

THE SKELETAL SYSTEM

Introduction:

The skeleton is the body's structural framework and is composed of two of the supportive tissues studied earlier; bone and cartilage. The main functions of the skeleton are to provide support and protection for the body. It also acts as a point of attachment for muscles providing the leverage needed to produce movement. The skeleton also acts as a site for mineral storage and as the site of **hematopoiesis** (production of blood cells).

Bone Markings Overview:

The bumps, holes, and ridges that cover the bones of the body are called bone markings. Bone markings represent the points of attachment for muscles, the structures responsible for forming joints, and the openings through which vessels and nerves pass.

- Projections:
 - Serve as muscle and ligament attachment:
 - Tuberosity- Large rounded projection or a collection of roughened lumps
 - Crest- narrow ridge of bone that is usually prominent
 - Trochanter- large, blunt, irregular shaped processes
 - Line- thin, narrow ridge of bone, usually less prominent than a crest
 - Tubercle- Small rounded projection or process
 - Epicondyle- raised area on or above a condyle (see below)
 - Spine- sharp, slender, process or projection that is typically pointed
 - Process- any bony projection
 - Form joints:
 - Head- Enlarged portion of a bone typically carried on a narrow neck
 - Facet- smooth and often flat articulating surface
 - Condyle- rounded surface that serves as a point of articulation
 - Ramus- arm-like bar or projection of bone
- Depressions and openings that allow passage of blood vessels and nerves:
 - Groove- a furrow or ditch-like structure
 - Fissure- a narrow slit-like crack or opening
 - Foramen- a round or oval opening through a bone
 - Notch- indentation at the edge of a structure or bone.
- Others:
 - Meatus- canal or channel-like passageway
 - Sinus- bone cavity or space within a bone.
 - Fossa- shallow depression in the surface of a bone.

Divisions of the skeleton:

The skeleton can be divided into two basic parts; the axial skeleton and the appendicular skeleton. The axial skeleton is the bones associated with the central portion of the body and include the bones of the skull, thoracic (chest) cage, and the vertebral column. The appendicular skeleton is made up of the bones associated with the limbs and includes the pectoral girdle, the upper limbs, the pelvic girdle, and the lower limbs.

You are responsible for learning all the bones of the skeleton and all the markings listed on the next several pages.

AXIAL SKELETON:

1. skull

a. cranial bones

i. **frontal**

1. glabella
2. supraorbital ridge
3. supraorbital foramen (notch)

ii. **parietal**

1. sagittal suture- between parietals
2. coronal suture- between frontal and anterior border of parietals

iii. **temporal**

1. squamous suture-between parietals and temporals
2. zygomatic process
3. petrous portion
4. external acoustic (auditory) meatus
5. styloid process
6. mastoid process
7. jugular foramen
8. carotid canal
9. internal acoustic meatus
10. foramen lacerum

iv. **occipital**

1. lambdoid suture, between posterior parietals and occipital
2. foramen magnum
3. occipital condyles
4. external occipital protuberance

v. **sphenoid**

1. greater wings
2. pterygoid processes
3. superior orbital fissure
4. sella turcica
5. lesser wings
6. optic canals
7. foramen rotundum
8. foramen ovale

vi. **ethmoid**

1. crista galli
2. cribriform (horizontal) plates
3. perpendicular plate
4. middle nasal concha

b. facial bones

i. **mandible**

1. mandibular body
2. mandibular ramus
3. mandibular condyle
4. coronoid process
5. mandibular angle
6. mental foramen
7. mandibular foramen
8. alveolar margin

ii. **maxillae**

1. alveolar margin
2. palatine processes
3. infraorbital foramen

- iii. **lacrimal bones**
 - iv. **palatine bones**
 - v. **zygomatic bones**
 - 1. temporal process
 - 2. orbital process
 - 3. maxillary process
 - vi. **nasal bones**
 - vii. **vomer**
 - viii. **inferior nasal conchae**
 - c. **paranasal sinuses (visible on sagittal sections and on real skull)**
 - i. frontal
 - ii. ethmoid
 - iii. sphenoid
 - iv. maxillary
2. **hyoid bone**
3. **vertebral column**
- a. **common structures** (found on all vertebrae)
 - i. body (centrum)
 - ii. vertebral foramen
 - iii. transverse processes
 - iv. spinous process
 - v. superior and inferior articulating processes
 - vi. intervertebral foramen (foramina)
 - b. **cervical vertebrae**
 - i. atlas (C1)
 - ii. axis (C2)
 - 1. odontoid process (dens)
 - iii. special features
 - 1. seven total cervical vertebrae
 - 2. possess bifid spinous process
 - 3. transverse foramina
 - c. **thoracic vertebrae**
 - i. special features
 - 1. twelve total thoracic vertebrae
 - 2. downward pointing, sharp spinous process
 - 3. superior and inferior costal facets- articulating surface for ribs on centrum
 - 4. transverse costal facet- articulating surface for ribs on transverse process
 - d. **lumbar vertebrae**
 - i. special features
 - 1. five total lumbar vertebrae
 - 2. massive centrum
 - 3. short and wide spinous processes
 - e. **sacrum** – five fused vertebrae, articulates with L5 (fifth lumbar vertebrae)
 - i. median sacral crest
 - ii. ala
 - iii. sacral foramina
 - iv. sacral canal
 - v. sacral hiatus
 - vi. sacral promontory
 - vii. apex
 - viii. sacroiliac joint
 - f. **coccyx**- four fused vertebrae, articulates at the apex of the sacrum

4. **thoracic cage**

a. **sternum**

- i. manubrium
- ii. body (gladiolus=Latin, "little sword")
- iii. xiphoid process
- iv. jugular notch
- v. clavicular notch
- vi. sternal angle

b. **ribs**

- i. true ribs (ribs 1-7)- connect directly to the sternum by way of costal cartilages
- ii. false ribs (ribs 8-12)- connect to the sternum indirectly
 1. floating ribs (ribs 11 and 12)- make no connection to the sternum

APPENDICULAR SKELETON:

1. pectoral (shoulder) girdle

a. **clavicle**

- i. sterna (medial) end
- ii. acromial (lateral) end

b. **scapula**- students are responsible for correctly labeling these bones as right or left in addition to knowing the bone and its markings

- i. acromion process
- ii. coracoid process
- iii. suprascapular notch
- iv. inferior angle
- v. glenoid fossa (cavity)
- vi. vertebral (medial) border
- vii. axillary (lateral) border
- viii. subscapular fossa [anterior]
- ix. infraspinous fossa [posterior]
- x. supraspinous fossa [posterior]
- xi. spine

2. arm

a. **humerus**- students are responsible for correctly labeling these bones as right or left in addition to knowing the bone and its markings

- i. head [medial]
- ii. anatomical neck
- iii. surgical neck
- iv. greater tubercle [lateral]
- v. lesser tubercle [lateral]
- vi. intertubercular groove (sulcus)
- vii. deltoid tuberosity
- viii. trochlea
- ix. capitulum
- x. medial epicondyle (funny bone)
- xi. lateral epicondyle
- xii. coronoid fossa [anterior]
- xiii. olecranon fossa [posterior]

3. forearm (antebrachium)

a. **radius**

- i. head
- ii. neck
- iii. shaft
- iv. radial tuberosity
- v. ulnar notch
- vi. styloid process

b. **ulna**

- i. coronoid process
- ii. olecranon process
- iii. trochlear notch
- iv. radial notch
- v. head
- vi. styloid process

4. hand (manus)

a. **carpus** (wrist)

- i. **carpals**- eight bones that form the wrist

b. **metacarpals**- five bones forming the palm

c. **phalanges**- fourteen bones forming the fingers

- i. proximal phalanx- bone closest to the metacarpals
- ii. middle phalanx- falls between the proximal and distal phalanges
- iii. distal phalanx- the endmost bone in the fingers

Note: The thumb (pollex) possesses only the proximal and distal phalanges.

5. pelvic (hip) girdle

a. coxal bones (ossa coxae)

i. **ilium**

1. sacroiliac joint
2. iliac crest
3. anterior superior iliac spine
4. posterior superior iliac spine
5. anterior inferior iliac spine
6. posterior inferior iliac spine
7. iliac fossa
8. greater sciatic notch

ii. **ischium**

1. ischial tuberosity
2. ischial spine
3. lesser sciatic notch

iii. **pubis**

1. pubic rami
2. obturator foramen
3. pubic symphysis

iv. **acetabulum** (“vinegar cup or wine cup”)- hip socket

6. thigh

- a. **femur**- students are responsible for correctly labeling these bones as right or left in addition to knowing the bone and its markings
 - i. head [medial]
 - ii. fovea capitis
 - iii. neck
 - iv. greater trochanter [lateral]
 - v. lesser trochanter
 - vi. shaft
 - vii. gluteal tuberosity
 - viii. linea aspera
 - ix. medial condyle
 - x. lateral condyle
 - xi. intercondylar fossa [posterior]
 - xii. medial epicondyle
 - xiii. lateral epicondyle
 - xiv. patellar surface [anterior]
- b. **patella**

7. leg

- a. **tibia**- students are responsible for correctly labeling these bones as right or left in addition to knowing the bone and its markings
 - i. medial condyle
 - ii. lateral condyle
 - iii. intercondylar eminence
 - iv. tibial tuberosity
 - v. shaft
 - vi. anterior border
 - vii. medial malleolus
- b. **fibula**
 - i. head
 - ii. shaft
 - iii. lateral malleolus

8. foot

- a. **tarsals**- seven bones that makeup the ankle
 - i. calcaneus
 - ii. talus
- b. **metatarsals**- five bones that form the top of foot
- c. **phalanges**- fourteen bones that form the toes
 - i. proximal phalanx- bone closest to the metatarsals
 - ii. middle phalanx- falls between the proximal and distal phalanges
 - iii. distal phalanx- the endmost bone in the toes

Note: The great toe (pollex) possesses only the proximal and distal phalanges