Bony Landmarks: Depressions and Openings

Canal

Fissure

Foramen

Fossa

Groove

Meatus

Notch

Sinus

A canal is tunnel or tube in bone. An example is the carotid canal in the temporal bone.

A sinus is an air cavity within a bone. Examples include the frontal sinuses.

Processes That Form Joints

Condyle

Head

Facet

Process

Trochlea

Condyles are rounded projections at the ends of bones that articulate with other bones to form a joint. Example: The medial condyle of the femur.

A process can be any bony growth that projects.

Processes for Tendons/Ligaments

Crest

Epicondyle

Line

Spinous process

Trochanter

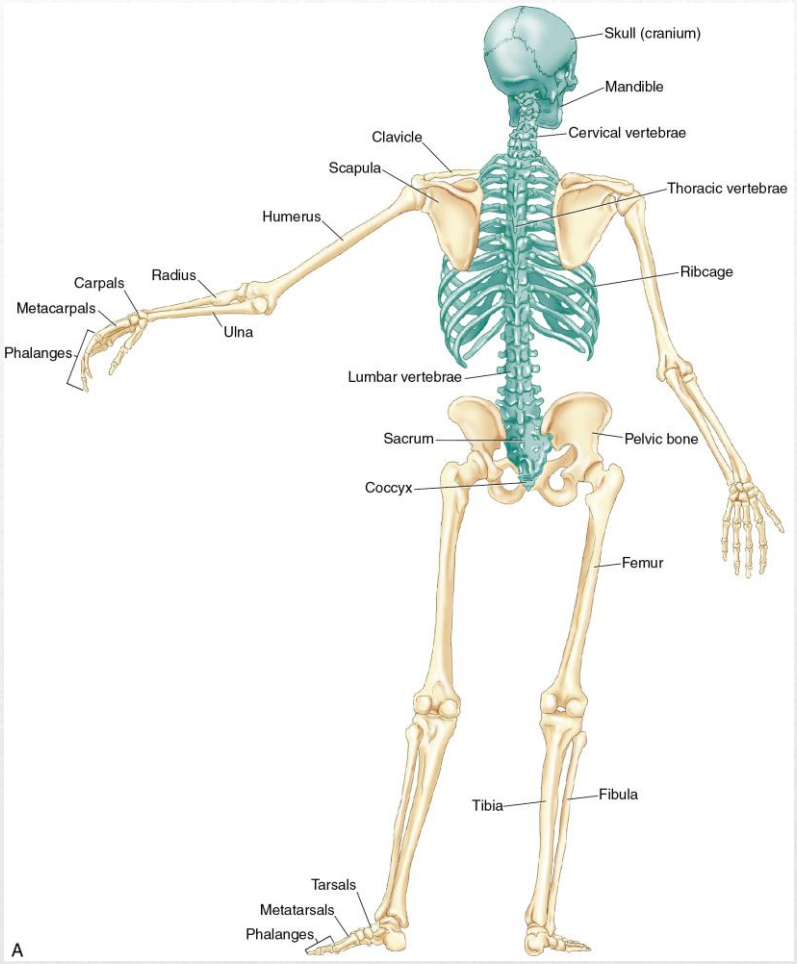
Tubercle

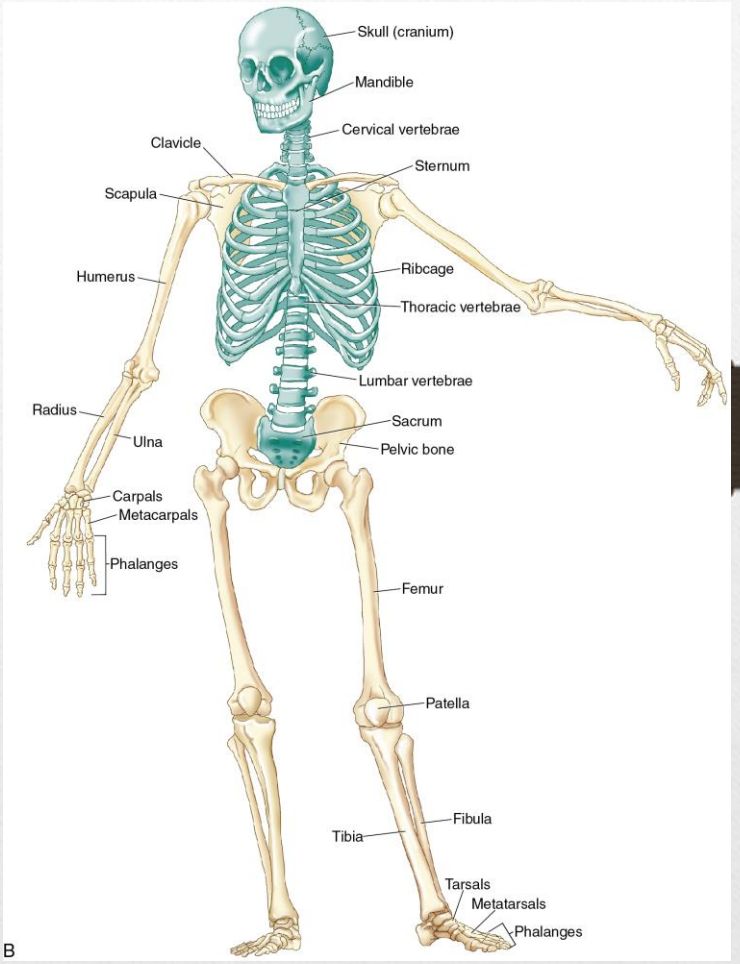
Tuberosity

An epicondyle is a projection above a condyle. An example is the medial epicondyle of the femur.

The Axial and Appendicular Divisions of the Skeleton

Divisions of the Skeleton





Axial skeleton: The head, the spine, the ribs, and the sternum compose the axial skeleton.

Appendicular skeleton: The limbs and their attachments compose the appendicular skeleton.

Framework of the Head

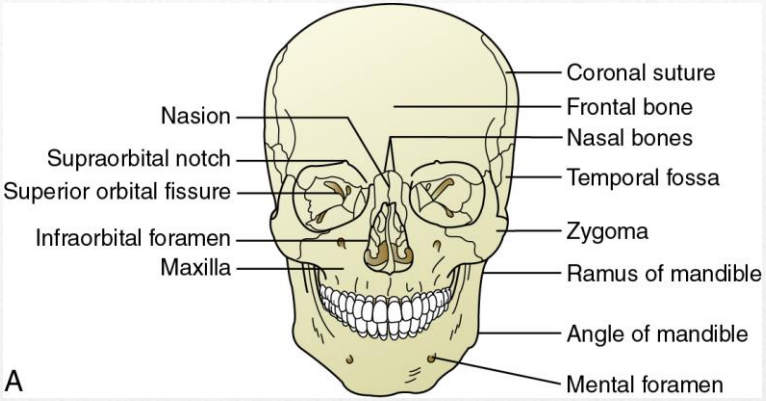
Made up of cranial bones and facial bones

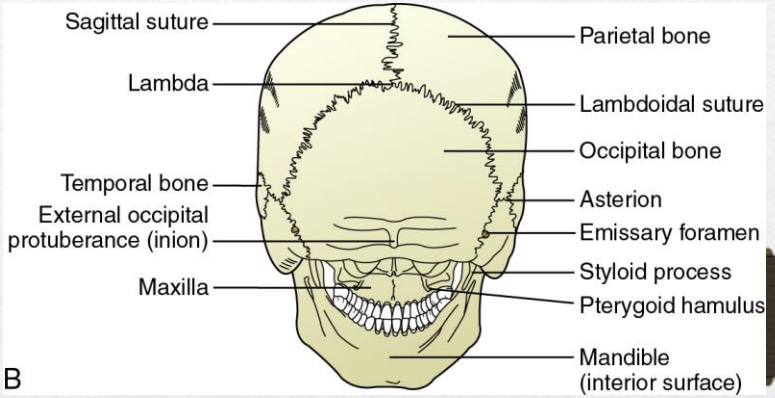
- Eight cranial
- Fourteen facial

Cranial bones include the frontal bone, the parietal bones, the temporal bones, the ethnoid bone, the sphenoid bone, and the occipital bone.

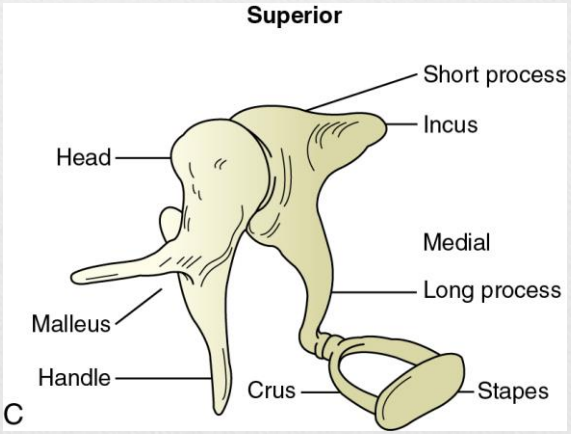
The facial bones are the mandible, the maxilla bones, the zygomatic bones, the nasal bones, the lacrimal bones, the vomer, the palatine bones, and the inferior nasal concha bones.

Anterior and Posterior Views of the Skull

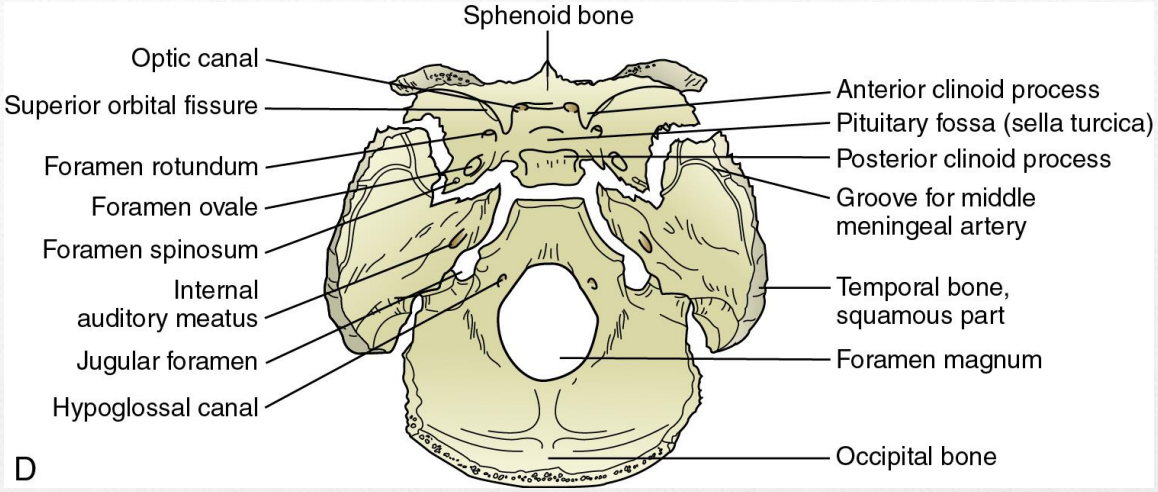


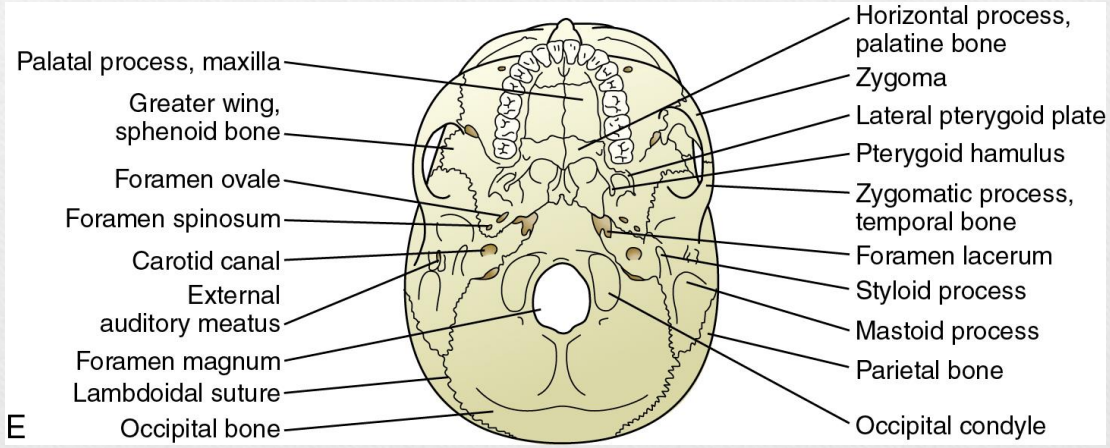


You might recognize the names of the skull bones. They correspond to the names given to the lobes of the brain.

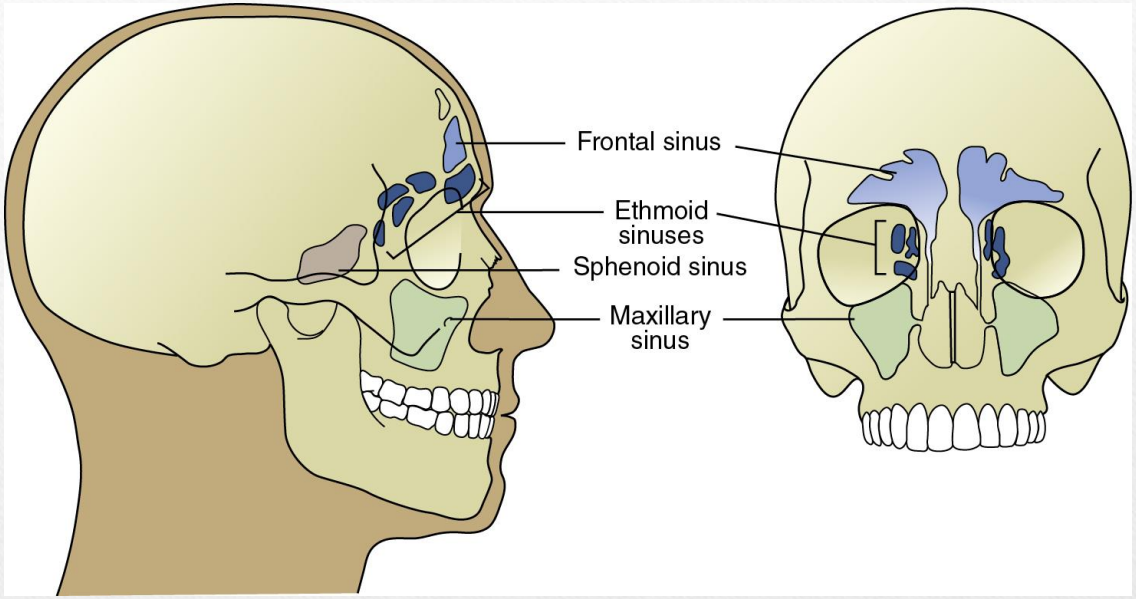


Internal Views of the Skull





Air Sinuses in the Nose



The sinuses are air spaces that resonate the voice and remove some of the weight of the bones, making the head lighter.

Sutures

Sagittal suture, between the parietal bones

Lambdoid suture, between the parietal bones and the occipital bone

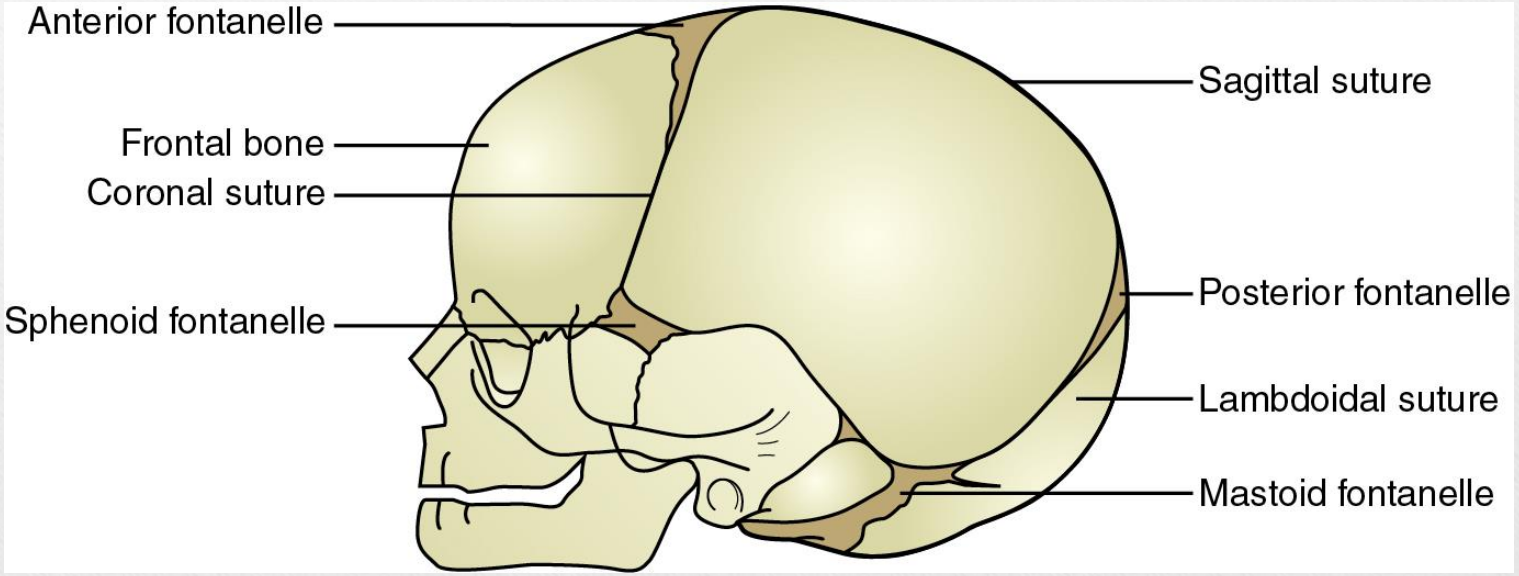
Coronal suture, between the parietal bones and the frontal bones

Squamous suture, between the temporal and parietal bones

Between the bones of the skull are specialized joints called sutures.

Infant Skull

Fontanelles allow for compression of skull during birth and expansion of skull during growth.



In the skull of an infant, bone formation is incomplete in some areas; these soft spots are called fontanelles.

Found between the cranial bones, fontanelles are formed from very dense connective tissue, which is replaced with bone as the infant grows.

The fontanelles close when the child is 18 to 24 months old.

Framework of the Trunk and Neck

Vertebral column and bones of chest

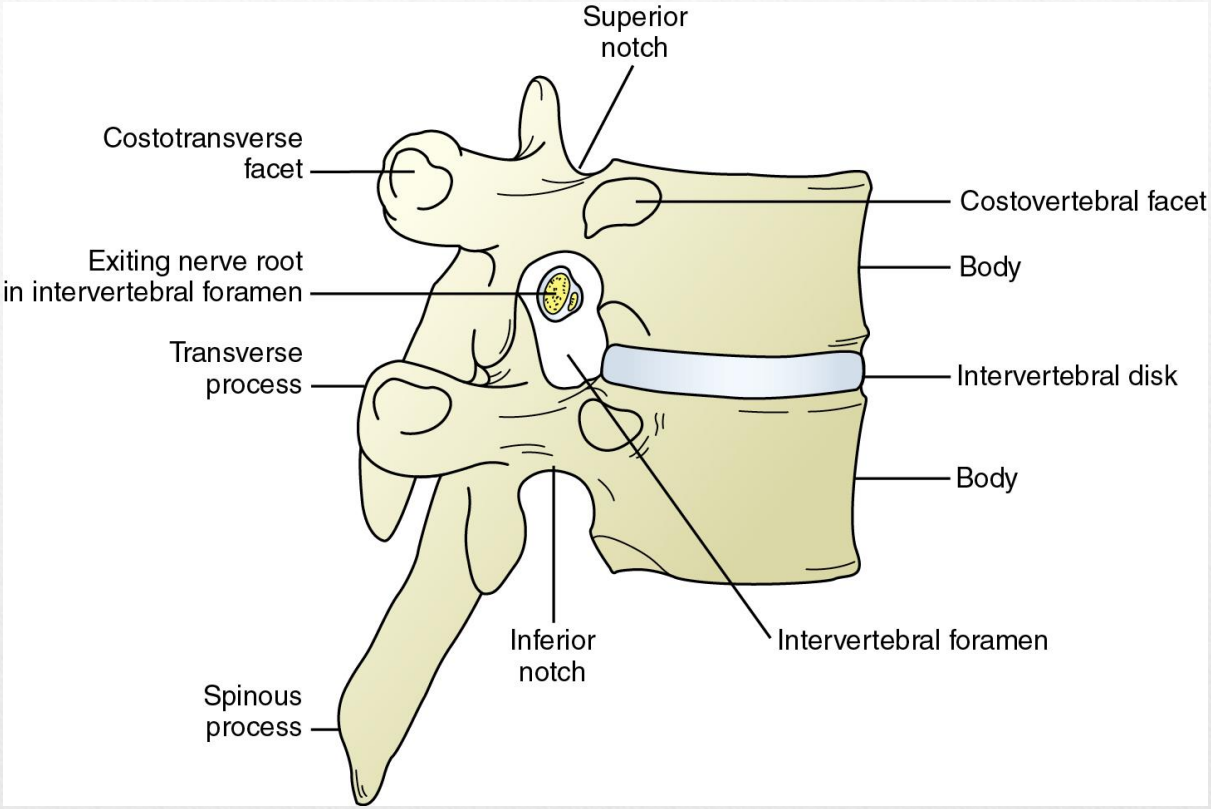
All vertebrae have:

- Drum-shaped body, or centrum
- Vertebral arch
- Large hole, or foramen
- Vertebrae stacked on one another
  - 7 cervical (C1-C7)
  - 12 thoracic (T1-T12)
  - 5 lumbar (L1-L5)

A child's vertebral column has 33 or 34 irregularly shaped bones. How many does an adult have?

Adults have 26. Bones in the lower portion fuse to bring about this change.

Intervertebral Foramen



Although not technically a part of the vertebrae, the intervertebral disks between the vertebral bodies act as shock absorbers and spacers and provide flexibility.

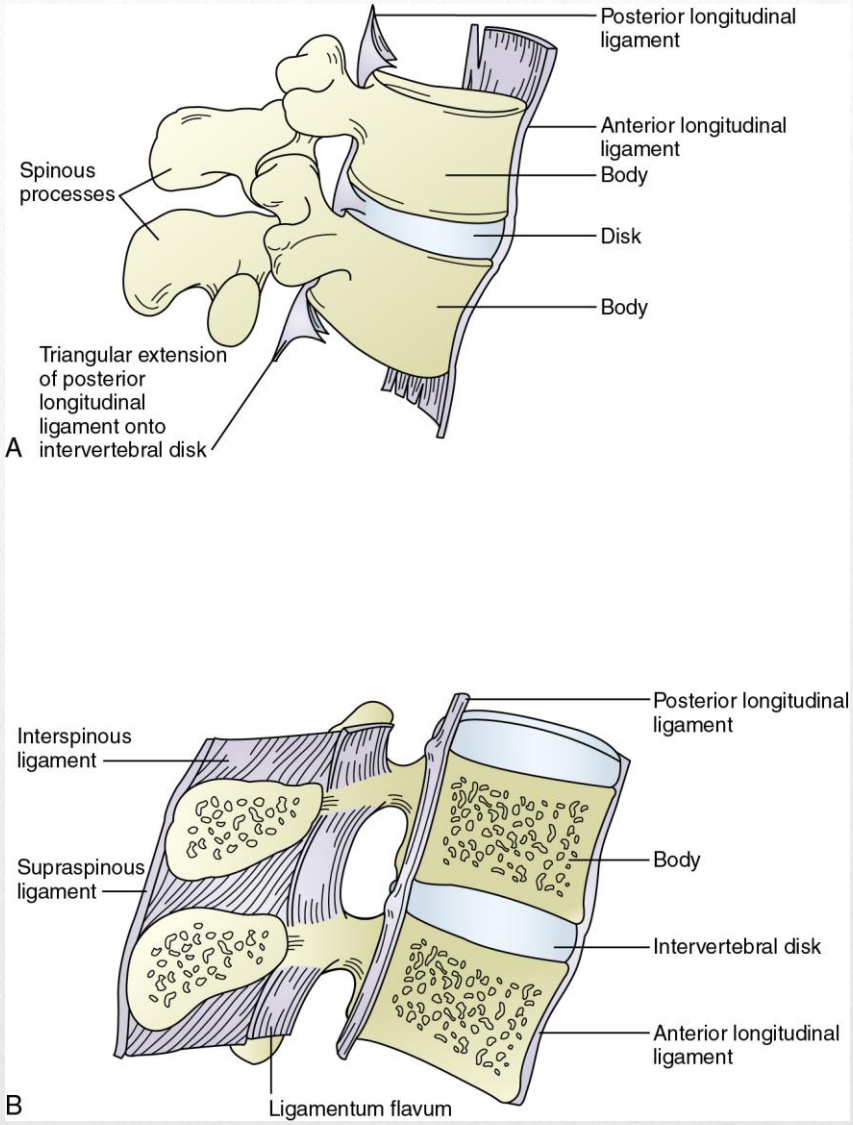
In the previous image, vertebrae T5 and T6 have been articulated, and the resultant intervertebral foramen is shown with a segmental nerve in place.

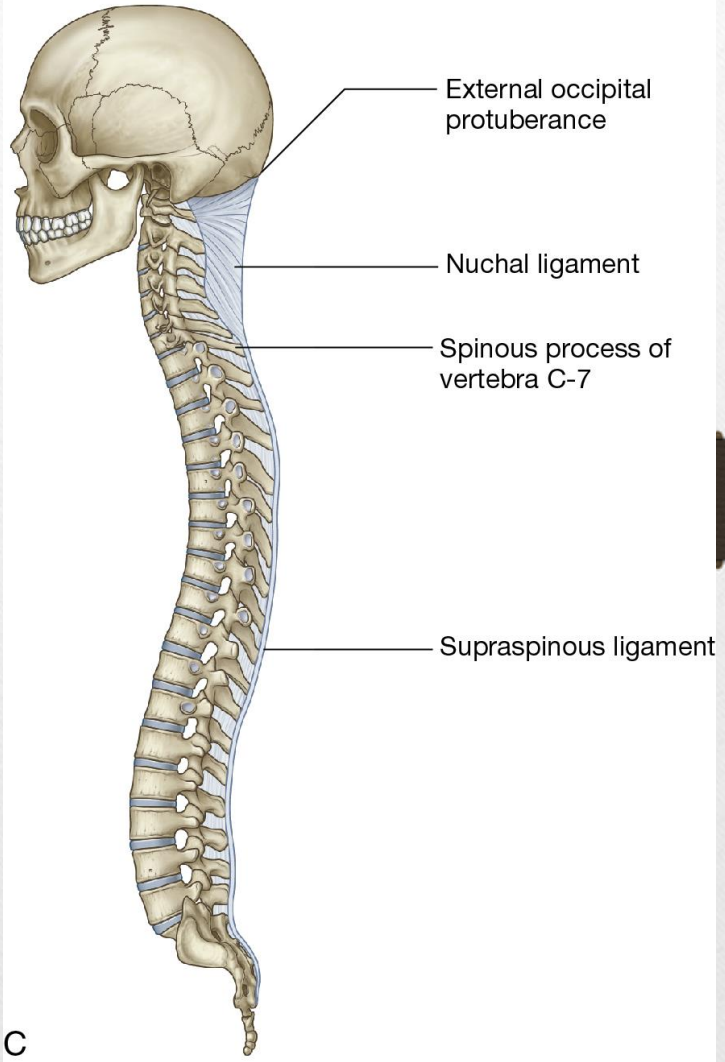
Ligaments

Extend the length of the vertebral column:

- Anterior longitudinal ligament – attaches to the front of the vertebral bodies and acts to restrain extension
- Posterior longitudinal ligament – attaches to the back of the bodies and acts to restrain flexion
- Supraspinous ligament – runs along the tips of the spinous processes and restrains flexion

A strong, fibrous band called the nuchal ligament (a thickening of the supraspinous ligament) runs along the notched spinous processes of C2 to C6 and helps support the weight of the head.


Posterior longitudinal ligament
Anterior longitudinal ligament
Spinous processes
Body
Disk
Body
Triangular extension of posterior longitudinal ligament onto intervertebral disk
A
Posterior longitudinal ligament
Interspinous ligament
Supraspinous ligament
Body
Intervertebral disk
Anterior longitudinal ligament
Ligamentum flavum
B


External occipital protuberance
Nuchal ligament
Spinous process of vertebra C-7
Supraspinous ligament
C

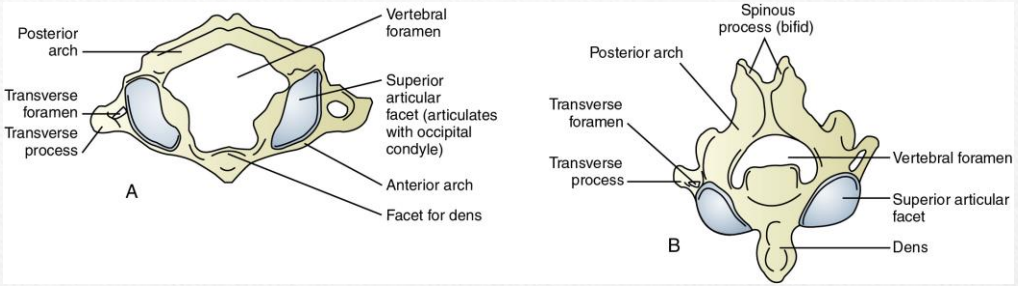
Other vertebral ligaments are placed between individual vertebrae:

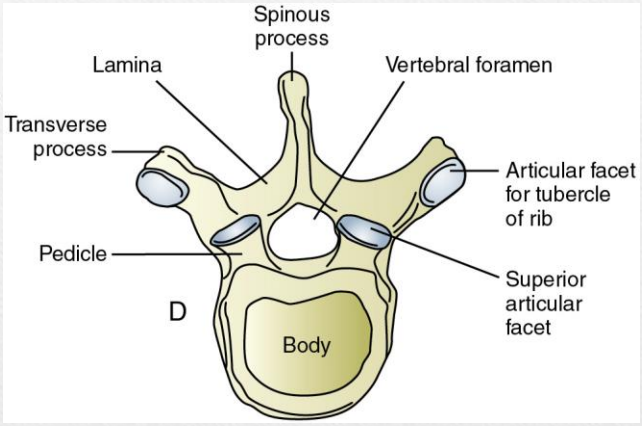
The ligamenta flava connects the laminae of each adjacent vertebra.

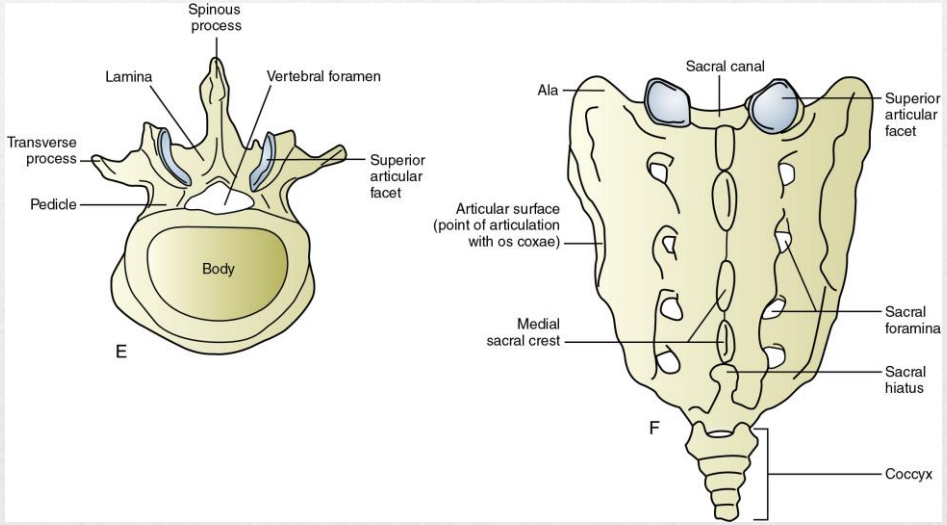
The interspinous ligaments connect the spinous processes.

The intertransverse ligaments connect the transverse processes.

Six Types of Vertebrae







A, atlas; B, axis; C, cervical; D, thoracic; E, lumbar; F, sacrum.

Bones and Structures of the Vertebral Column

7 cervical vertebrae (C1-C7) – located in neck

12 thoracic vertebrae (T1-T12) – located in thorax

5 lumbar vertebrae (L1-L5) – located in abdomen of trunk

Sacrum

Coccyx

Box 7-5 Bones and Structures of the Vertebral Column (see Figures 7-6 to 7-9)

The seven cervical vertebrae (C1 to C7) are located in the neck.

- The first vertebra (C1), called the *atlas,* supports the head. When you nod your head "yes," the occipital bone of the skull rocks on the atlas. The atlas is greatly modified for articulation within the occipital region of the skull. The atlas does not have a body or spinous process; rather, it essentially is a bony ring consisting of anterior and posterior arches and two lateral masses.
- The second cervical vertebra (C2), called the *axis,* serves as a pivot when the head is turned from side to side (as in the gesture "no"). The axis has a peglike dens, or odontoid process, projecting superiorly from its anterior side.
- The pivot joint of C1 to C2 consists of a ringlike structure (the atlas) that rotates around the dens. Considerable movement, especially as seen in rotation, is possible because of the design of this joint.

The 12 thoracic vertebrae (T1 to T12) are located in the thorax of the trunk (the body area between the neck and diaphragm). The main functions of the thoracic vertebrae are to provide spaces on which to build the rib cage, which protects the heart and lungs, and to house the spinal cord.

- The posterior ends of the 12 pairs of ribs are attached to these vertebrae at posterior facets and hemifacets (thought of as one half of a facet).
- T1 has a whole facet joint space for the first rib articulation and an inferior hemifacet, which works with the corresponding superior hemifacet of T2 for articulation with the second rib.
- T2 to T8 each has superior and inferior hemifacets, which together form the vertebral portion of the articulation with the ribs. T9 has one superior hemifacet, and T10 to T12 each has a whole facet to articulate with the ribs.
- The arrangement of the vertebrae in the thorax allows for a certain amount of flexion, extension, side bending, and rotation; but movements generally are limited, with most movement occurring at the thoracic-lumbar junction at T11, T12, and L1.

The five lumbar vertebrae (L1 to L5) are located in the abdomen of the trunk. They are larger and heavier than the other vertebrae, which allows them to support more weight.

- The interlocking shape of the lumbar vertebrae makes rotation difficult but facilitates flexion, extension, and side bending. L4 and L5 allow the most motion.
- Most disk injuries occur at L4 to L5 and L5 to S1 (the area of the lumbar-sacral junction).

The sacral vertebrae are five separate bones in a child; however, they eventually fuse to form a single bone, the sacrum, in an adult.

- Wedged between the two pelvic bones, the sacrum completes the posterior part of the bony pelvis. Four transverse ridges are the remnants of intervertebral disks. At the ends of each ridge are paired sacral foramina, through which the sacral nerves pass.

The coccyx, or tailbone, consists of four or five tiny bones in a child. As a person develops, these bones fuse to form a single bone in an adult

Vertebral Curves

The cervical region is convex forward, or has a *lordosis*.

The thoracic region is concave forward, called a *kyphosis*.

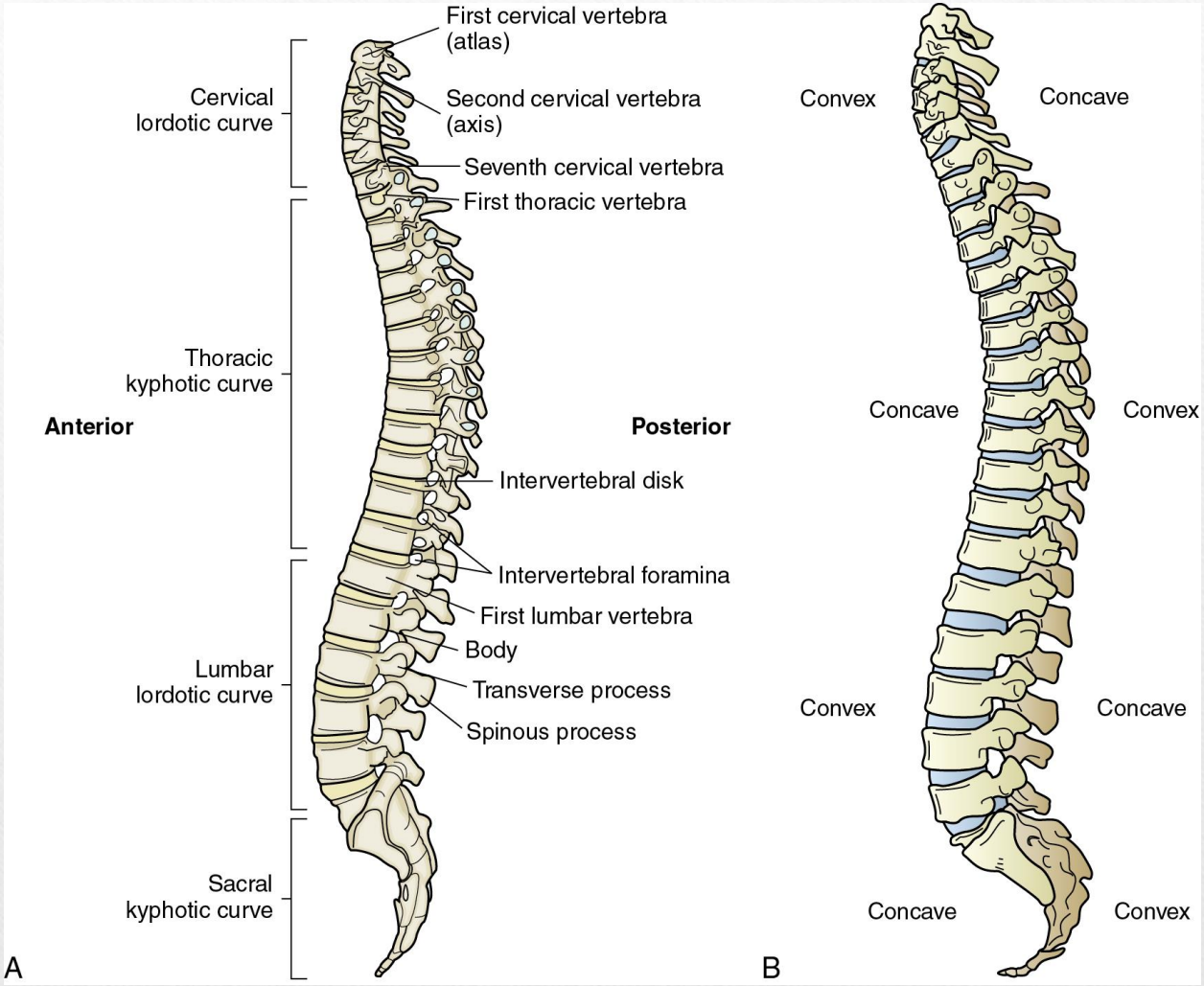
The lumbar region is also lordotic.

The sacrum is also kyphotic.

When viewed from the side, the vertebral column can be seen to have curves that correspond to the groups of vertebrae.

The curves of the vertebral column provide some of the resilience and spring so essential to walking and running.

Curves of the Vertebral Column

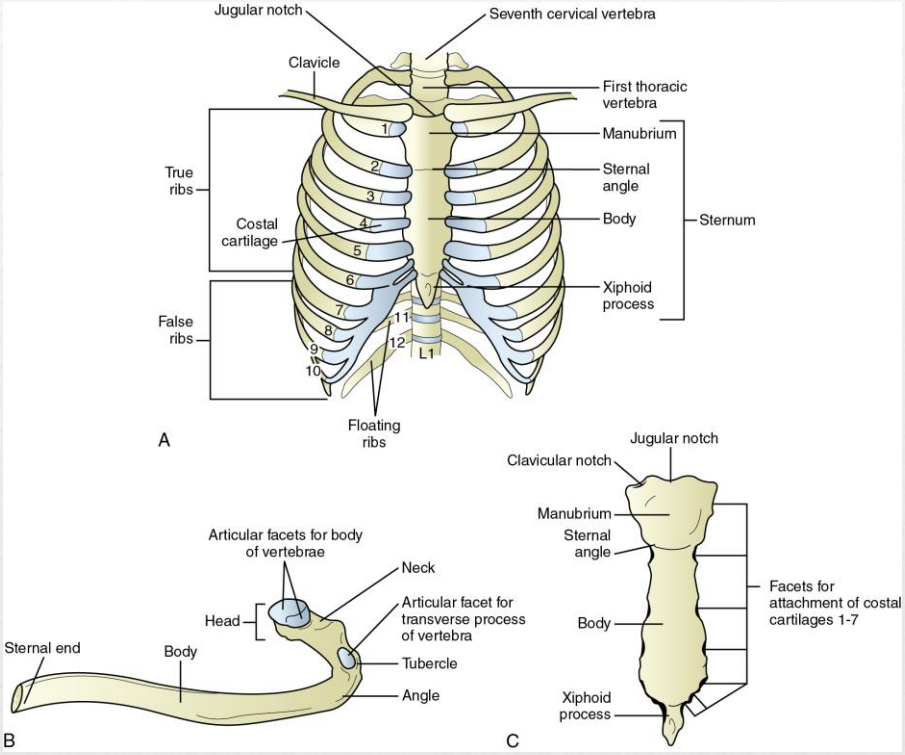


Vertebral curvatures develop dysfunction generally from exaggerated posture, activity, obesity, pregnancy, trauma, and disease. These conditions have the same name as the normal curves but are considered abnormal if they are exaggerated enough to cause problems.

Examples: Osteoporosis can lead to the development of a hump in the thoracic vertebrae, called hyperkyphosis or dowager's hump. A swayback of the lower back is a hyperlordosis. Scoliosis is a lateral curvature of the spine.

Bones of the Thorax

- Form a conical cage
- Protect heart, lungs, and other organs



There are 12 pairs of ribs. The first seven attach to the sternum and are called the "true ribs"; the next three attach to the cartilage of the rib above and are called "false ribs"; the last two are called "floating ribs" because they have no anterior attachment. (All ribs are attached to the vertebrae in back.)

Ribs need to be able to move and have specific muscles that do so.

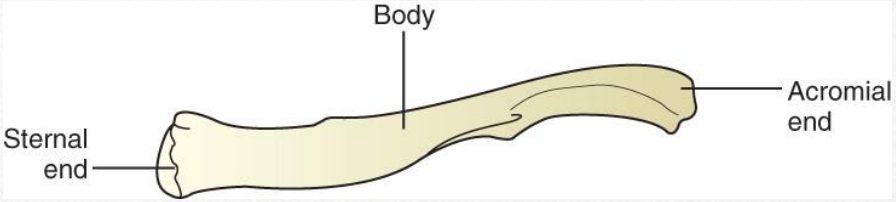
Bones of the Appendicular Skeleton

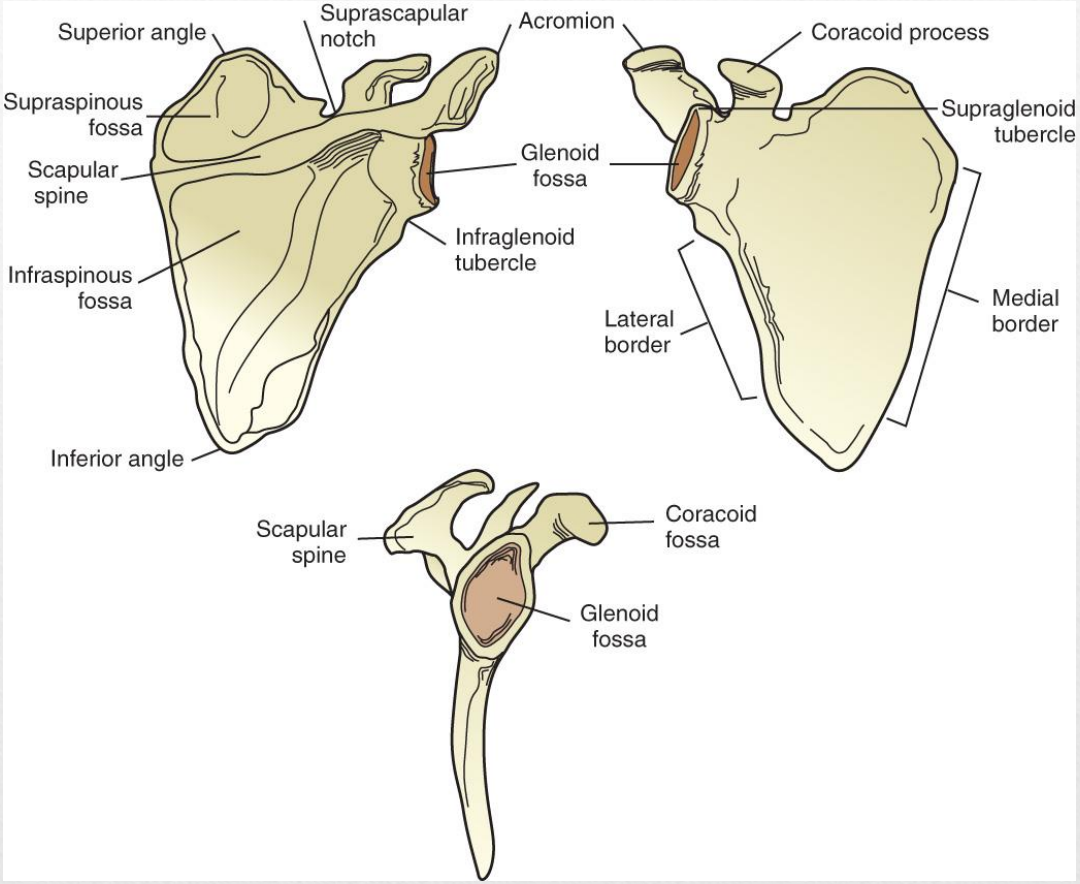
Upper extremity

- Clavicle
- Scapula
- Humerus
- Bones of the forearm
- Bones of the wrist and hand

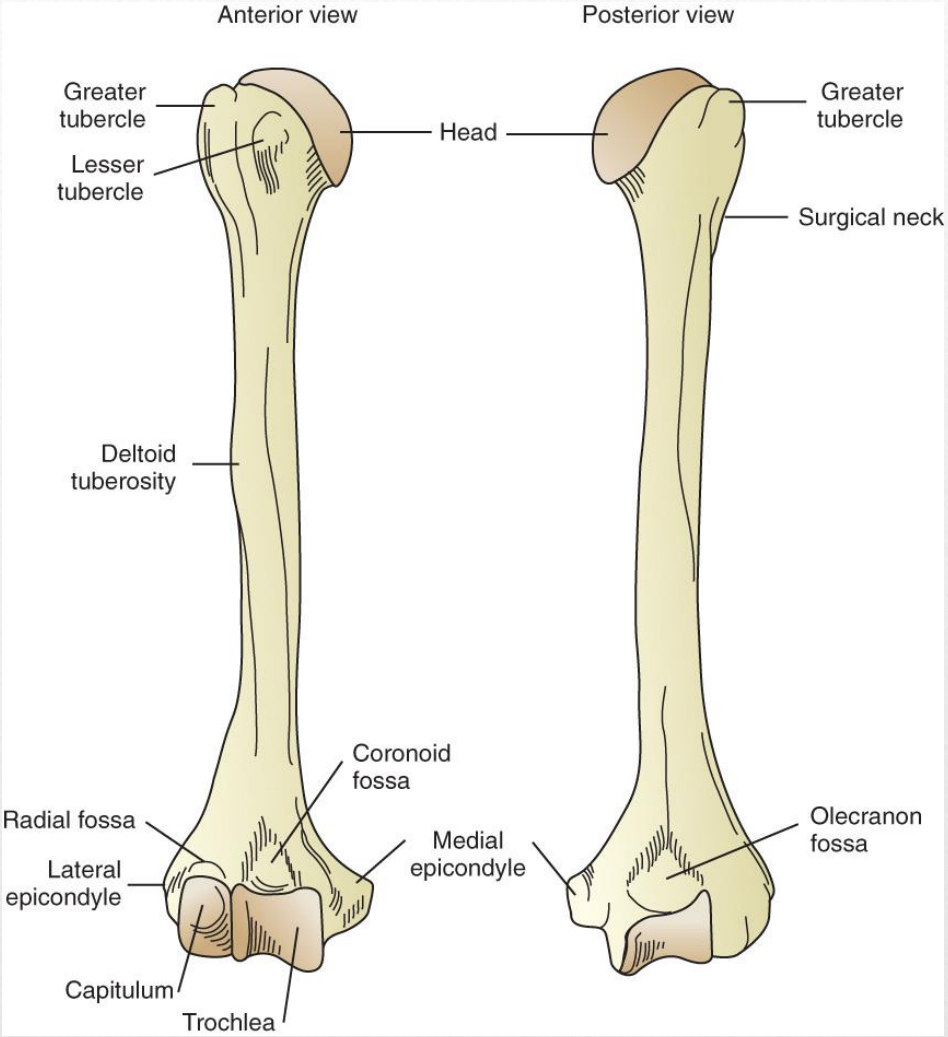
The appendicular skeleton is divided into the upper extremity and lower extremity.

The clavicle is also known as the collar bone, while the scapula is also known as the shoulder blade.





Humerus

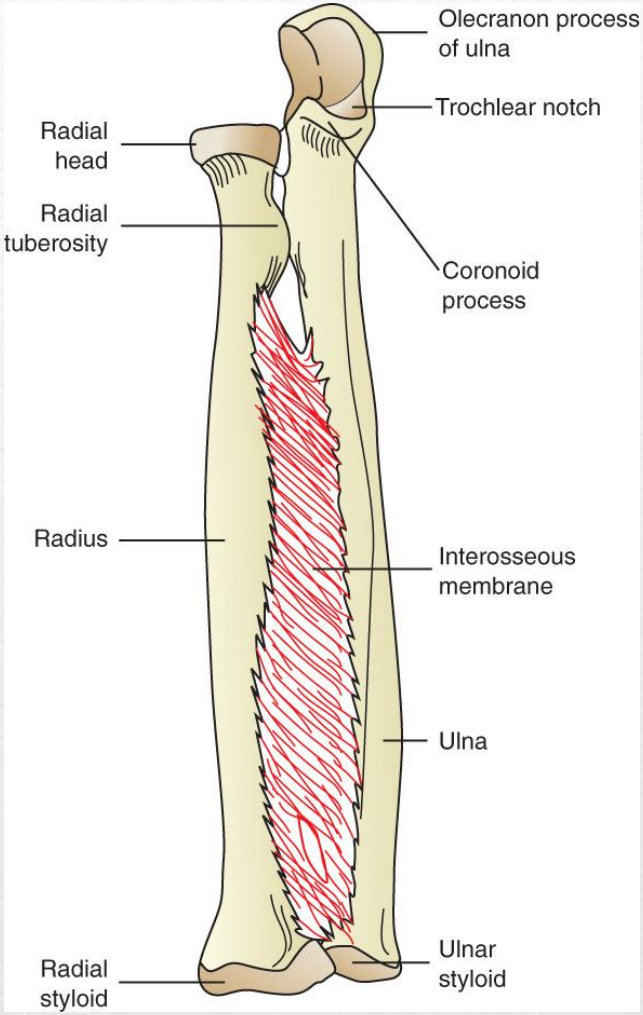

Anterior view
Posterior view
Greater tubercle
Lesser tubercle
Head
Greater tubercle
Surgical neck
Deltoid tuberosity
Coronoid fossa
Radial fossa
Lateral epicondyle
Capitulum
Trochlea
Medial epicondyle
Olecranon fossa

The second group of bones of the upper division consists of the bones of the upper extremity, which are the humerus, radius, ulna, and bones of the wrist and hand.

The humerus articulates with the radius and the ulna to form the elbow joint.

The medial and lateral epicondyles of the humerus are attachment points for muscles and are prone to problems from repetitive use.

Forearm


Olecranon process of ulna
Trochlear notch
Radial head
Radial tuberosity
Coronoid process
Radius
Interosseous membrane
Ulna
Radial styloid
Ulnar styloid

The ulna provides most of its stability

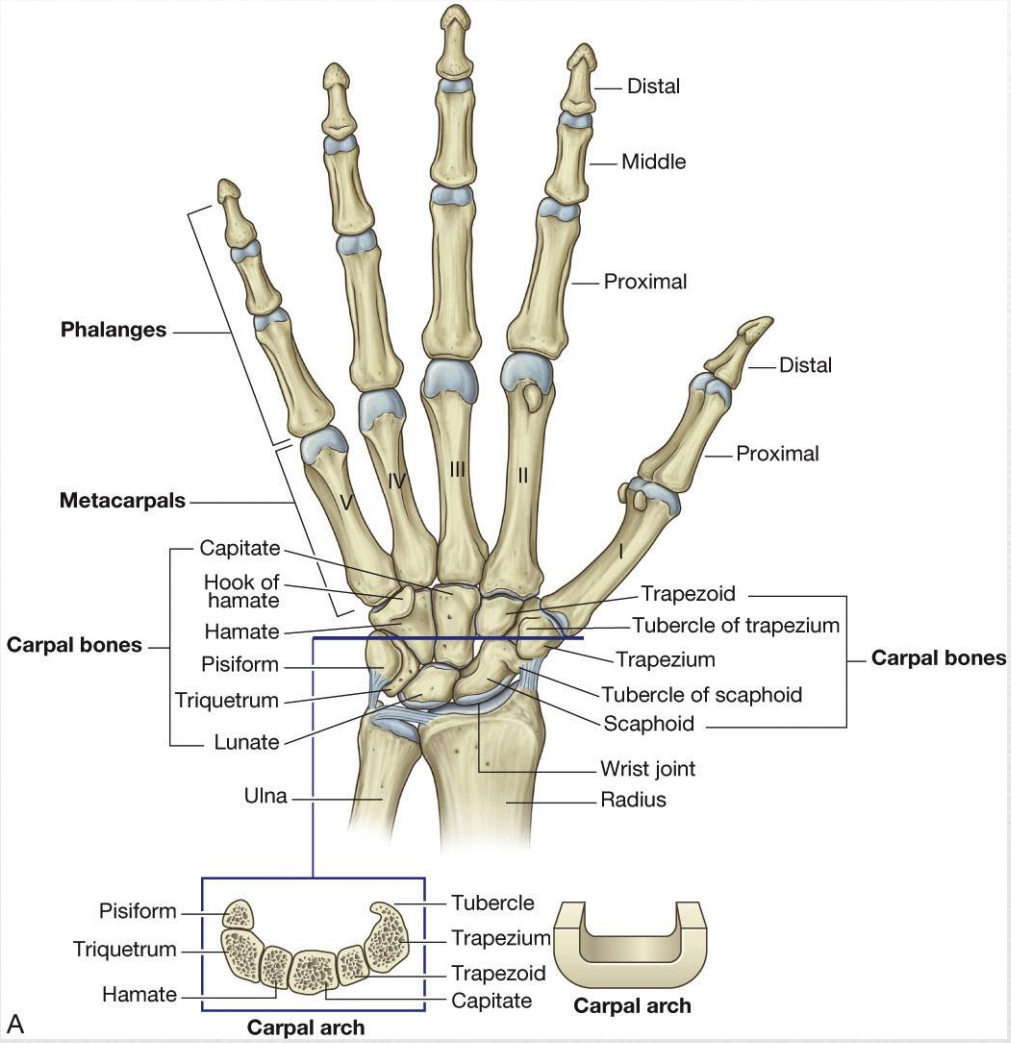
The radius is on the lateral (thumb side) of the forearm. It is narrow at the elbow and widens just above the wrist.

The ulna lies on the medial side and is opposite in shape to the radius (wider at the elbow).

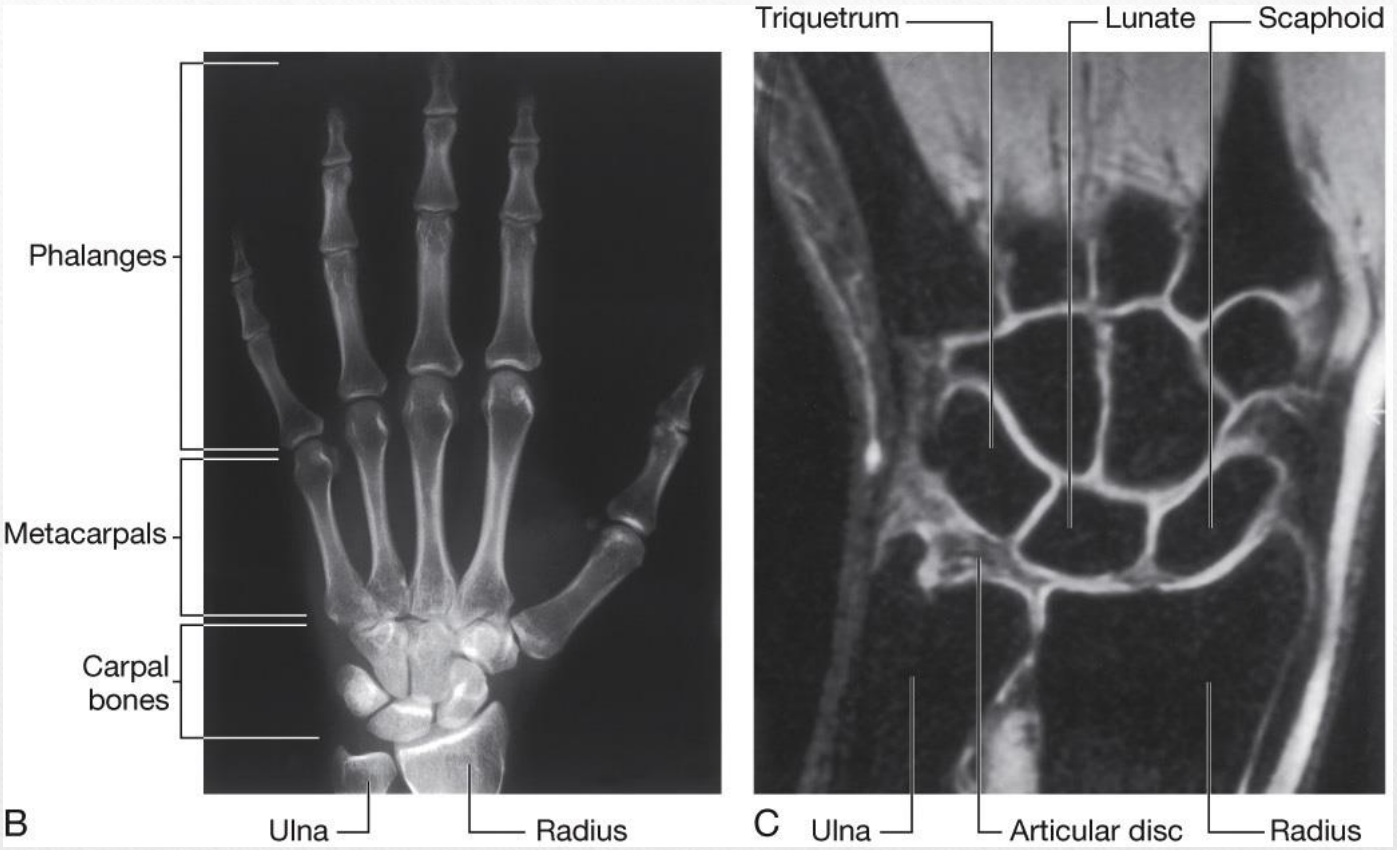
Bones of the Wrist and Hand

The wrist is the joint between the hand and the forearm. The structure of the wrist allows movement of the hand.

The human hand has 27 bones.

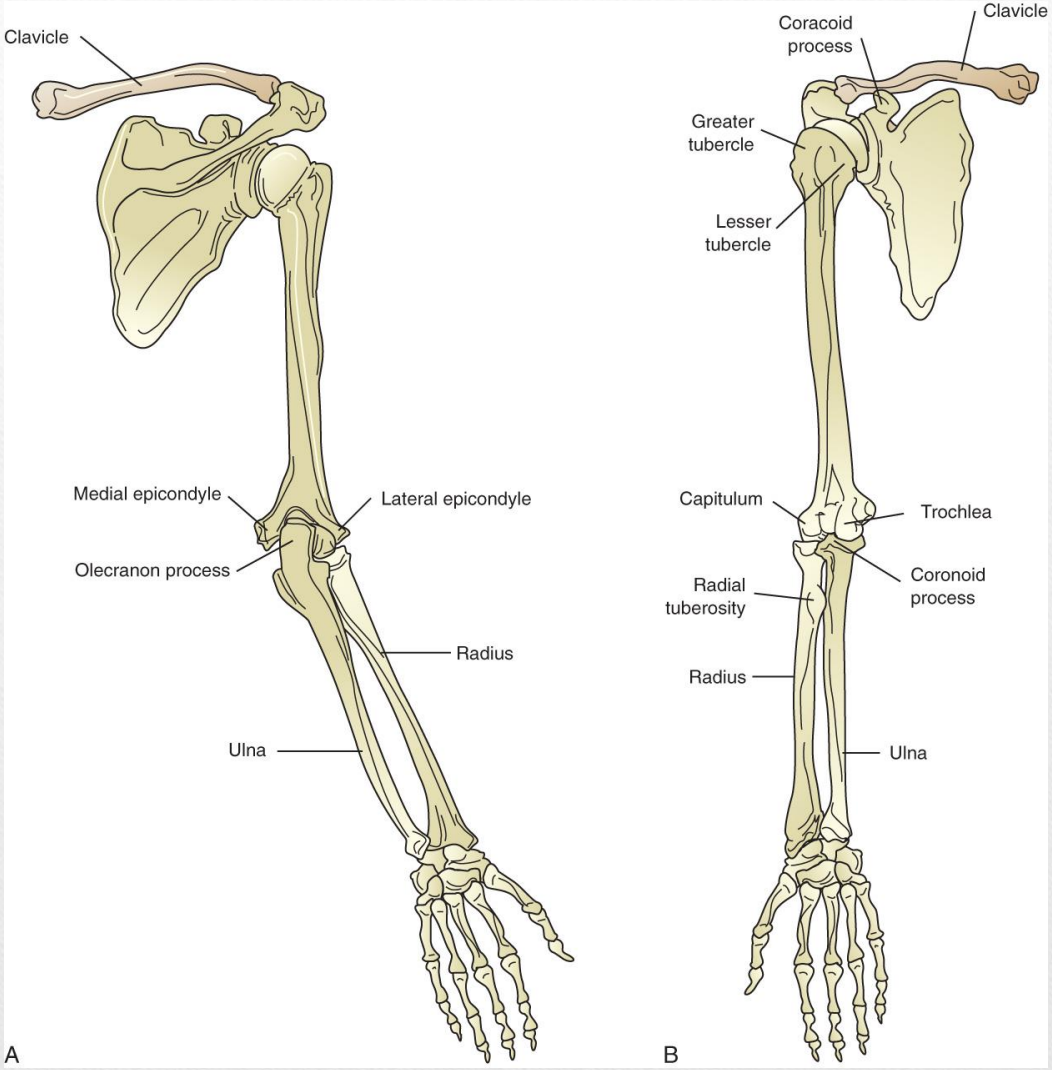


Bones of the Hand



There are fourteen phalanges on each hand. This number includes three for each finger and two for the thumb.

Bones of the Upper Limb



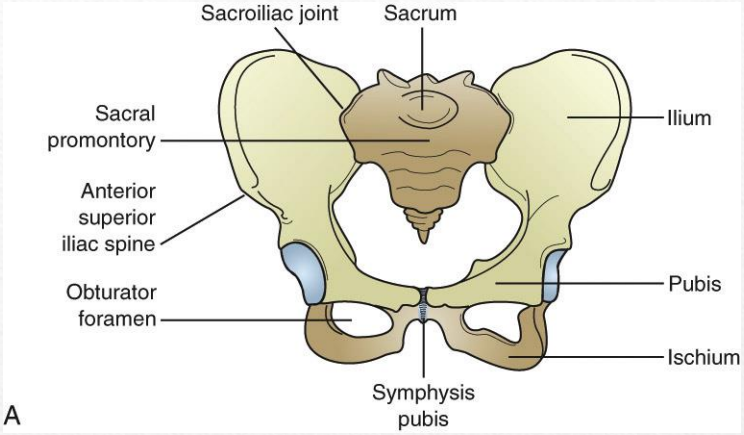
Bones of the Appendicular Skeleton

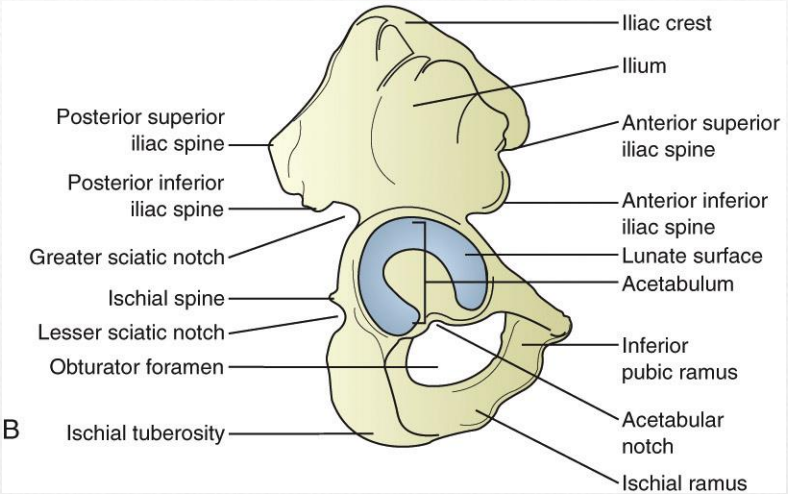
Lower extremity

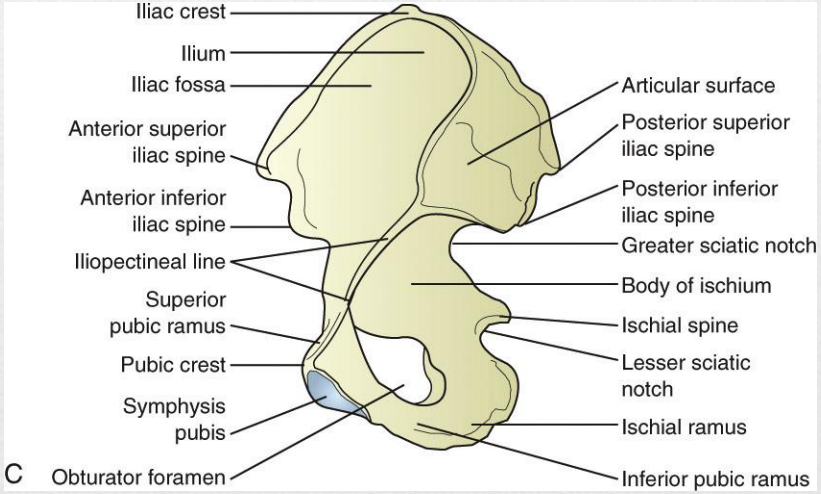
- Pelvic girdle
- Femur
- Patella
- Lower leg
- Foot

The bones in the lower division are grouped similarly to those of the upper division.

Pelvis


Sacroiliac joint
Sacrum
Sacral promontory
Ilium
Anterior superior iliac spine
Obturator foramen
Pubis
Ischium
Symphysis pubis
A


Iliac crest
Ilium
Posterior superior iliac spine
Anterior superior iliac spine
Posterior inferior iliac spine
Anterior inferior iliac spine
Greater sciatic notch
Lunate surface
Acetabulum
Ischial spine
Lesser sciatic notch
Obturator foramen
Inferior pubic ramus
Acetabular notch
Ischial tuberosity
Ischial ramus
B


Iliac crest
Ilium
Iliac fossa
Articular surface
Anterior superior iliac spine
Posterior superior iliac spine
Anterior inferior iliac spine
Posterior inferior iliac spine
Iliopectineal line
Greater sciatic notch
Body of ischium
Superior pubic ramus
Ischial spine
Pubic crest
Lesser sciatic notch
Symphysis pubis
Ischial ramus
Obturator foramen
Inferior pubic ramus
C

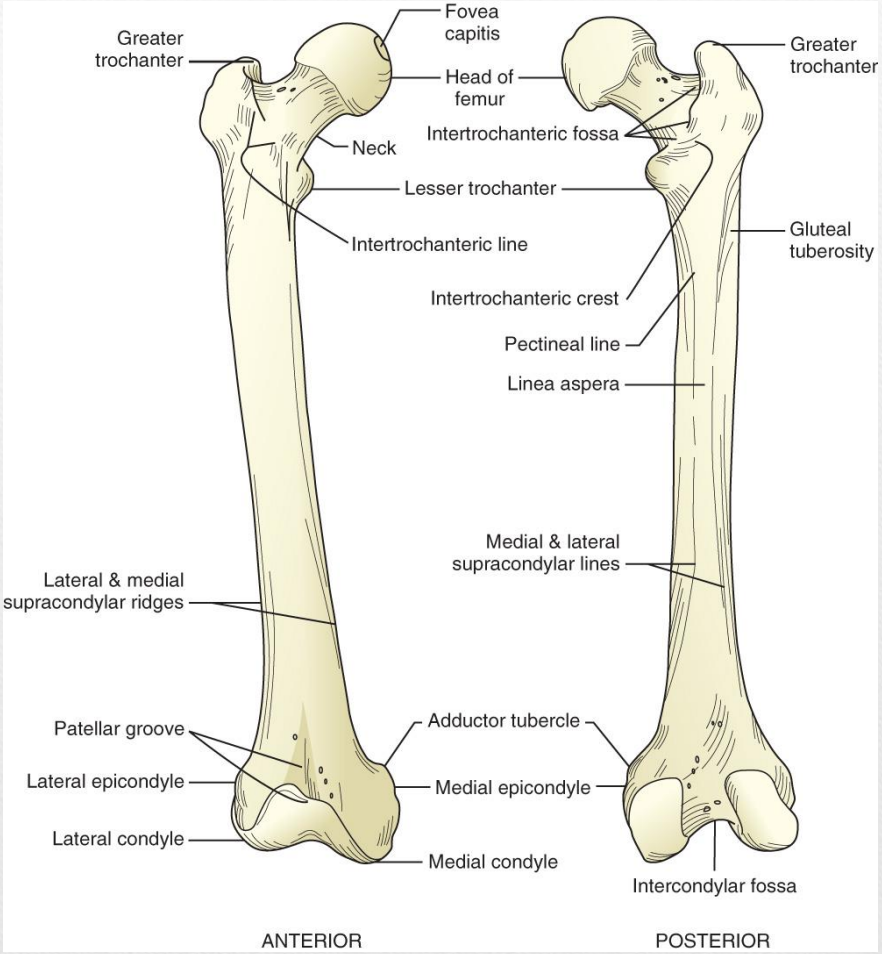
Female pelvises are wider and lighter than male pelvises, because they are adapted to make childbirth easier.)

The lateral portion of the pelvis articulates with the head of the femur to form the coxal (hip) joint.

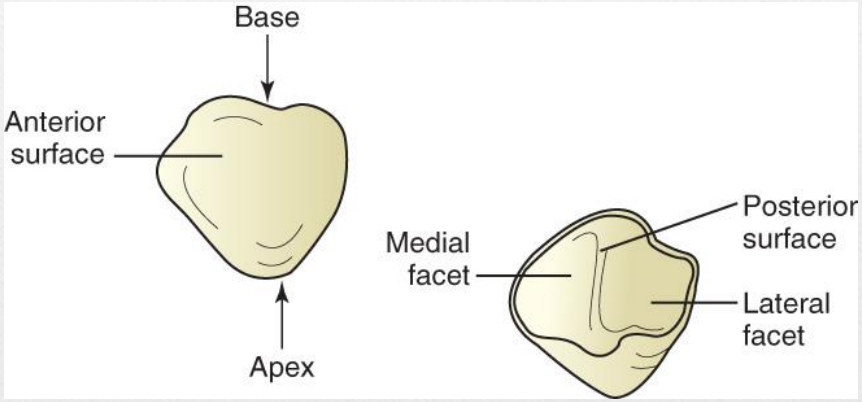
Anterior and Posterior Views of the Femur

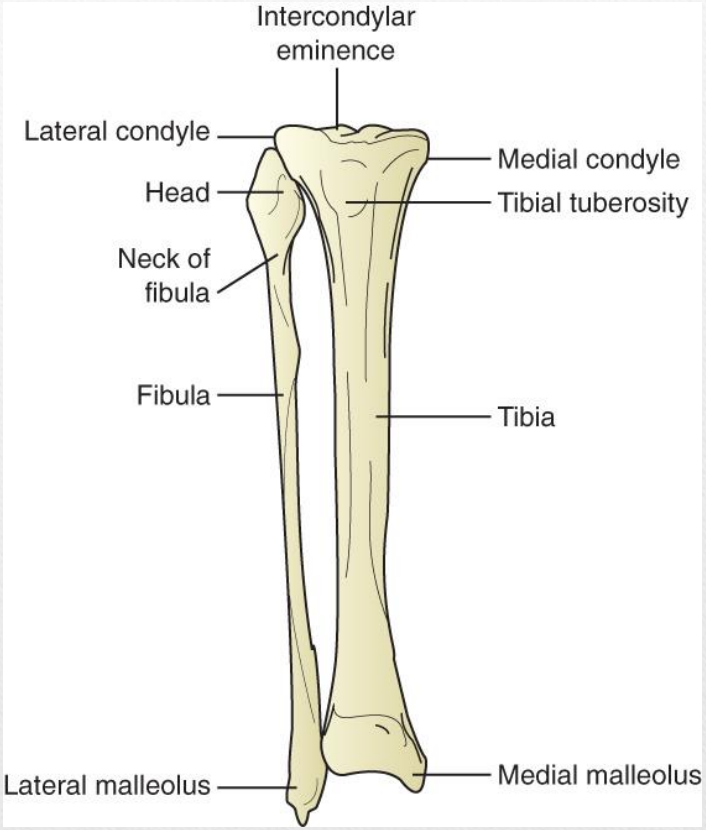
The femur is the longest, strongest, and heaviest bone in the body.

The lateral and medial condyles are smooth surfaces that articulate with the proximal tibia.



Patella, Tibia and Fibula

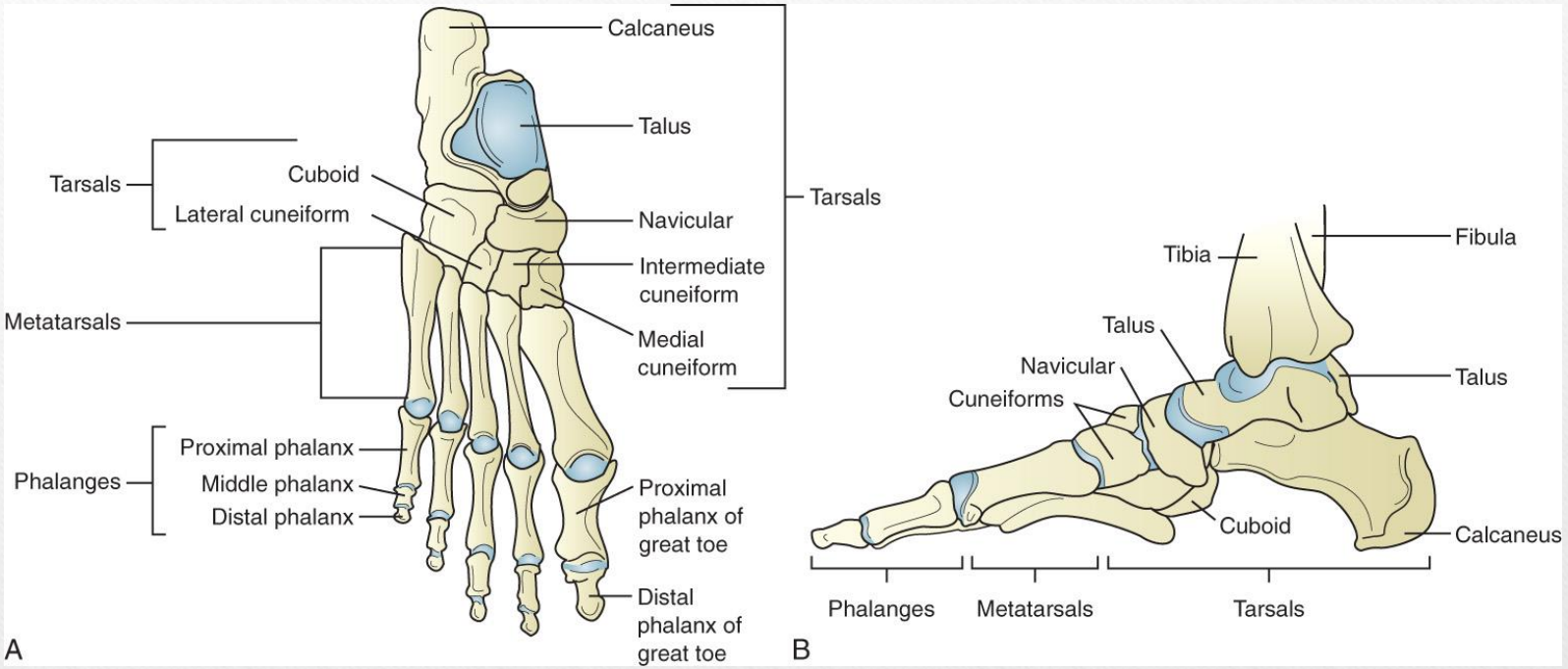




The patella is a sesamoid bone. Sesamoid bones are round bones that are embedded in tendons and joint capsules.

The two articular facets on the posterior surface of the patella fit against the medial and lateral condyles of the femur. The tibia articulates with the fibula at the proximal end and at the distal end. The tibia also articulates with the ankle bones. The fibula also articulates with the talus.

Bones of the Foot

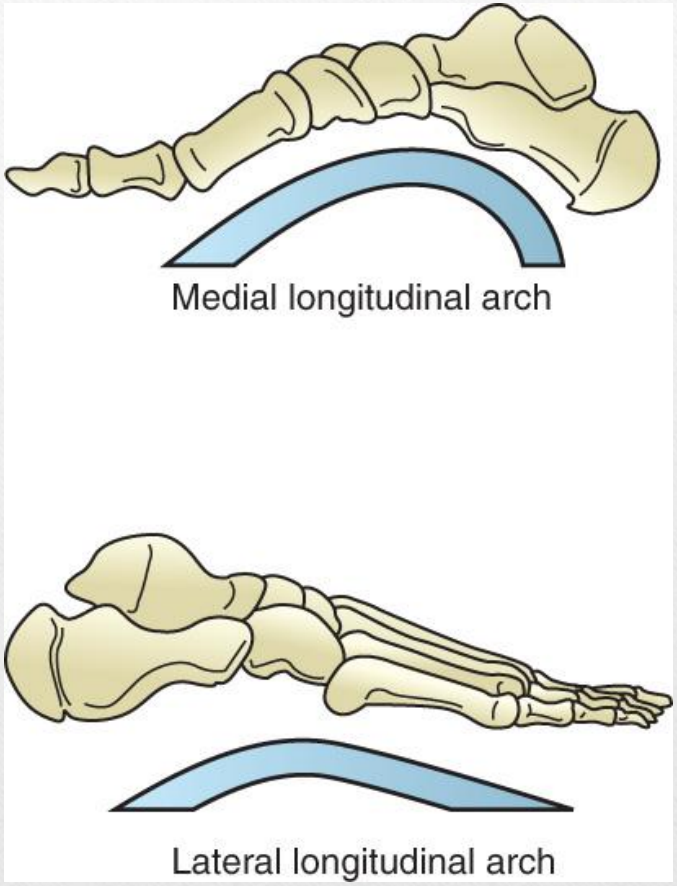


There are 26 bones in the foot, which articulate at 31 joints.

Arches of the Foot

The bones and joints of the foot form the arches of the foot.

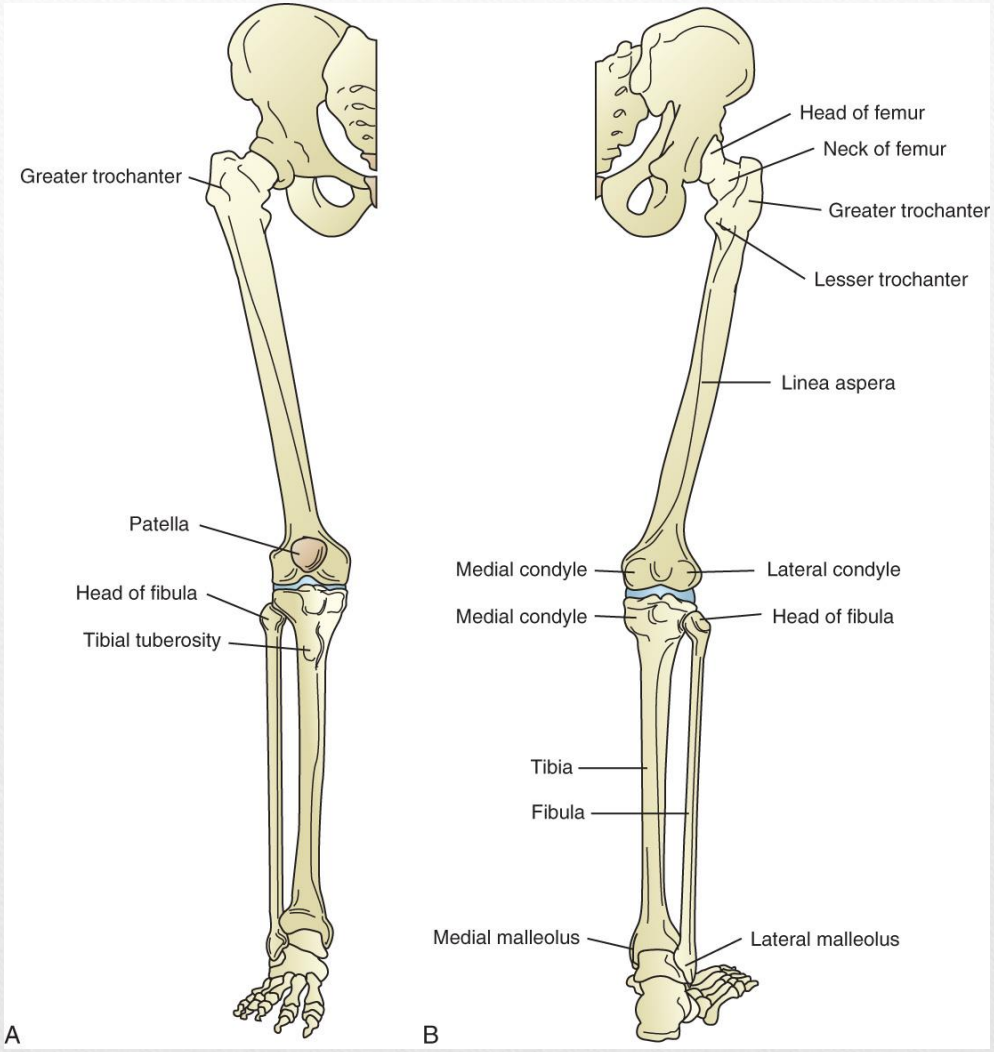
The transverse arch of the foot is also known as the instep. The transverse arch is concave from the medial to lateral aspect of the foot.



The medial longitudinal arch is the longest and highest arch. This arch is made up of the calcaneus and talus and the navicular, cuneiform, and first metatarsal bones.

The lateral longitudinal arch is made up of the calcaneus and cuboid and fifth metatarsal bones.

Bones of the Lower Limb



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