- | | | | |
|--------------------|--------------------|---------------------------|--------------------|
| 1 external oblique | 4 rectus abdominis | 7 tendinous intersections | 10 xiphoid process |
| 2 internal oblique | 5 rectus sheath | 8 transversus abdominis | |
| 3 linea alba | 6 sternal body | 9 umbilicus | |



Which set of muscles would you use for lateral bending and rotation of the trunk? Give an example of an activity that would require these muscles.

The internal and external oblique muscles are important in lateral bending and rotation of the trunk (e.g., in throwing a javelin).

List some exercises you can do to strengthen the abdominal muscles:

- Sit-ups, crunches (flat, incline, medicine ball)
- “Roman chair” leg lifts (pictured on the right)
- Leg lifts (flat, while hanging)
- Bicycle exercise (alternating legs)
- Planks



4.2.1 Review Your Key Terms

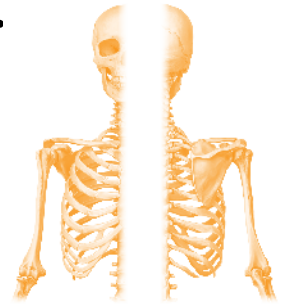
acetabulum
 Achilles tendon
 acromioclavicular joint
 adductor brevis
 adductor longus
 adductor magnus
 ankle (talocrural) joint
 anterior cruciate ligament
 biceps brachii
 biceps femoris
 brachialis
 brachioradialis
 calcaneus
 capitate
 carpals
 carpometacarpal joints
 carpus
 clavicle
 coracobrachialis
 cuboid
 cuneiforms
 deltoid
 extensor–supinator group
 femur
 fibula
 fibularis (peroneus) brevis
 fibularis (peroneus) longus
 flexor digitorum longus
 flexor hallucis longus
 flexor–pronator group
 gastrocnemius
 gluteus maximus
 gluteus medius
 gluteus minimus
 gracilis
 hamate
 hamstrings
 hip (iliofemoral) joint
 hip bone (os coxae)
 humeroradial joint
 humeroulnar joint

humerus
 hypothenar muscles
 iliacus
 iliopsoas
 iliotibial band
 ilium
 infraspinatus
 intercarpal joints
 intermetacarpal joints
 interossei muscles
 interosseous membrane
 interphalangeal joints
 ischium
 knee (tibiofemoral) joint
 lateral collateral ligament
 lateral malleolus
 latissimus dorsi
 levator scapulae
 lumbrical muscles
 lunate
 medial collateral ligament
 medial malleolus
 menisci
 metacarpals
 metacarpophalangeal (MCP) joints
 metatarsals
 midcarpal joint
 navicular
 patella
 pectineus
 pectoral girdle
 pectoralis major
 pectoralis minor
 pelvic girdle
 phalanges
 pisiform
 plantaris
 popliteus
 posterior cruciate ligament
 proximal radioulnar joint
 psoas major

psoas minor
 pubic symphysis
 pubis
 quadriceps femoris
 radiocarpal joint
 radius
 rectus femoris
 rhomboid muscles
 rotator cuff
 sacroiliac joint
 sartorius
 scaphoid
 scapula
 semimembranosus
 semitendinosus
 serratus anterior
 shoulder (glenohumeral) joint
 soleus
 sternoclavicular joint
 subscapularis
 supraspinatus
 talus
 tarsals
 tarsus
 tensor fasciae latae
 teres major
 teres minor
 thenar muscles
 tibia
 tibialis anterior
 tibialis posterior
 transverse tarsal joint
 trapezium
 trapezius
 trapezoid
 triceps brachii
 triquetrum
 ulna
 vastus intermedius
 vastus lateralis
 vastus medialis

Can you define most of the key terms listed here? Highlight the key terms you don't know, and look them up in the chapter or in the glossary at the back of the textbook.

4.2.2 Pectoral Girdle



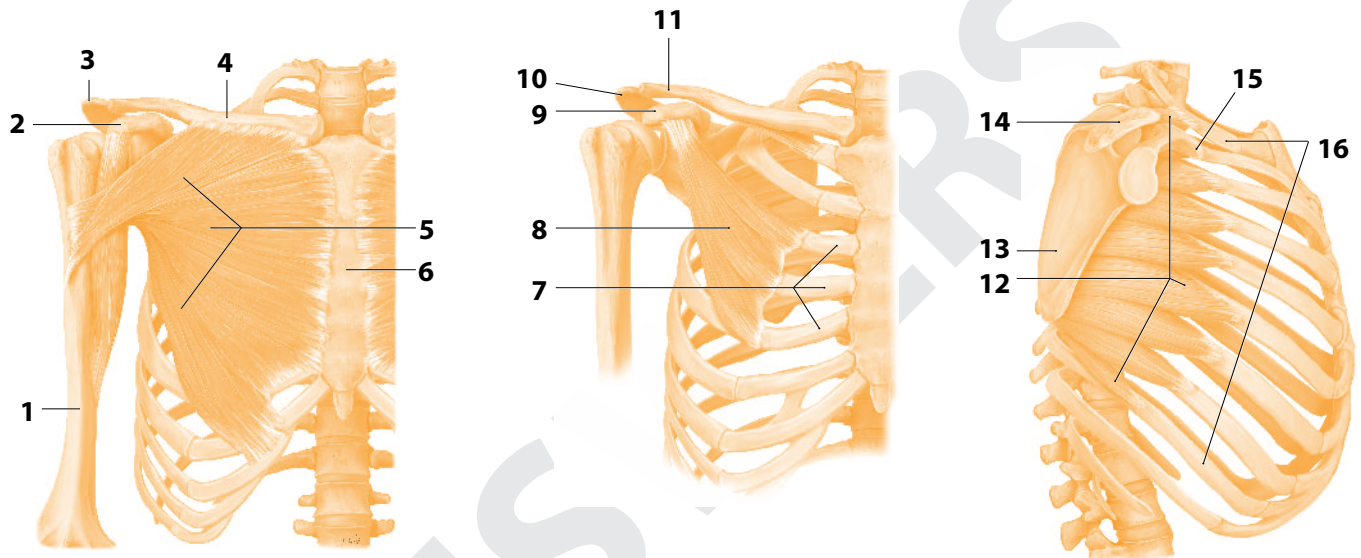
(A) Bones of the Pectoral Girdle

- The collarbone, or *clavicle*, is the only bone connecting the upper limb to the axial skeleton. This bone, plus the *scapula* make up the pectoral girdle.

Identify, label, and colour the bones that make up the pectoral girdle in the figures on the right.

(B) Anterior Muscles of the Pectoral Girdle

- In the spaces provided, label the anterior muscles of the pectoral girdle.

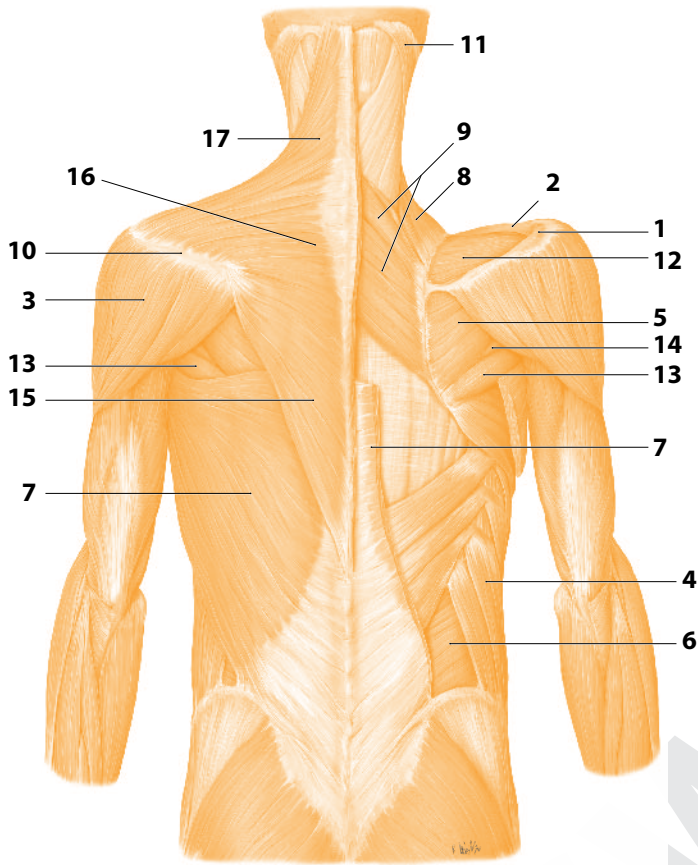


- | | |
|--------------------------|-------------------------|
| 1 Humerus | 9 Coracoid process |
| 2 Coracoid process | 10 Acromion |
| 3 Acromion | 11 Clavicle |
| 4 Clavicle | 12 Serratus anterior |
| 5 Pectoralis major | 13 Scapula |
| 6 Sternum (sternal body) | 14 Acromion |
| 7 3rd through 5th ribs | 15 Coracoid process |
| 8 Pectoralis minor | 16 1st through 9th ribs |

Label 5 has two heads: one is attached to the *sternum* and the other is attached to the more superior *clavicle*.

(C) Posterior Muscles of the Pectoral Girdle

Identify the structures below using the labels provided.



- | | |
|--------------------|-----------------------------|
| 1 acromion | 10 scapular spine |
| 2 clavicle | 11 sternocleidomastoid |
| 3 deltoid | 12 supraspinatus |
| 4 external oblique | 13 teres major |
| 5 infraspinatus | 14 teres minor |
| 6 internal oblique | 15 trapezius, lower fibres |
| 7 latissimus dorsi | 16 trapezius, middle fibres |
| 8 levator scapulae | 17 trapezius, upper fibres |
| 9 rhomboids | |

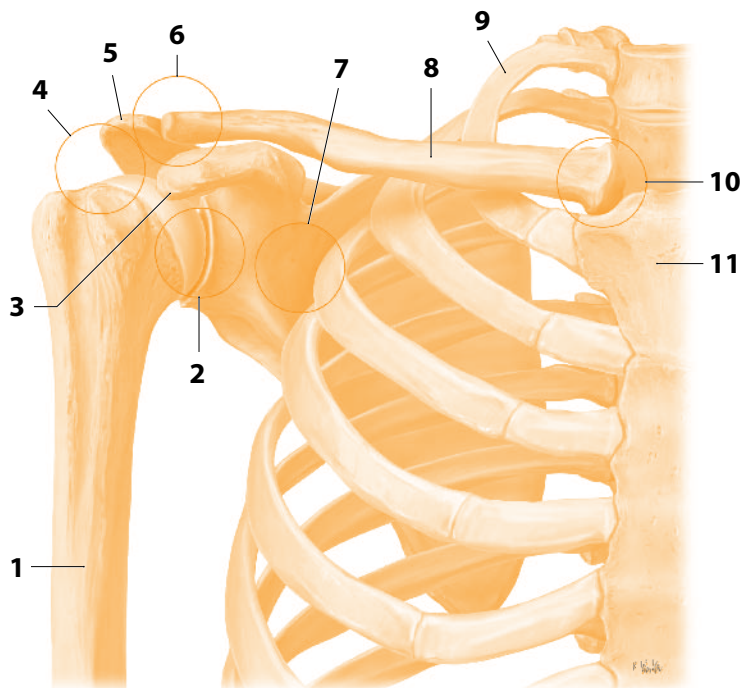
The levator scapulae and rhomboid muscles lie *deep* to trapezius and latissimus dorsi. Which of these muscles is the most superior?

Trapezius (upper fibres)

(D) Joints of the Pectoral Girdle

Fill in the appropriate labels below for the structures and joints of the pectoral girdle.

- 1 Humerus
- 2 Glenohumeral joint
- 3 Coracoid process
- 4 Subacromial space
- 5 Acromion
- 6 Acromioclavicular joint
- 7 Scapulothoracic joint
- 8 Clavicle
- 9 1st rib
- 10 Sternoclavicular joint
- 11 Manubrium (sternum)



4.2.3 Muscles of the Scapulohumeral Region

(A) Anterior, Superior, and Posterior Groups

Identify the structures of the scapulohumeral region below using the labels provided. Then indicate which view is anterior and which is posterior.

1 acromion

3 humerus

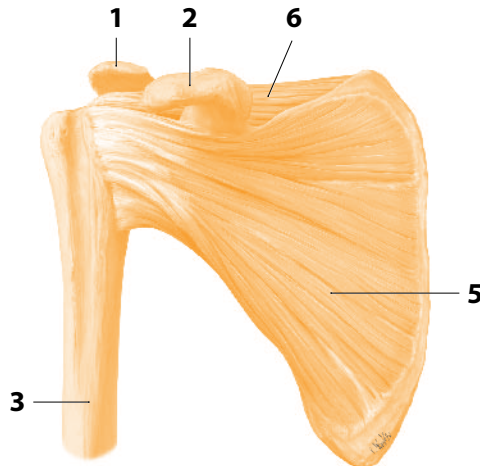
5 subscapularis

7 teres minor

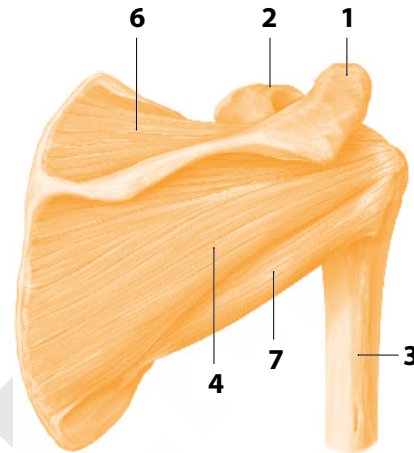
2 coracoid process

4 infraspinatus

6 supraspinatus



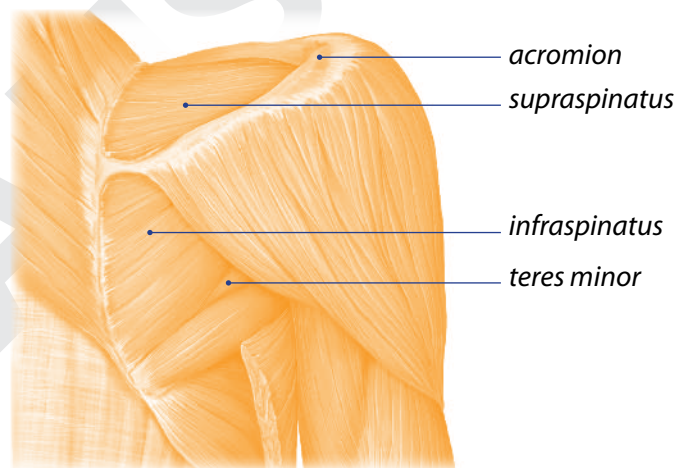
Anterior view



Posterior view

Use the same numbered labels from above to label the image below. Are there any structures that can't be seen in this image?

You can't see the coracoid process, humerus, or subscapularis in the image provided.



What muscles make up the rotator cuff of the shoulder? What is their primary role?

The **rotator cuff** muscles of the shoulder (abbreviated **SSIT**) include the **supraspinatus**, **subscapularis**, **infraspinatus**, and **teres minor**. Collectively, these muscles act mainly as stabilizers, allowing full use of the upper limb and preventing instability and dislocations.

(B) Lateral Group

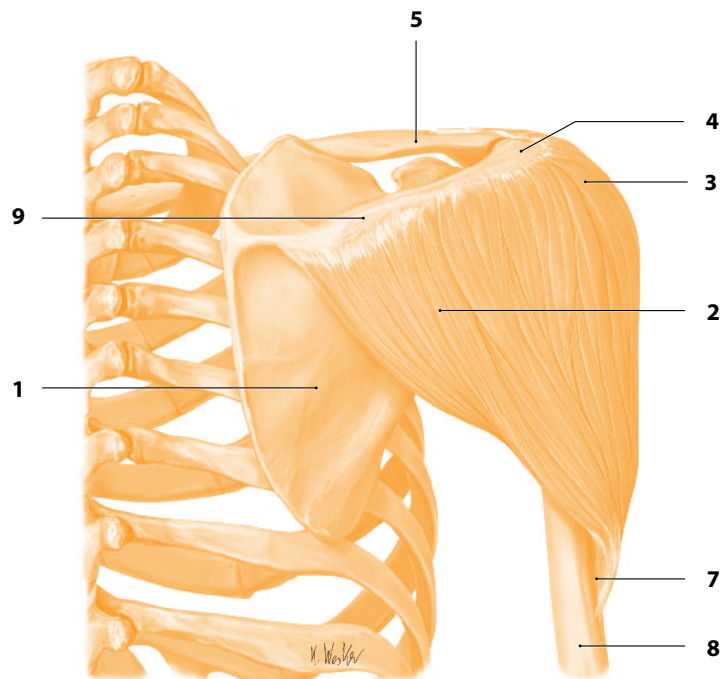
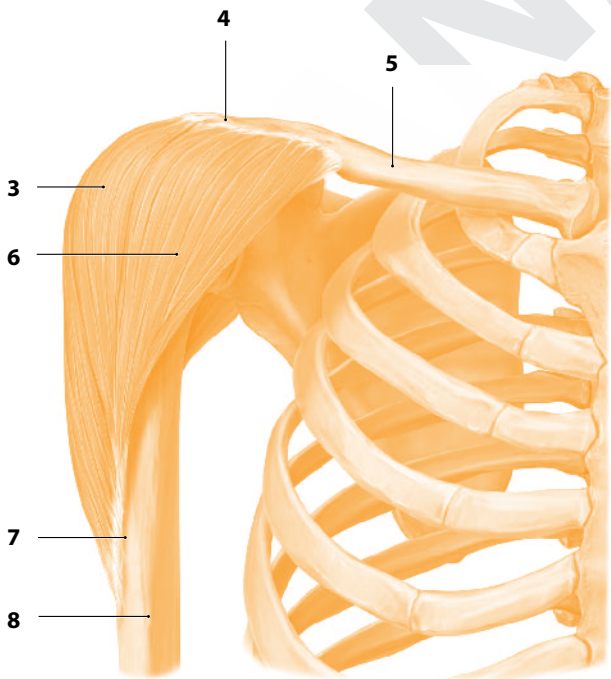
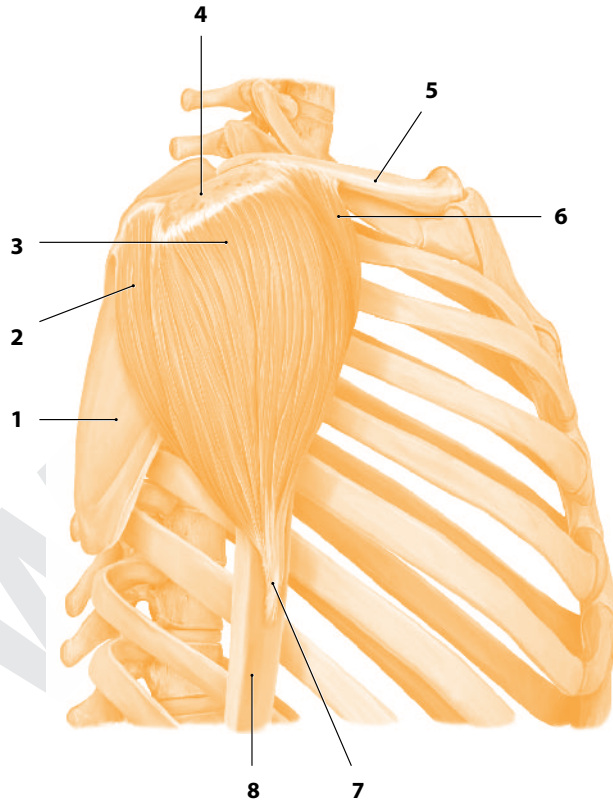
Complete the statements below by filling in the blanks. Then label the structures in the figures below using some of the words you filled in.

The lateral group of the scapulohumeral region is composed of the deltoid muscle, which has three functional groups of fibres. The anterior fibres flex and medially rotate the upper limb; the middle fibres abduct the upper limb; and the posterior fibres extend and laterally rotate the upper limb. All three groups insert into the deltoid tuberosity of the humerus.

- 1 scapula
- 2 deltoid, posterior fibres
- 3 deltoid, middle fibres
- 4 acromion
- 5 clavicle
- 6 deltoid, anterior fibres
- 7 deltoid tuberosity
- 8 humerus
- 9 scapular spine

Can you think of a few examples of actions or activities you might use these muscles for?

Examples include paddling sports (kayaking, canoeing), tennis or volleyball serve, jumping jacks, and so on.

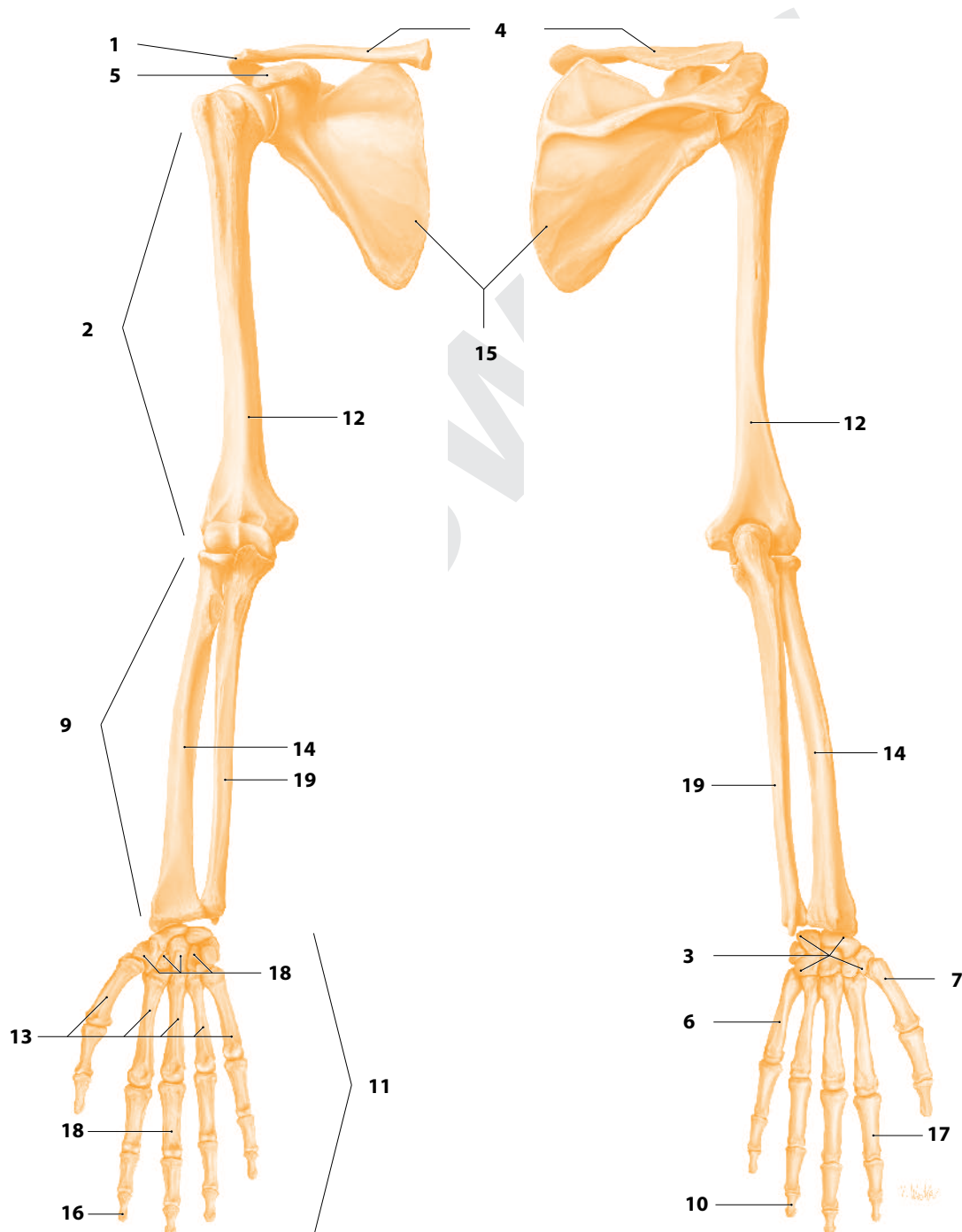


4.2.4 Upper Limb

(A) Bones of the Upper Limb

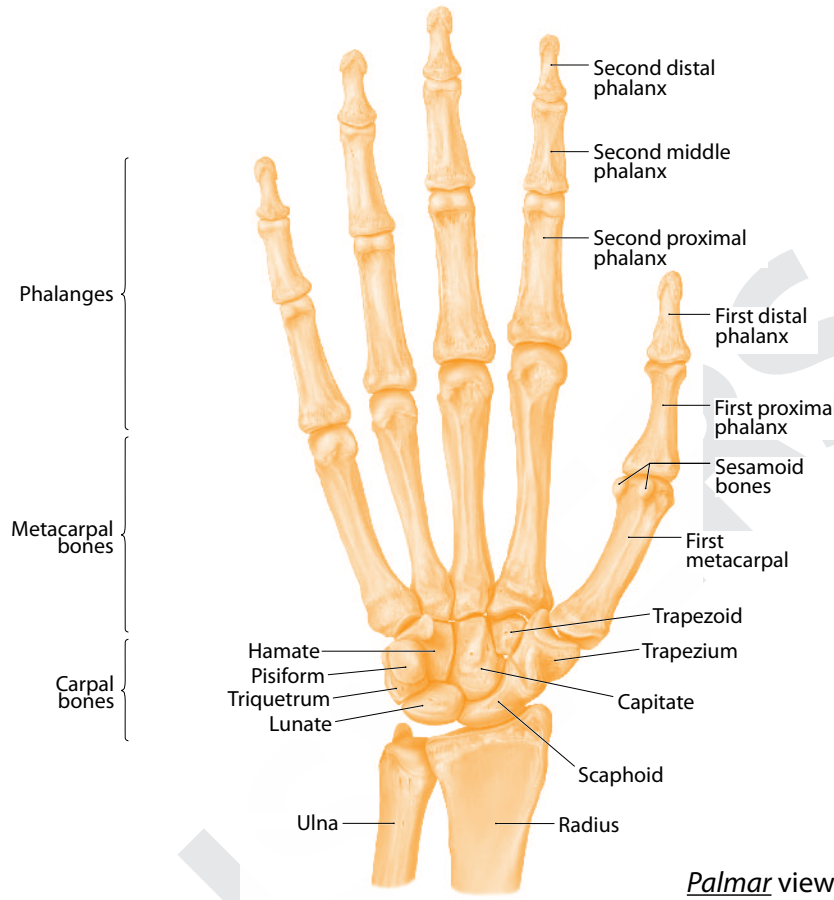
Identify the structures below and label them with the appropriate numbers. Then colour the most lateral bone of the forearm in each image. [The most lateral bone of the forearm is the radius.]

- | | | | |
|--------------------|--------------------------|----------------|----------------------------|
| 1 acromion | 6 fifth metacarpal | 11 hand | 16 second distal phalanx |
| 2 arm | 7 first metacarpal | 12 humerus | 17 second proximal phalanx |
| 3 carpals | 8 first proximal phalanx | 13 metacarpals | 18 third proximal phalanx |
| 4 clavicle | 9 forearm | 14 radius | 19 ulna |
| 5 coracoid process | 10 fourth distal phalanx | 15 scapula | |



(B) Bones of the Hand and Wrist

The wrist, or carpus, is formed by two rows of four bones called carpals. The distal row joins with the five metacarpals bones of the hand, which articulate with the fingers, or phalanges. Identify the structures on the figure below and indicate which view is illustrated.

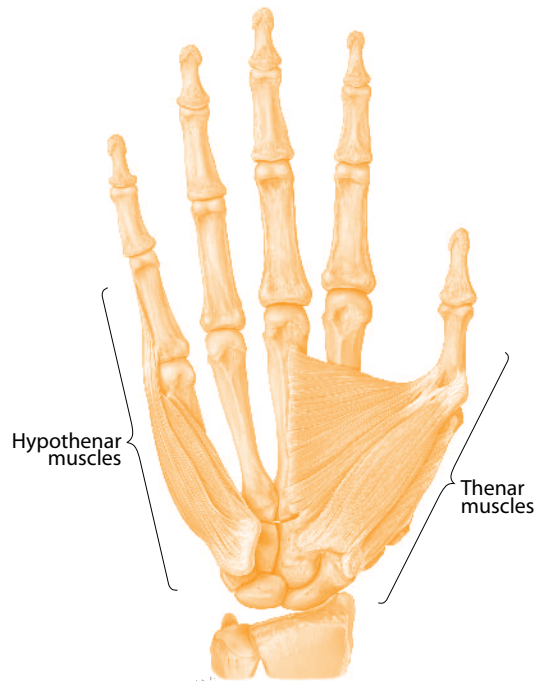


(C) Muscles of the Hand

The two largest muscle groups of the hand are the thenar (palm) group and the hypothenar (little palm) group. Between these groups lie the interossei and lumbrical muscles, which are referred to collectively as the intrinsic muscles of the hand.

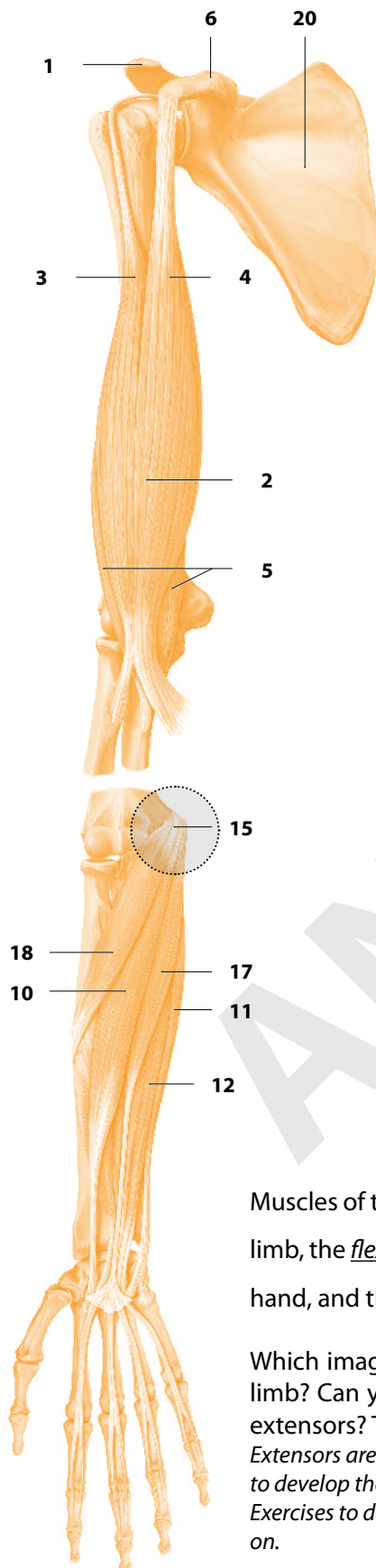
Label the muscles illustrated on the figure to the right. What action do these muscles allow you to perform?

Together the thenar and hypothenar muscles allow you to cup your hand as in holding a ball. They allow you to abduct, flex, and oppose the thumb tip to the digits.



(D) Muscles of the Arm and Forearm

Identify the structures below and label them with the appropriate numbers. Then circle the structure that serves as the common head of the flexors of the wrist and digits.



- 1 acromion
- 2 biceps brachii
- 3 biceps brachii, long head
- 4 biceps brachii, short head
- 5 brachialis
- 6 coracoid process
- 7 extensor carpi ulnaris
- 8 extensor digiti minimi
- 9 extensor digitorum
- 10 flexor carpi radialis
- 11 flexor carpi ulnaris
- 12 flexor digitorum superficialis
- 13 humerus
- 14 lateral epicondyle
- 15 medial epicondyle
- 16 olecranon
- 17 palmaris longus
- 18 pronator teres
- 19 radius
- 20 scapula
- 21 scapular spine
- 22 triceps brachii, lateral head
- 23 triceps brachii, long head
- 24 triceps brachii, medial head
- 25 ulna



Muscles of the limbs are primarily flexors or extensors. In the upper limb, the *flexors* are on the anterior surface of the arm, forearm, and hand, and the *extensors* are on the posterior surface.

Which images depicted here illustrate the extensors of the upper limb? Can you think of exercises that can be done to develop the extensors? The flexors?

Extensors are depicted on the images to the right (posterior view). Exercises to develop these muscle would include dips, push-ups, bench press, etc. Exercises to develop the flexors would include pull-ups, biceps curls, and so on.

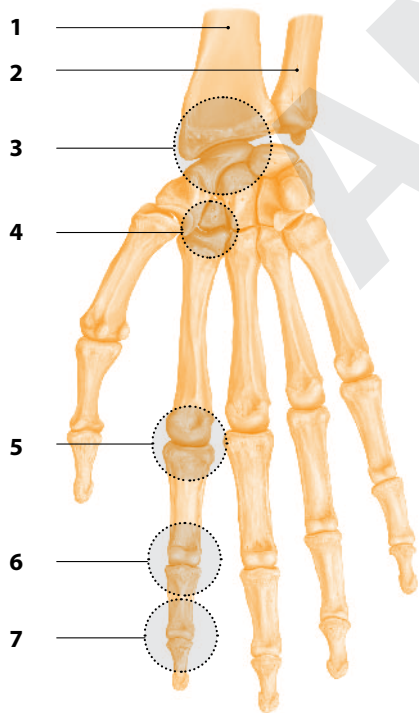
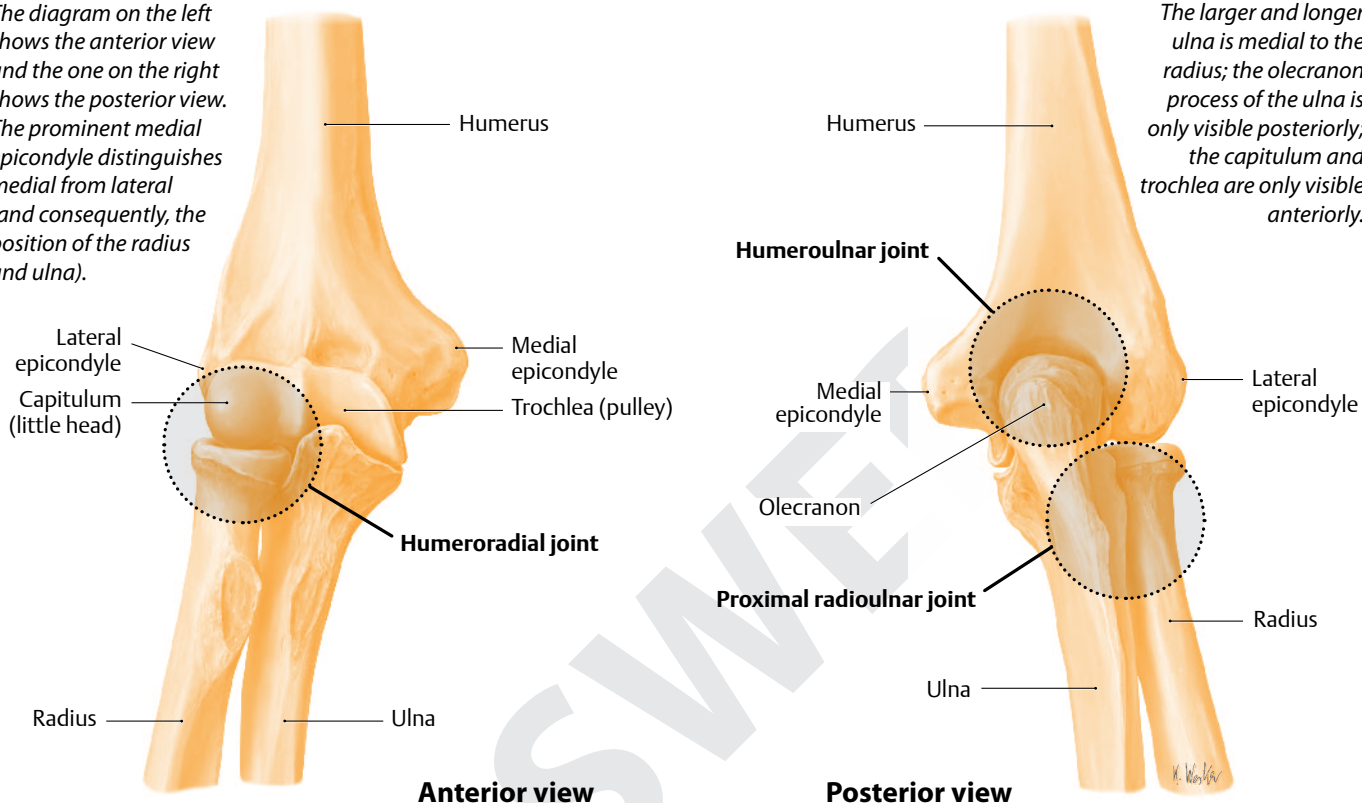
(E) Joints of the Upper Limb

The shoulder joint, or *glenohumeral* joint, is classified as a *ball and socket* joint. The integrity of the joint depends on the SSIT, or *rotator cuff*, muscles that hold the head of the humerus against the *glenoid fossa* of the scapula.

There are actually three joints at the elbow. Identify and label the structures below, and then circle and name the three joints at the elbow. How do you know which view is anterior and which is posterior?

The diagram on the left shows the anterior view and the one on the right shows the posterior view. The prominent medial epicondyle distinguishes medial from lateral (and consequently, the position of the radius and ulna).

The larger and longer ulna is medial to the radius; the olecranon process of the ulna is only visible posteriorly; the capitulum and trochlea are only visible anteriorly.



In the spaces provided, label the structures and joints of the wrist and hand indicated in the figure on the left.

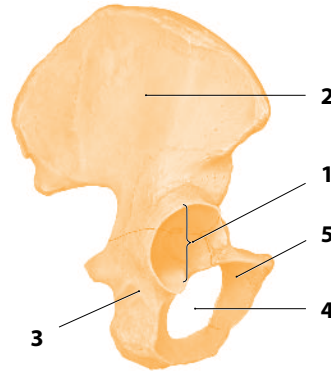
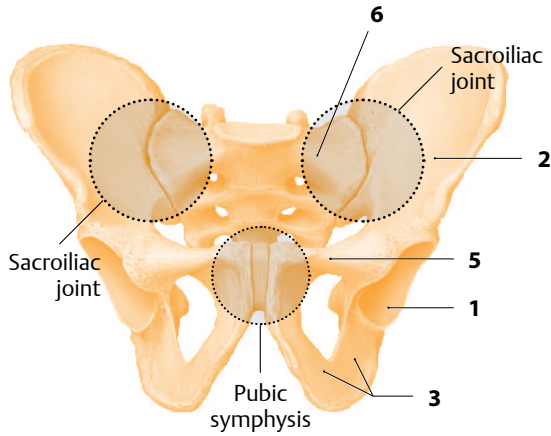
- 1 Radius
- 2 Ulna
- 3 Radiocarpal joint
- 4 Carpometacarpal joint
- 5 Metacarpophalangeal (MCP) joint
- 6 Proximal interphalangeal (PIP) joint
- 7 Distal interphalangeal (DIP) joint

What joints form what we know as the knuckles?
Metacarpophalangeal joints

4.2.5 Pelvic Girdle

(A) Bones and Joints of the Pelvic Girdle

Identify the structures of the pelvic girdle below. Then circle and label the *sacroiliac* and *pubic symphysis* joints.



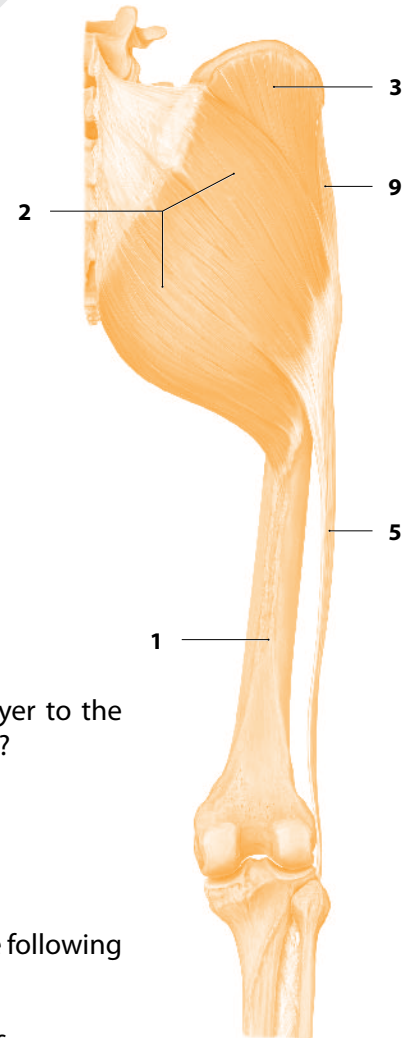
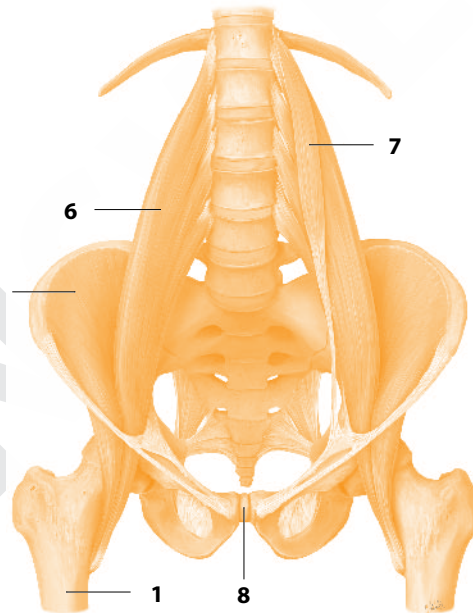
- 1 acetabulum
- 2 ilium
- 3 ischium
- 4 obturator foramen
- 5 pubis
- 6 sacrum

(B) Muscles of the Pelvic Girdle

Identify the structures below using the labels provided.

- 1 femur
- 2 gluteus maximus
- 3 gluteus medius
- 4 iliacus
- 5 iliotibial band
- 6 psoas major
- 7 psoas minor
- 8 pubic symphysis
- 9 tensor fasciae latae

Labels 4 and 6 unite to form the *iliopsoas* muscle, the primary flexor of the hip.



List the three muscles that make up the gluteals from the most superficial layer to the deepest layer. Which of these layers cannot be seen in the images depicted here?

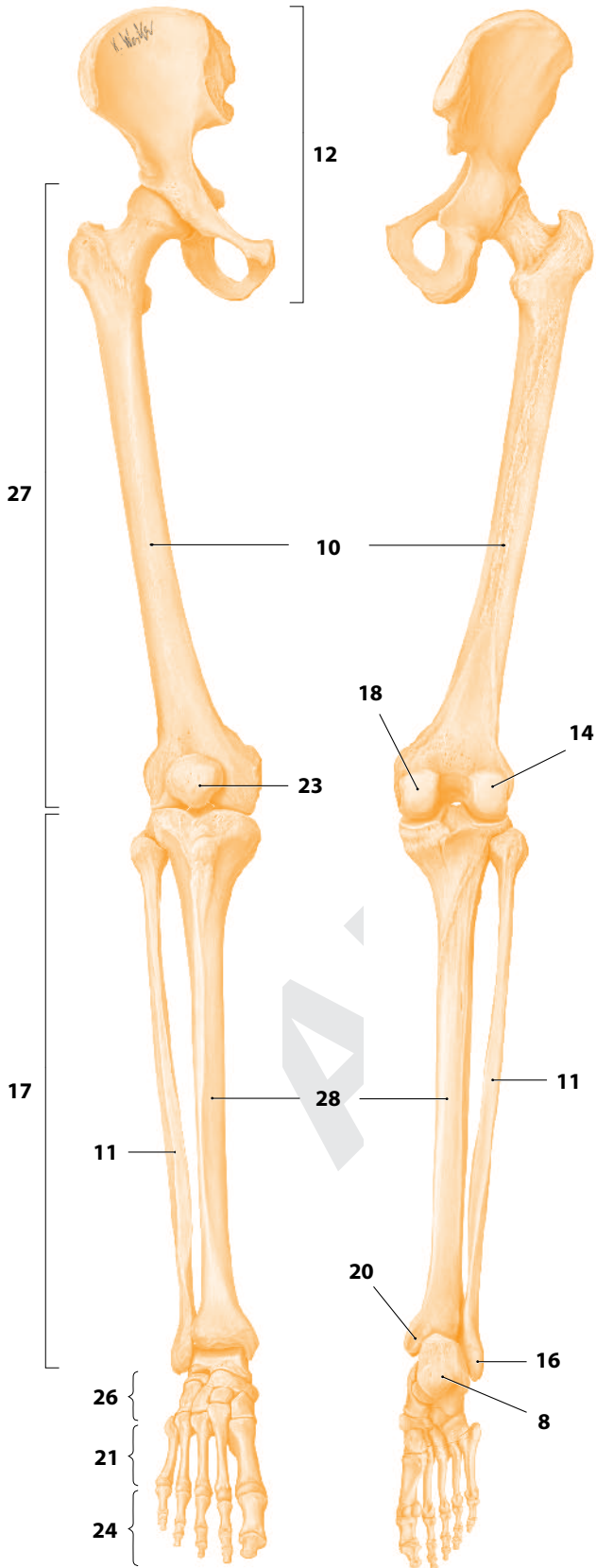
- Most superficial layer: *Gluteus maximus*
- Middle layer: *Gluteus medius*
- Deepest layer: *Gluteus minimus*
- Gluteus minimus* is not visible in the image.

The deepest layer of six little muscles work to laterally rotate the hip. Which of the following muscles is **not** included in this group of muscles? Check all that apply.

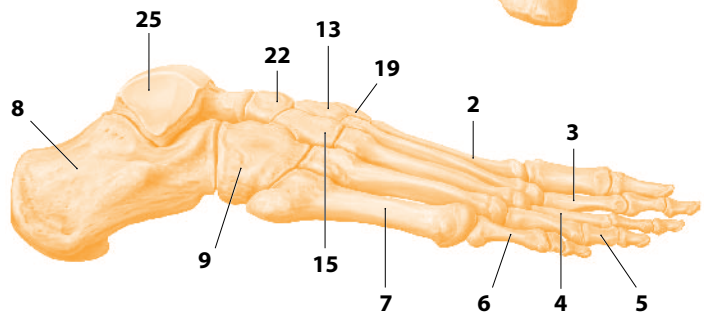
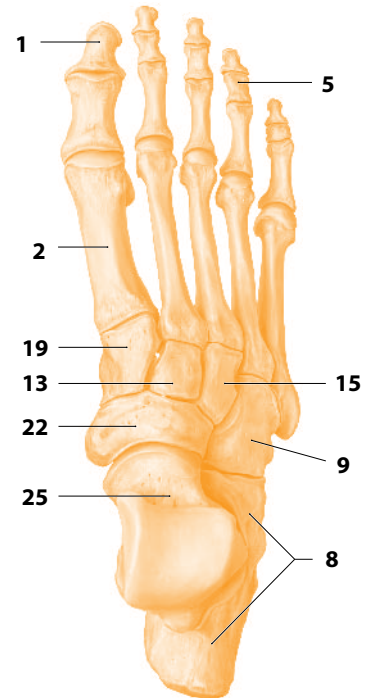
- Gemellus inferior
- Gluteus medius
- Obturator internus
- Piriformis
- Gemellus superior
- Iliacus
- Pectineus
- Quadratus femoris

4.2.6 Bones of the Lower Limb

Identify the structures below and label them with the appropriate numbers. Then colour the structure that is classified as a sesamoid bone. [The patella is classified as a sesamoid bone.]



- 1 1st digit distal phalanx
- 2 1st metatarsal
- 3 2nd digit proximal phalanx
- 4 3rd digit proximal phalanx
- 5 4th digit middle phalanx
- 6 5th digit proximal phalanx
- 7 5th metatarsal
- 8 calcaneus
- 9 cuboid
- 10 femur
- 11 fibula
- 12 hip bone
- 13 intermediate cuneiform
- 14 lateral condyle
- 15 lateral cuneiform
- 16 lateral malleolus
- 17 leg
- 18 medial condyle
- 19 medial cuneiform
- 20 medial malleolus
- 21 metatarsals
- 22 navicular
- 23 patella
- 24 phalanges
- 25 talus
- 26 tarsals
- 27 thigh
- 28 tibia

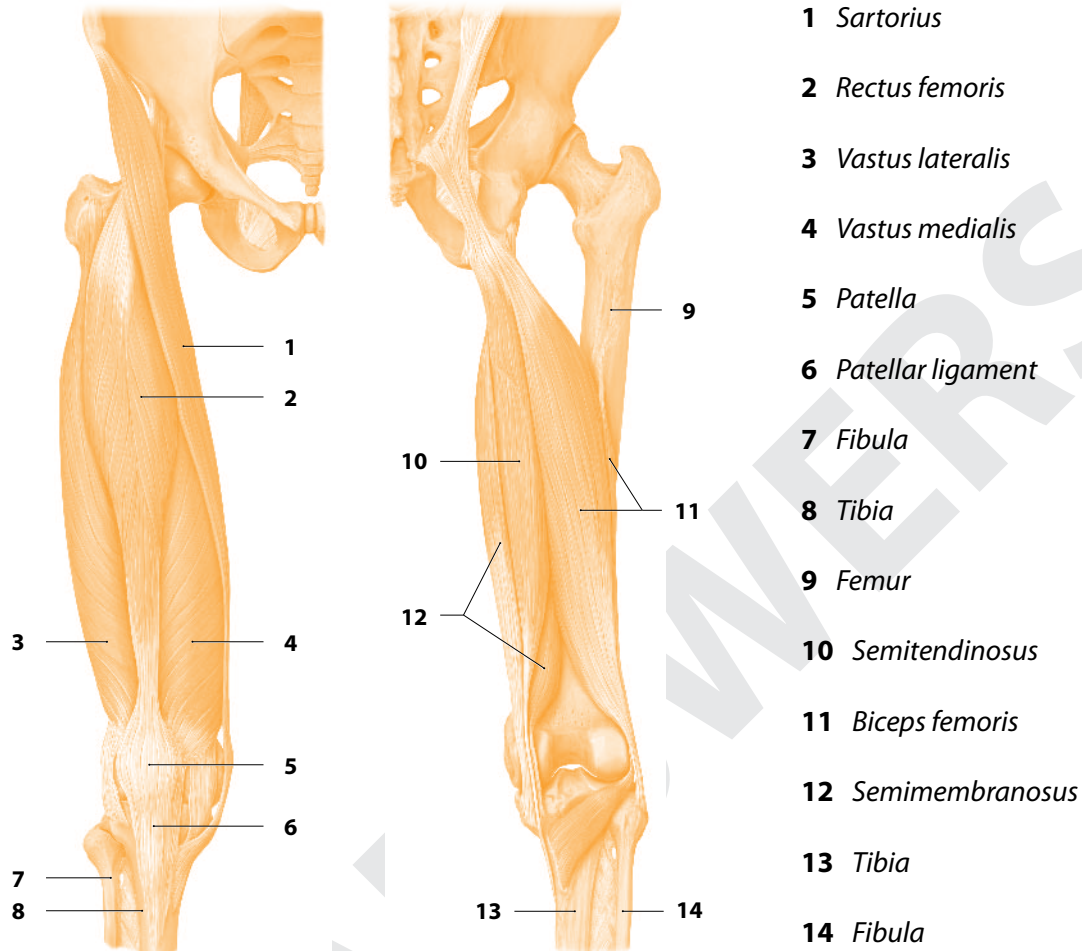


4.2.7 Muscles of the Lower Limb

(A) Muscles of the Anterior and Posterior Compartments of the Thigh

- Identify the structures below and fill in the spaces. Then colour the most lateral muscle of the anterior compartment of the thigh and the muscle that attaches distally to the fibula in the posterior compartment of the thigh.

[The most lateral muscle of the anterior thigh is the vastus lateralis. The muscle that attaches distally to the fibula in the posterior thigh is the biceps femoris.]



Collectively, the anterior muscles of the thigh are referred to as the quadriceps.

What type of action does this muscle group perform? What are some examples of exercises that can be used to strengthen these muscles?

The anterior group of thigh muscles form the extensor group, which serve to extend the knee. Exercises that can be used to strengthen these muscles include squats, leg extensions, and lunges (any exercise where knee extension occurs).

Collectively, the posterior muscles of the thigh are referred to as the hamstrings.

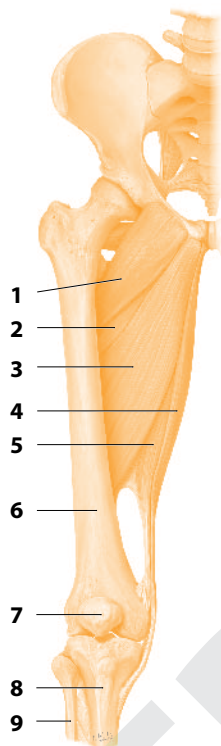
What type of action do these muscles perform? What exercises can be used to strengthen this muscle group?

The posterior group of thigh muscles serve to flex the knee and extend the hip (along with gluteus maximus). Exercises that can be used to strengthen these muscles include leg curls, dead lifts, and lunges (any exercise where knee flexion or hip extension occurs).

(B) Muscles of the Medial Compartment of the Thigh

Fill in the appropriate labels for the structures of the medial compartment of the thigh.

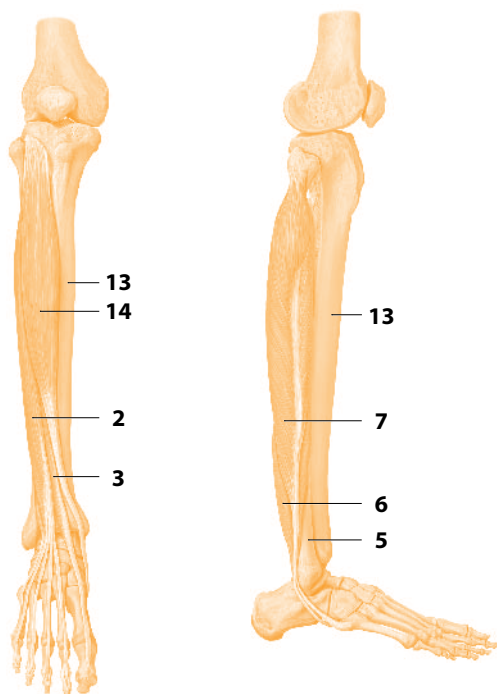
- 1 *Pectineus*
- 2 *Adductor brevis*
- 3 *Adductor longus*
- 4 *Gracilis*
- 5 *Adductor magnus*
- 6 *Femur*
- 7 *Patella*
- 8 *Tibia*
- 9 *Fibula*



This group of medial thigh muscles has one primary action – that is, to adduct the thigh towards the midline.

(C) Muscles of the Leg

Fill in the appropriate labels for the structures below.



- 1 Achilles tendon
- 2 extensor digitorum longus
- 3 extensor hallucis longus
- 4 femur
- 5 fibula
- 6 fibularis brevis
- 7 fibularis longus
- 8 gastrocnemius
- 9 lateral malleolus
- 10 medial malleolus
- 11 plantaris
- 12 soleus
- 13 tibia
- 14 tibialis anterior

Which of the muscles above would be used primarily to

- | | |
|-------------------------|---|
| (a) stand on the toes? | (a) <i>gastrocnemius; soleus</i> |
| (b) evert the foot? | (b) <i>peroneus longus; peroneus brevis</i> |
| (c) dorsiflex the foot? | (c) <i>tibialis anterior</i> |

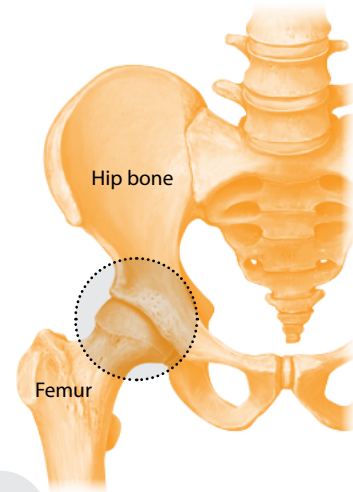
4.2.8 Joints of the Lower Limb

(A) The Hip Joint

- The hip joint is also known as the *iliofemoral* joint. Label the bones involved in the hip and circle the joint on the figure to the right.

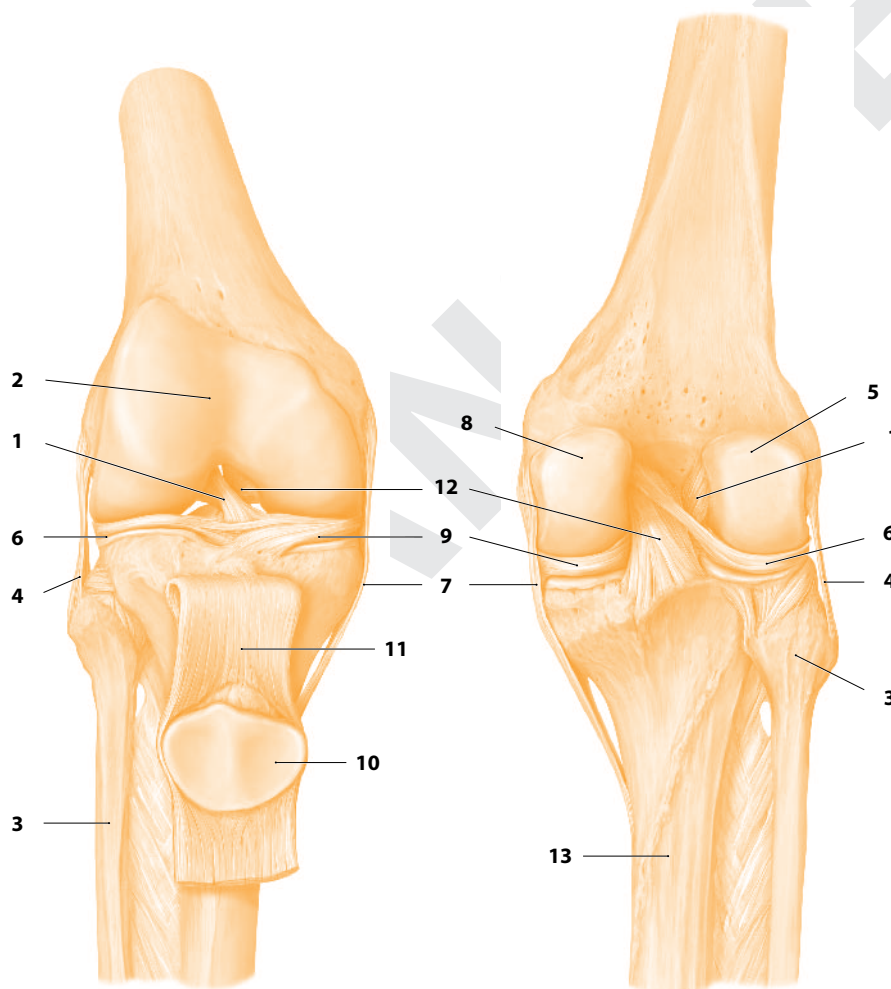
Based on shape, the hip is classified as a *ball and socket* joint, which provides the greatest range of motion and mobility of any joint type. List the types of movements that can occur at the hip.

flexion–extension *abduction–adduction*
circumduction *rotation*



(B) The Knee Joint

- Complete the figure of the right knee below using the labels provided. The knee joint is classified as a *hinge* joint, and the primary action performed here is *flexion–extension*, such as when performing a squat.



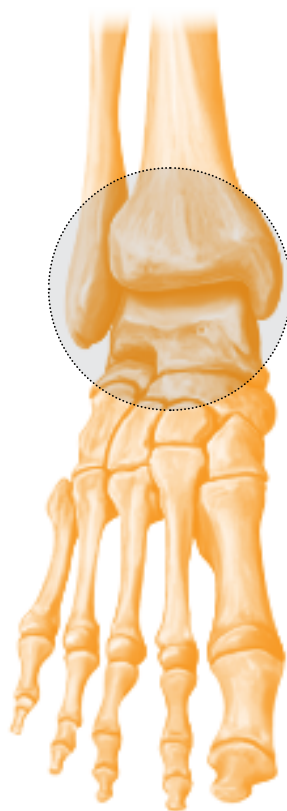
- 1 anterior cruciate ligament
- 2 femur
- 3 fibula
- 4 lateral collateral ligament
- 5 lateral condyle
- 6 lateral meniscus
- 7 medial collateral ligament
- 8 medial condyle
- 9 medial meniscus
- 10 patella
- 11 patellar ligament
- 12 posterior cruciate ligament
- 13 tibia

How do you know which view is anterior and which is posterior?

The image on the left depicts the knee from an anterior view and the image on the right from a posterior view. Many clues give this away: the fibula is lateral to the larger tibia; the knee is flexed slightly in the left diagram, which clearly shows the articulation between the tibia and femur; the patella can only be seen anteriorly; the medial and lateral femoral condyles can only be seen posteriorly.

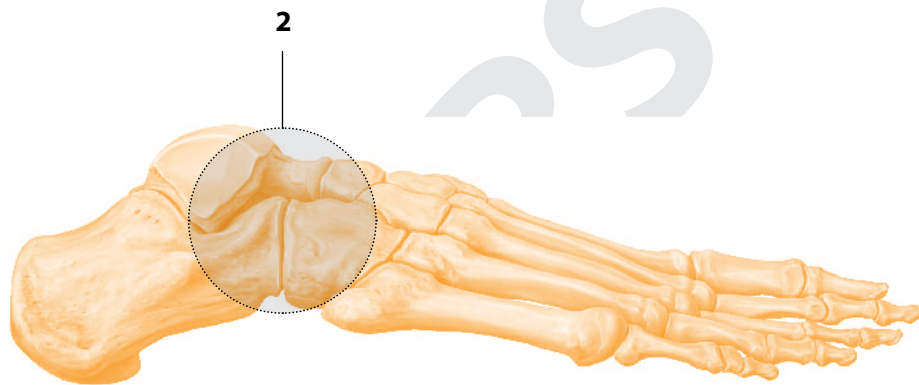
(C) Ankle and Foot Joints

Identify and label the two major ankle and foot joints below.



1 Talocrural joint

2 Transverse tarsal joint



The ankle joint is made up of several bones. Which of the following is **not** part of this joint? Check all that apply.

Calcaneus

Lateral cuneiform

Navicular

Cuboid

Lateral malleolus

Talus

Fibula

Medial malleolus

Tibia

3

CHECK YOUR UNDERSTANDING



Name: _____

Date: _____



Multiple Choice

1. Which of the following is **not** a facial bone:

- A) zygomatic
- B) maxilla
- C) sphenoid
- D) mandible
- E) lacrimal

Answer: C

2. The false ribs:

- A) attach directly to the sternum
- B) are ribs 7 to 10
- C) articulate with the thoracic vertebrae
- D) are ribs 10 to 12
- E) do not attach to the sternum

Answer: C

3. Which of the following is **not** a posterior muscle of the pectoral girdle:

- A) latissimus dorsi
- B) trapezius
- C) levator scapulae
- D) teres major
- E) none of the above

Answer: E

4. Which of the following is **not** a bone of the upper limb:

- A) phalanx
- B) metacarpal
- C) pisiform
- D) lunate
- E) cuboid

Answer: E

5. Which of the following is **not** a muscle of the pelvic girdle:

- A) gluteus maximus
- B) psoas major
- C) iliacus
- D) gluteus minimus
- E) sartorius

Answer: E

2. The *erector spinae* muscles allow us to stand straight and walk on two feet.

3. At the pectoral girdle, the lateral end of the *clavicle* joins with the *acromion process* of the scapula.

4. The *triceps* brachii extends the elbow joint, while the *biceps* brachii flexes the elbow joint.

5. The major anterior compartment muscle of the lower leg is *tibialis* anterior.

Word Bank

- | | | |
|---------------------|---------------------|--------------|
| a. acromion process | e. erector spinae | i. manubrium |
| b. biceps | f. fibularis | j. orbit |
| c. clavicle | g. foramen | k. tibialis |
| d. coracoid process | h. levator scapulae | l. triceps |



True or False

Indicate whether each statement is **true (T)** or **false (F)**. If the statement is false, provide the correct answer.

1. The head sits on the first *cervical* vertebra, called the *atlas*.

Answer: true; true

2. The anterior abdominal wall is formed by the external oblique, internal oblique, and *rectus abdominis* muscles.

Answer: false (Correct: *transversus abdominis*)

3. The *subscapularis* is one of the rotator cuff muscles.

Answer: true

4. Each finger has two *metacarpophalangeal* joints.

Answer: false (Correct: interphalangeal)

5. The tibiofemoral joint is more commonly known as the *ankle*.

Answer: false (Correct: *knee*)



Fill in the Blanks

Fill in the blanks for the following statements using words from the **word bank**. Place the corresponding letter from the word bank in the blank spaces provided.

1. An opening in bone through which an anatomical structure can pass is a/an *foramen*.

Think and Link

1. Match each of the following bones with its corresponding location.

Bone	Answer	Location
Xiphoid process	C	A) Skull
Ilium	F	B) Face
Fibula	G	C) Chest
Sphenoid	A	D) Pectoral girdle
Talus	G	E) Upper limb
Manubrium	C	F) Pelvic girdle
Ulna	E	G) Lower limb
Cuboid	G	
Scapula	D	
Metatarsal	G	
Trapezium	E	
Zygomatic	B	
Lunate	E	
Clavicle	D	
Parietal	A	

2. Discuss the anterior and posterior muscle groups of the thigh, identifying the muscles in each group and the role they play.

The anterior group of thigh muscles is commonly called the quadriceps. The quadriceps muscles are rectus femoris, vastus lateralis, vastus intermedius, and vastus medialis. Their role is to extend the knee. The posterior group of thigh muscles is commonly called the hamstrings. The hamstring muscles are semitendinosus, semimembranosus, and biceps femoris. Their role is to flex the knee and extend the hip with the gluteus maximus.

3. Select one upper body and one lower body region in the chapter and describe all aspects of its anatomy: the bones and muscles involved, up to three joints involved, and the types of movements that can occur there. Remember to use relevant directional terms and anatomical terminology whenever possible.

Body Region	Bones	Muscles	Joints	Movements
Upper body: Example: Elbow	<ul style="list-style-type: none"> • humerus • radius • ulna 	<ul style="list-style-type: none"> • biceps brachii • brachialis • brachioradialis • triceps brachii 	<ul style="list-style-type: none"> • humeroradial • humeroulnar • radioulnar 	<ul style="list-style-type: none"> • flexion–extension • pronation–supination at the radioulnar joint
Lower body: Example: Knee	<ul style="list-style-type: none"> • femur • tibia • fibula 	<ul style="list-style-type: none"> • quadriceps (rectus femoris; vastus medialis, intermedius, and lateralis) • sartorius • hamstrings (biceps femoris; semitendinosus; semimembranosus) 	<ul style="list-style-type: none"> • tibiofemoral • many ligaments for structural support, including patellar, anterior cruciate, posterior cruciate, medial collateral, lateral collateral 	<ul style="list-style-type: none"> • primarily flexion–extension • medial and lateral rotation also possible when knee is flexed

Name: _____

Date: _____

4

CHAPTER CULMINATING ASSIGNMENT



Case Study: Focus on the Road



It was a sunny afternoon, and Alyssa and Victoria were having fun on the street in their quiet residential neighbourhood. Alyssa was doing cartwheels, and Victoria was skipping rope. In the distance, a high school student named Knowshon and his friend Robert were speeding at approximately 80 km/h in the 50 km/h zone.

Knowshon was sending text messages on his cell phone as he was driving. Robert noticed the kids on the street, and he screamed at his friend to pay attention. As Knowshon swerved to avoid hitting the girls, he lost control of his Civic and hit a tree. Because he was not wearing a seat belt, he was ejected from the car.

The initial impact resulted in multiple fractures of the lower mandible and skull. Knowshon was treated quickly for a suspected epidural haemorrhage but miraculously was still conscious. He also fractured his coccyx, ilium, and the distal end of his left fibula as well as dislocating his right patella.

Robert, who was wearing his seat belt, fractured his clavicle and ribs 5 and 6 on the right side. Because he tried to grasp the dashboard before the crash, Robert suffered additional fractures of the radius and scaphoid.

As the victims were being transferred to the ambulance, Knowshon reported intense pain when trying to extend his right leg from the knee and complained of tenderness of the thigh muscles. Robert reported extreme pain and stiffness in the cervical region resulting from severe whiplash.

Considering all this information, complete the following statements.

While doing cartwheels in the street, Alyssa was performing actions in the frontal plane, and Victoria was performing actions in the sagittal plane as she skipped rope.

When Knowshon was ejected from the car through the windshield, he rolled forward several times. Rolling forward is an example of a sagittal plane movement.

When Knowshon slammed on the brakes, he had to quickly plantar flex his foot. The muscles that allowed him to perform this action include the gastrocnemius and soleus.

Knowshon fractured his lower mandible, ilium, and coccyx and dislocated his patella. In layperson's terms, he broke his jaw, pelvis (hip bone), and tail bone and dislocated his knee cap.

Robert fractured his scaphoid and radius and suffered severe whiplash in his cervical region. In layperson's terms, he broke his wrist and forearm and severely strained his neck muscles.

Knowshon also suffered multiple fractures of the skull, and based on the suspected epidural haemorrhage, the temporal bone was likely one of them. If the anterior aspect of his skull made first impact, he may have also fractured the frontal bone.

Robert's fractured ribs are part of the upper pairs of ribs called true ribs.

Knowshon fractured the distal end of the fibula; therefore, he fractured his ankle joint.

Knowshon's thigh tenderness and inability to straighten his leg are most likely related to the bruising impact on his quadriceps muscles and the dislocation of his patella, which is a sesamoid type of bone.

As the emergency (EMS) personnel lifted the stretchers into the ambulance from a squatting position, they had to extend their knees using primarily the quadriceps muscles.

When the attendant pushed the doors of the ambulance closed, she had to extend her elbow using her triceps muscles.

It was later determined that Knowshon's ilium was also dislocated from his upper thigh bone. This type of joint is a ball and socket joint, and it connects the (head of the) femur to the os coxae (hip bone). In this type of joint, rotation in all planes of movement is possible.

Robert's fractured clavicle was a nuisance when attempting rehabilitation of his whiplash, as the clavicle has two joints in which movement was severely hindered. Name those two joints: acromioclavicular and sternoclavicular.

What life lessons can be learned from this fictional case study scenario?

Answers will vary.

- 1) Don't text while driving
- 2) Be aware of your speed and your surroundings
- 3) Wear your seatbelt