

6

The Skeletal System: Bones and Joints

FOCUS: The extracellular matrix of bone contains collagen, which lends flexible strength, and minerals, which give bone weight-bearing strength. The two major types of bone are compact bone and cancellous bone. Bone ossification, growth, remodeling and repair are dynamic processes carried out by osteoblasts and osteoclasts. The skeletal system consists of the axial skeleton (skull, vertebral column, and rib cage) and the appendicular skeleton (limbs

and their girdles). The skull surrounds and protects the brain; the vertebral column supports the head and trunk and protects the spinal cord; and the rib cage protects the heart and lungs. The pectoral girdle attaches the upper limbs to the trunk and allows a wide range of movement of the upper limbs. The pelvic girdle attaches the lower limbs to the trunk and is specialized to support the weight of the body.

CONTENT LEARNING ACTIVITY

Connective Tissue

“Connective tissue consists of cells separated from each other by an extracellular matrix.”

Match these terms with the correct statement or definition:

Bone
Cartilage

Ligaments
Tendons

1. Extracellular matrix is made up primarily of collagen.
2. Extracellular matrix is made up of collagen and proteoglycans.
3. Extracellular matrix is made up of collagen and minerals.
4. Attach muscles to bones.



Most of the mineral in bone is in the form of calcium phosphate crystals called hydroxyapatite.

General Features of Bone

“There are four types of bone, described by their shape as long, short, flat, and irregular.”

A. Match these terms with the correct statement or definition:

Flat bones
Irregular bones

Long bones
Short bones

1. Bones longer than they are wide, e.g., limb bones.
2. Bones as broad as they are long, e.g., ankle and wrist bones.
3. Bones such as the ribs, scapula, and sternum.
4. Bones such as the vertebrae and facial bones.

B. Using the terms provided, complete these statements:

Blood-forming
Diaphysis
Endosteum
Epiphysis
Epiphyseal line
Epiphyseal plate

Fat
Marrow
Medullary cavity
Osteoblasts
Periosteum

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

Each long bone consists of a shaft, called the (1), and a(n) (2) at each end of the bone. A long bone that is still growing has a(n) (3), composed of cartilage, between each epiphysis and the diaphysis. When bone growth stops, the epiphyseal plate is replaced by bone, and is called the (4). The large cavity in the diaphysis is called the (5). This space, and other spaces are filled with soft tissue called (6). Yellow marrow consists mostly of (7), whereas red marrow consists of (8) cells. Most of the outer surface of the bone is covered by a connective tissue layer called the (9), which contains blood vessels and nerves. The medullary cavity is lined with a thinner connective tissue membrane, the (10). The periosteum and endosteum contain (11), which function in the formation, repair, and remodeling of bone.

C. Using the terms provided, complete these statements:

Canaliculi
Lacunae

Lamellae
Osteocytes

1. _____
2. _____
3. _____
4. _____

Bone is formed in thin sheets of extracellular matrix called (1), with bone cells, called (2) between the lamellae. The osteocytes are located within spaces called (3). Cell processes extend from the osteocytes across the extracellular matrix of the lamellae within tiny canals called (4).

Compact Bone and Cancellous bone

“The two major types of bone are compact bone, which is mostly solid matrix and cells, and cancellous bone, which consists of a lacy network of bone with many small, marrow-filled spaces.”

A. Using the terms provided, complete these statements:

Blood vessels
Canaliculi
Central canal

Osteon
Periosteum and
endosteum

1. _____
2. _____
3. _____
4. _____
5. _____

Most of the lamellae of compact bone are organized into sets of concentric rings with each set surrounding a (1). Within the central canal are (2) that run parallel to the long axis of the bone. Each central canal with the lamellae and osteocytes surrounding it, is called a(n) (3). The osteocytes are connected to each other by cell processes located in (4). Blood vessels in the (5) supply blood to vessels in the central canal.

B. Using the terms provided, complete these statements:

Blood vessels
Canaliculi
Marrow

Osteocytes
Trabeculae

1. _____
2. _____
3. _____
4. _____
5. _____

Cancellous (spongy) bone consists of delicate interconnecting rods or plates of bone called (1). The spaces between the trabeculae are filled with (2). Each trabecula consists of several lamellae, with (3) between the lamellae. Usually no (4) penetrate the trabeculae, and the trabeculae have no central canals. Nutrients pass by diffusion through the (5) to the osteocytes of the trabeculae.

Bone Ossification

“Ossification is the formation of bone by osteoblasts.”

A. Match these terms with the correct statement or definition:

Endochondral ossification
Intramembranous ossification

- _____
- _____
- _____

1. Bone formation that occurs within connective tissue membranes.
2. Ossification process that occurs primarily in the flat bones of the skull.
3. Ossification process that produces most of the skeletal system.

B. Using the terms provided, complete these statements:

Calcified
Cartilage model
Connective tissue
Osteoblasts
Osteoclasts

Primary
 ossification center
Secondary
 ossification centers

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

Intramembranous ossification occurs when osteoblasts begin to produce bone in ossification centers of (1) membranes. Endochondral ossification begins with a (2), which has the general shape of the mature bone. The chondrocytes of the cartilage model increase in number, hypertrophy, and die and the cartilage matrix becomes (3), forming an ossification center. When chondrocytes die, (4) invade spaces in the center of the bone and produce bone matrix; (5) remove bone and calcified cartilage to form the medullary cavity. The center part of the diaphysis where bone first begins to appear is called the (6). Later, (7) form in the epiphyses.

Bone Growth, Remodeling, and Repair

“Bone growth, remodeling, and repair all involve deposition of new bone matrix by osteoblasts.”

A. Using the terms provided, complete these statements:

Calcified
Chondrocytes
Diameter
Epiphyseal plate
Length

Ossification
Osteoblasts
Osteoclasts
Proliferating

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

As osteoblasts deposit new bone matrix on the surface of bones between the periosteum and the existing bone, the bone increases in (1). Growth in the (2) of a bone, which is the major source of increased height in an individual, occurs in the (3). Just as in endochondral ossification, (4) increase in number. Within the (5) zone, the chondrocytes line up in columns, hypertrophy, and die. The cartilage matrix is (6), and (7) start forming bone matrix on the surface of the calcified cartilage. This process produces a zone of (8) on the diaphyseal side of the epiphyseal plate.

B. Using the terms provided, complete these statements:

Calcium	Decrease
Callus	Increase
Cancellous	Osteoblasts
Clot	Osteoclasts

Bone remodeling involves the removal of old bone by (1), and the deposition of new bone by (2). Bone is the major storage site for (3) in the body. Calcium is removed from bones when blood calcium levels (4), and it is deposited when dietary calcium is adequate. When a bone is broken, the bone bleeds, and a (5) is formed in the damaged area. Cells from surrounding tissue invade and form a fibrous network with islets of cartilage, which holds the bone fragments together. The zone of tissue repair between the two bone fragments is called a (6). Osteoblasts enter the callus and begin forming (7) bone, which is later remodeled.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

General Considerations of Bone Anatomy

“Several common terms are used to describe features of bones.”

Match these terms with the correct statement or definition:

Canal or meatus
Condyle
Foramen

Fossa
Process
Tubercle or tuberosity

- | | |
|-------|---|
| _____ | 1. Hole in a bone. |
| _____ | 2. Tunnel-like passage through a bone. |
| _____ | 3. Depression in a bone. |
| _____ | 4. Lump on a bone. |
| _____ | 5. Projection from a bone. |
| _____ | 6. Smooth, rounded end of a bone, where it forms a joint with another bone. |



The axial skeleton is divided into the skull, vertebral column, and thoracic cage.

Skull

“The bones of the skull are divided into two portions, the cranial vault and the face.”

A. Match these terms with the correct statement or definition:

Cranial vault (braincase)
Facial bones
Hyoid bone
Nasal conchae

Nasal septum
Orbit
Paranasal sinuses
Sella turcica

1. Subdivision of the skull that protects the brain.
2. Bones that form the structure of the face, but do not contribute to the cranial vault.
3. Bone that "floats" in the neck and is the attachment site for throat and tongue muscles.
4. Structure in the skull that surrounds and protects the eye.
5. Three bony shelves of the nasal cavity that help to warm and moisten the air.
6. Air-filled cavities that open into the nasal cavity.
7. Structure resembling a saddle that is occupied by the pituitary gland.
8. Perpendicular bone and cartilage that divide the nasal cavity into right and left halves.

B. Match these openings or depressions with the correct description:

External auditory meatus
Foramen magnum
Mandibular fossa
Nasolacrimal canal

Orbit
Orbital fissures
Optic foramen

1. Large openings through which nerves or blood vessels communicate with the eye.
2. Opening through which the optic nerve passes into the skull.
3. Opening through which the spinal cord connects to the brain.
4. Depression where mandible articulates with temporal bone.
5. Cone-shaped fossa that surrounds the eye.
6. Opening that passes from the orbit into the nasal cavity.
7. Temporal bone canal; allows sound to reach the eardrum.

C. Match these terms with the correct parts labeled in figure 6.1:

Coronal suture
 External auditory meatus
 Frontal bone
 Lambdoid suture
 Mandible
 Mastoid process
 Maxilla
 Nasal bone

Occipital bone
 Parietal bone
 Sphenoid bone
 Squamous suture
 Styloid process
 Temporal bone
 Zygomatic arch
 Zygomatic bone

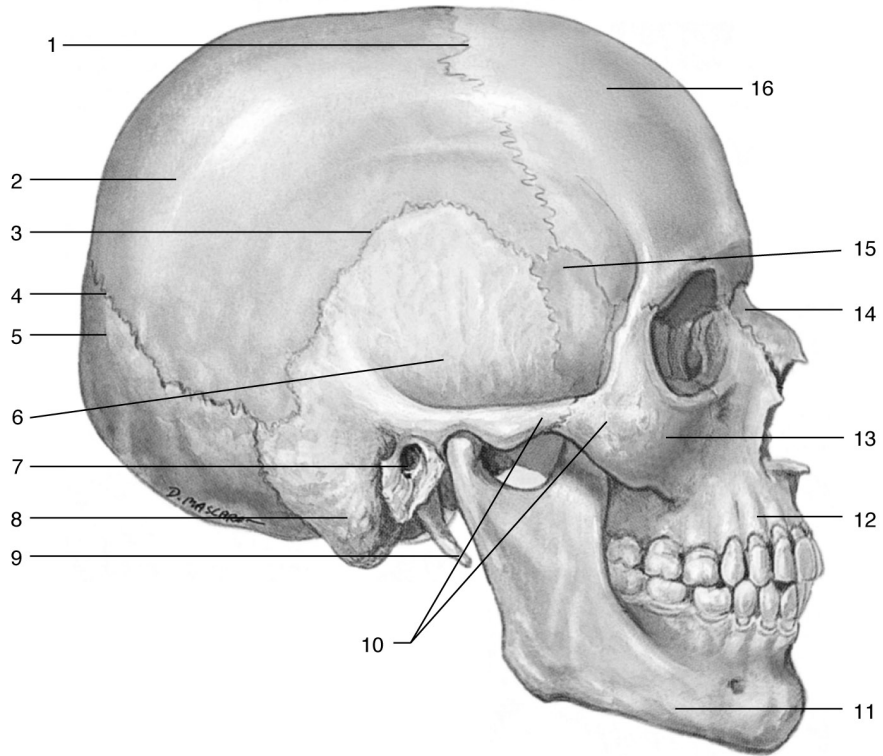


Figure 6.1

- | | | |
|----------|-----------|-----------|
| 1. _____ | 7. _____ | 12. _____ |
| 2. _____ | 8. _____ | 13. _____ |
| 3. _____ | 9. _____ | 14. _____ |
| 4. _____ | 10. _____ | 15. _____ |
| 5. _____ | 11. _____ | 16. _____ |
| 6. _____ | | |

D. Match these bone parts with structures to which they contribute:

Horizontal plate of palatine	Temporal
Palatine process of maxilla	Vomer
Perpendicular plate of ethmoid	Zygomatic

1. Two parts that form the hard palate.
2. Two parts that form the nasal septum.
3. Two bones that form the zygomatic arch.

Vertebral Column

“The vertebral column provides support, protection, a site for muscle attachment, and flexibility.”

A. Match these terms with the correct statement or definition:

Cervical	Sacral
Lumbar	Thoracic

1. Two sections of the vertebral column that curve posteriorly.
2. There are seven of these vertebrae in the vertebral column.
3. There are twelve of these vertebrae in the vertebral column.
4. There are five of these vertebrae in the vertebral column.

B. Match the type of vertebra with the correct description:

Atlas	Lumbar vertebrae
Axis	Sacrum
Cervical vertebrae	Thoracic vertebrae
Coccyx	

1. Have transverse foramina and partly split spinous processes.
2. First cervical vertebra; allows a "yes" motion of the head.
3. Articular facets for ribs present.
4. Superior articular facets of these vertebrae face medially and "lock" with laterally facing inferior articular facets of the vertebra above it.
5. Five fused vertebrae that have a median crest and a hiatus.
6. Tailbone, usually consisting of four fused vertebrae.

C. Match these terms with the correct statement or definition:

Articular process
 Body
 Intervertebral disk
 Intervertebral foramina
 Lamina

Pedicle
 Spinous process
 Transverse process
 Vertebral foramen

1. Weight-bearing portion of the vertebra.
2. Two parts that form the vertebral arch.
3. Contains the spinal cord; all of them together form the vertebral canal.
4. Where the spinal nerves exit the vertebral column.
5. Where vertebrae articulate with each other.
6. Lumps that can be seen and felt down the midline of the back.
7. Dense fibrous connective tissue that separates vertebrae.

D. Match these terms with the correct parts labeled in figure 6.2:

Articular facet
 Articular process
 Body
 Lamina
 Pedicle
 Spinous process
 Transverse process
 Vertebral arch
 Vertebral foramen

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

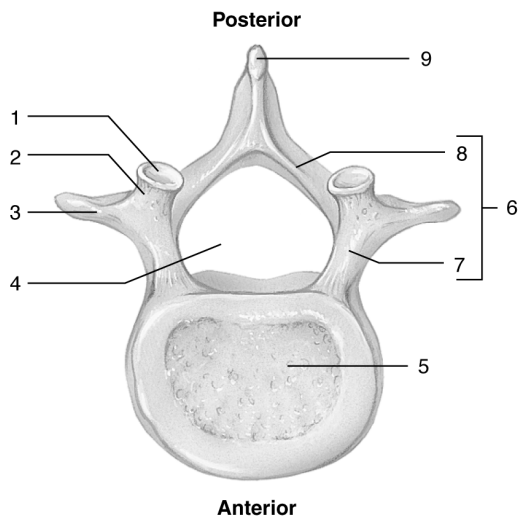


Figure 6.2



Spinous processes of the first four sacral vertebrae form the median sacral crest, but the fifth sacral vertebra does not form, leaving a sacral hiatus (opening) at the inferior end of the sacrum. The anterior edge of the first sacral vertebra forms the sacral promontory.

Thoracic Cage

“The thoracic cage or rib cage protects the vital organs within the thorax and prevents the collapse of the thorax during respiration.”

A. Match these terms with the correct statement or definition:

Body
False ribs
Floating ribs
Jugular notch

Manubrium
Sternal angle
True ribs
Xiphoid process

1. First seven pairs of ribs that attach directly to the sternum.
2. Eleventh and twelfth ribs, which have no attachment to the sternum.
3. Middle part of the sternum.
4. Most superior part of the sternum.
5. Depression at the superior end of the sternum.
6. Slight elevation at the junction of the manubrium and body of the sternum; landmark for locating the second rib.

B. Match these terms with the correct parts labeled in figure 6.3:

Body
Costal cartilage
False ribs
Floating ribs

Manubrium
Sternum
True ribs
Xiphoid process

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

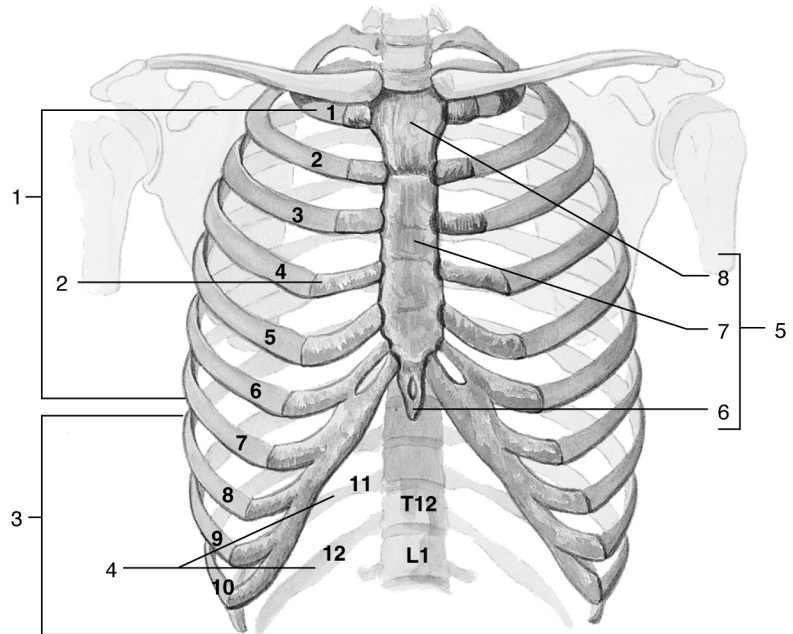


Figure 6.3

Pectoral Girdle

“The pectoral, or shoulder girdle consists of two pairs of bones that attach the upper limb to the body: the scapulae, or shoulder blades, and the clavicles, or collar bones.”

Match these terms with the correct statement or definition:

Acromion process
Coracoid process

Glenoid fossa
Spine

1. Ridge that runs across the posterior surface of the scapula.
2. Projection from the scapular spine that forms the point of the shoulder; point of attachment of the clavicle.
3. Projection from the scapula that curves below the clavicle and provides attachment for arm and chest muscles.
4. Depression where the head of the humerus articulates with the scapula.

Upper Limb

“The upper limb consists of the bones of the arm, forearm, wrist, and hand.”

A. Match the bone parts that articulate with each other:

Distal end of humerus
Head of humerus

Head of radius
Head of ulna

1. Glenoid fossa
2. Semilunar notch
3. Humerus and ulna
4. Carpals



The portion of the ulna proximal to the semilunar notch is the olecranon process, or point of the elbow. Just distal to the semilunar notch is the coronoid process.

B. Match the bony part with its function:

Epicondyles
Greater and lesser tubercles

Radial tuberosity
Styloid processes

1. Location for shoulder muscles to attach to the humerus.
2. Location where forearm muscles attach to the humerus.
3. Location of attachment of the biceps brachii to the radius.
4. Attachments for the ligaments of the wrists.



The wrist is composed of eight carpal bones, the hand is composed of five metacarpals, and each finger, called a digit, is composed of three phalanges. The thumb has two phalanges.

Pelvic Girdle

“The pelvic girdle is a ring of bones formed by the sacrum and two coxae.”

Using the terms provided, complete these statements:

- | | |
|-------------------------------|-------------------|
| Acetabulum | Iliac crest |
| Coxa | Male |
| Female | Obturator foramen |
| Anterior superior iliac spine | |

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Each (1) is formed by the fusion of the ilium, ischium, and pubis. The superior margin of the ilium is called the (2), and a(n) (3) is located at each ilium's anterior end. The (4) is the socket of the hip joint, and the (5) is the large hole in the coxa. The pelvic inlet and outlet are larger and the pelvic inlet is more oval in the pelvis of the (6).

Lower Limb

“The lower limb consists of the bones of the thigh, leg, ankle, and foot.”

A. Match the bone parts that articulate with each other:

- | | |
|-------------------|-------|
| Acetabulum | Talus |
| Condyles of femur | Tibia |

- | | |
|-------|------------------------------------|
| _____ | 1. Head of the femur. |
| _____ | 2. Proximal end of tibia. |
| _____ | 3. Head of fibula. |
| _____ | 4. Distal end of tibia and fibula. |

B. Match the bony part with its function:

- | | |
|-------------|-------------------|
| Calcaneus | Patella |
| Condyles | Tibial tuberosity |
| Epicondyles | Trochanters |
| Malleolus | |

- | | |
|-------|---|
| _____ | 1. Projections lateral to the condyles on the distal end of femur. |
| _____ | 2. Points of muscle attachment near the head of the femur. |
| _____ | 3. Located within the major tendon of the thigh muscles; enables the tendon to turn the corner over the knee. |
| _____ | 4. Location on the tibia where anterior thigh muscles attach. |
| _____ | 5. Prominence on each side of the ankle that forms a partial socket for the talus bone. |
| _____ | 6. Inferior to the talus; protrudes posteriorly to form the heel. |

Location of Major Bones of Skeletal System

Match these bones with the correct parts labeled in figure 6.4:

- Carpals
- Clavicle
- Coxa
- Femur
- Fibula
- Humerus
- Metacarpals
- Metatarsals
- Patella
- Phalanges
- Radius
- Scapula
- Tarsals
- Tibia
- Ulna

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

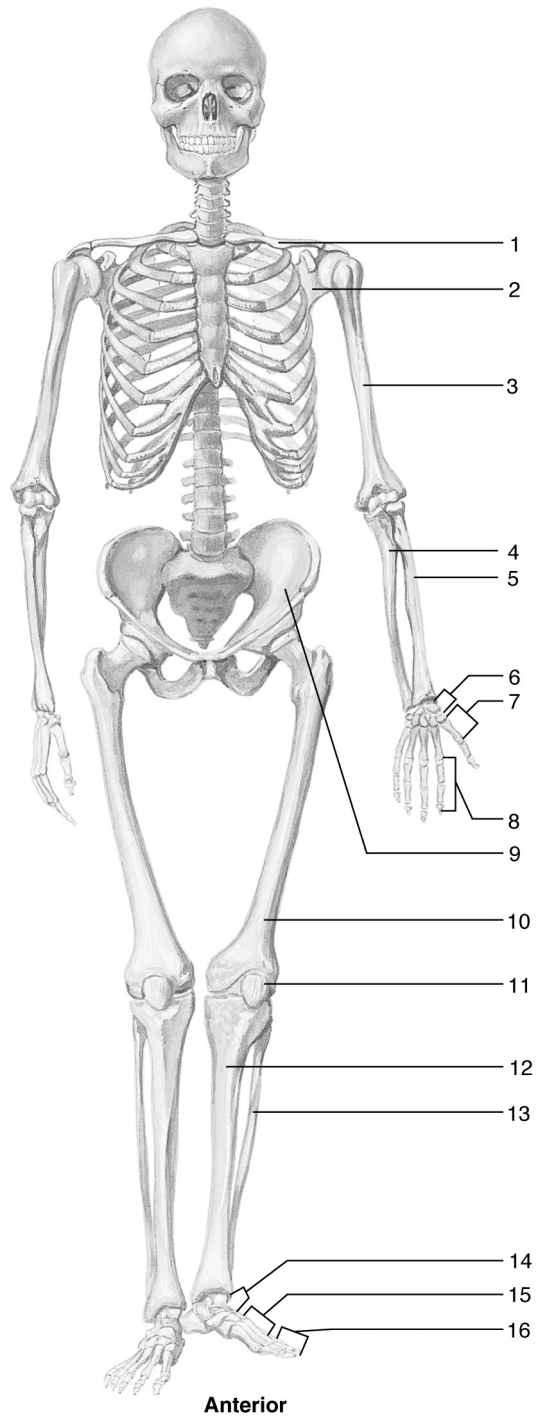


Figure 6.4

Articulations

“An articulation, or joint, is a place where two bones come together.”

A. Match the class of joint with the correct definition:

Cartilaginous
Fibrous

Synovial

1. Two bones united by fibrous tissue; exhibit little or no movement.
2. Two bones united by cartilage; only slight movement can occur at these joints.
3. Freely moving joints that contain fluid in a cavity surrounding the ends of bones.

B. Match these terms with the correct statement or definition:

Fontanels
Gomphoses

Sutures
Syndesmoses

1. Fibrous joints between the bones of the skull.
2. Wide sutures (soft spots) present in newborns.
3. Fibrous joints where bones are separated by some distance and are held together by ligaments.
4. Fibrous joints consisting of pegs fitted into sockets.

C. Match these terms with the correct statement or definition:

Articular cartilage
Bursa
Joint capsule

Joint cavity
Synovial membrane

1. Cartilage that provides a smooth surface where bones meet.
2. The space surrounding the ends of articulating bones.
3. Surrounds the joint cavity; portions may be thickened to form ligaments.
4. Tissue that lines the joint capsule except over the articular cartilage; produces synovial fluid.
5. Extension of the synovial membrane that forms a pocket or sac; reduces friction where structures would rub together.

D. Match these terms with the correct part labeled in figure 6.5:

- Articular cartilage
- Bursa
- Joint capsule
- Joint cavity
- Synovial membrane

1. _____
2. _____
3. _____
4. _____
5. _____

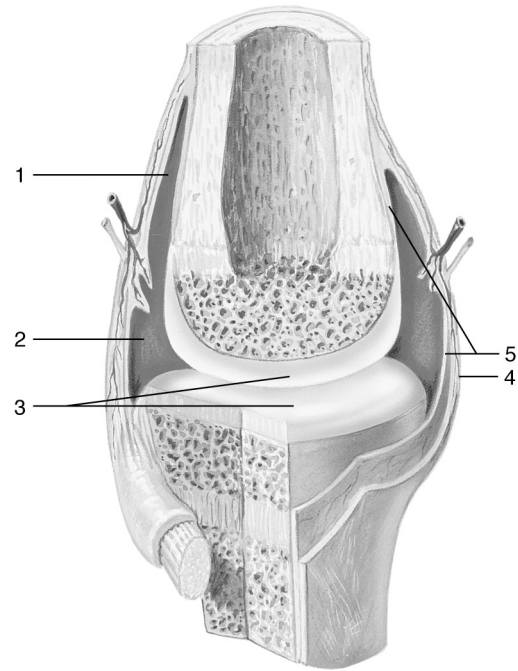


Figure 6.5

Types of Synovial Joints

“Synovial joints are classified according to the shape of the adjoining articular surfaces.”

Match these terms with the correct parts labeled in figure 6.6:

- Ball-and-socket joint
- Ellipsoid joint
- Hinge joint
- Pivot joint
- Plane joint
- Saddle joint

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

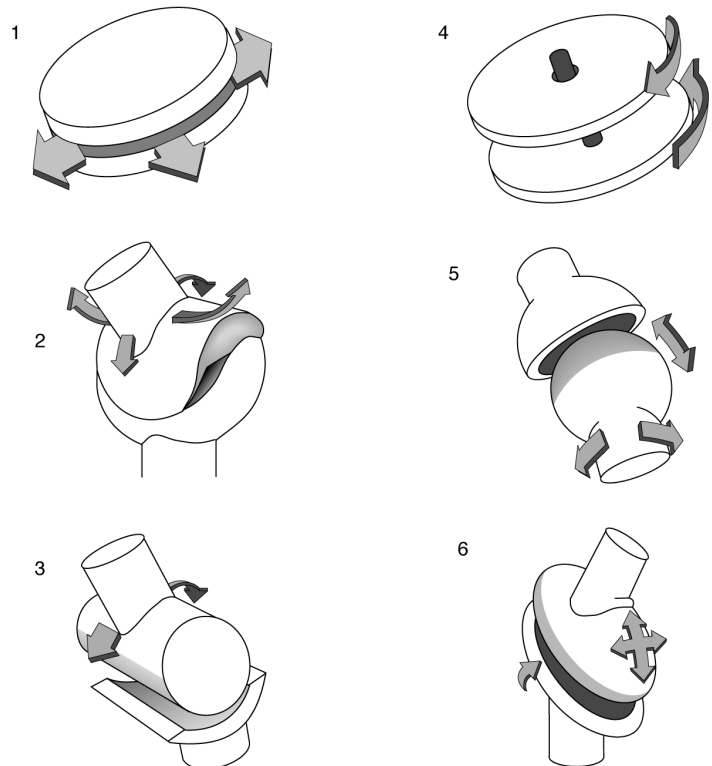


Figure 6.6

Types of Movement

“The types of movement occurring at a given joint are related to the structure of that joint.”

Match these terms with the correct parts labeled in Figure 6.7:

Abduct
Adduct
Circumduct
Extend

Flex
Pronate
Supinate

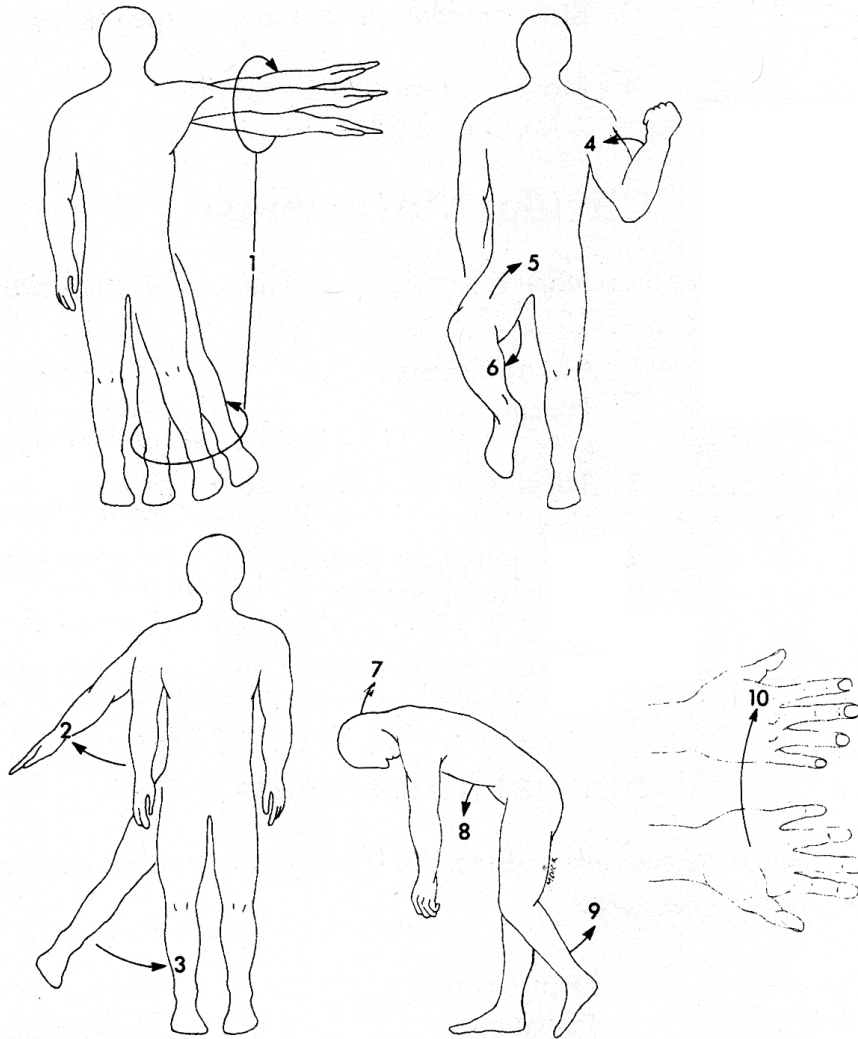


Figure 6.7

- | | | |
|----------|----------|-----------|
| 1. _____ | 5. _____ | 8. _____ |
| 2. _____ | 6. _____ | 9. _____ |
| 3. _____ | 7. _____ | 10. _____ |
| 4. _____ | | |

QUICK RECALL

1. List five functions of bone.
2. List three functions of cartilage.
3. List three types of bone cells, depending on their function.
4. List two types of bone, depending on their internal structure.
5. Name two types of bone ossification.
6. Explain how a bone grows in diameter and length.
7. Name the five types of vertebrae, and give the number of each found in the vertebral column.
8. Name the three types of ribs according to their attachment, and give the number of each type.

9. Name the bones of the pectoral and pelvic girdles.

10. Give the number of carpals, metacarpals, and phalanges in the upper limb, and give the number of tarsals, metatarsals, and phalanges in the lower limb.

11. List the three major classes of joints.

12. Name the six types of synovial joints and give an example of each.

WORD PARTS

Give an example of a new vocabulary word that contains each word part.

WORD PART	MEANING	EXAMPLE
chondr-	cartilage	1. _____
oste-	bone	2. _____
cancel-	crossbar; lattice	3. _____
lacun-	space; hollow	4. _____
styl-	shaped like a pen	5. _____
artic-	joint	6. _____

MASTERY LEARNING ACTIVITY

Place the letter corresponding to the correct answer in the space provided.

- _____ 1. Which of these is a function of bone?
a. internal support and protection
b. provide attachment for muscles
c. mineral storage
d. blood cell formation
e. all of the above
- _____ 2. Bone matrix contains
a. collagen.
b. calcium and phosphate.
c. proteoglycan.
d. chondrocytes.
e. both a and b
- _____ 3. A break in the shaft of a bone is a break in the
a. epiphysis.
b. perichondrium.
c. diaphysis.
d. articular cartilage.
- _____ 4. Which of these connective tissue structures cover the surface of mature bones?
a. perichondrium
b. periosteum
c. hyaline cartilage
d. b and c
- _____ 5. In compact bone, the osteocytes are connected to each other by tiny cell processes extending through tiny canals called
a. lamellae.
b. lacunae.
c. central canals.
d. canaliculi.
- _____ 6. Intramembranous ossification
a. occurs at the epiphyseal plate.
b. gives rise to the flat bones of the skull.
c. is responsible for increased diameter of bone.
d. develops from a cartilage model.
- _____ 7. Primary ossification centers of a long bone are found in the
a. diaphysis.
b. epiphysis.
c. perichondrium.
d. periosteum.
e. articular cartilage.
- _____ 8. As a long bone increases in diameter, the medullary cavity
a. increases in size.
b. decreases in size.
c. does not change in size.
- _____ 9. During bone growth at the epiphyseal plate, _____ increase in number, hypertrophy, and die.
a. osteocytes.
b. osteoblasts.
c. osteoclasts.
d. chondrocytes.
- _____ 10. The prime function of osteoclasts is to
a. prevent osteoblasts from forming.
b. break down bone.
c. produce calcium salts and collagen fibers.
d. change spongy bone to cartilage.
- _____ 11. In the healing of bone fractures
a. a blood clot forms around the break.
b. a callus is formed.
c. cancellous bone is formed in the callus.
d. the callus may eventually disappear.
e. all of the above
- _____ 12. Which of these is a tunnel-like passage through a bone?
a. canal or meatus
b. condyle
c. foramen
d. fossa
e. process

- _____ 13. Which of these is part of the appendicular skeleton?
a. cranium
b. ribs
c. clavicle
d. sternum
e. vertebra
- _____ 14. The perpendicular plate of the ethmoid and the _____ form the nasal septum.
a. zygomatic arch
b. nasal bone
c. nasal conchae
d. vomer
- _____ 15. Which of these bones does NOT contain a paranasal sinus?
a. ethmoid
b. sphenoid
c. temporal
d. frontal
e. maxilla
- _____ 16. The squamous suture joins the
a. frontal and temporal bones.
b. frontal and parietal bones.
c. parietal and temporal bones.
d. parietal and occipital bones.
- _____ 17. The passageway that carries tears from the eyes to the nasal cavity is
a. the nasolacrimal canal.
b. the optic foramen.
c. the orbital fissure.
d. the foramen magnum.
- _____ 18. The weight-bearing portion of a vertebra is the
a. vertebral arch.
b. articular process.
c. body.
d. transverse process.
e. spinous process.
- _____ 19. Transverse foramina are found only in
a. cervical vertebrae.
b. thoracic vertebrae.
c. lumbar vertebrae.
d. the sacrum.
e. the coccyx
- _____ 20. Which of these parts of the upper limb is NOT correctly matched with the number of bones in that part?
a. arm: 1
b. forearm: 2
c. wrist: 10
d. palm of hand: 5
e. fingers: 14
- _____ 21. Process that forms the outer ankle?
a. lateral condyle
b. lateral epicondyle
c. lateral tuberosity
d. lateral malleolus
e. none of the above
- _____ 22. Which of these pairs of bones or structures do NOT articulate with each other?
a. mandible - temporal bone
b. maxillary bone - palatine bone
c. scapula - clavicle
d. head of the ulna - humerus
e. acetabulum of coxa - femur
- _____ 23. Which of these types of joints contain fibrous connective tissue?
a. syndesmosis
b. suture
c. gomphosis
d. a and b
e. all of the above
- _____ 24. Which of these is characteristic of a synovial joint?
a. articular surfaces covered with cartilage
b. joint capsule
c. synovial membrane
d. synovial fluid
e. all of the above
- _____ 25. Once a doorknob is grasped with the right hand, what movement of the forearm is necessary to unlatch the door (turn in a clockwise direction)?
a. pronation
b. rotation
c. flexion
d. supination
e. extension



FINAL CHALLENGES



Use a separate sheet of paper to complete this section.

1. A doctor tells an elderly friend of yours that the cartilage in his joints is degenerating and has lost its resiliency. Your friend asks you to explain what that means and what the consequences might be. What do you say?
2. The length of the lower limbs of a 5-year-old were measured, and it was determined that one limb was 2 cm shorter than the other limb. Would you expect the little girl to exhibit kyphosis, scoliosis, or lordosis? Explain.
3. Can you suggest a possible advantage in having the coccyx attached to the sacrum by a flexible cartilage joint?
4. What would be the likely consequences if a fontanel in a baby's skull fused shortly after birth?