# Joints

**Joints** (articulations) are unions or junctions between two or more bones or cartilages of the skeleton.

Joints exhibit a variety of forms and functions

# 1.Fibrous joints

The articulating bones of fibrous joints are united by fibrous tissue.

The amount of movement occurring at a fibrous joint depends in most cases on the length of the fibers uniting the articulating bones.

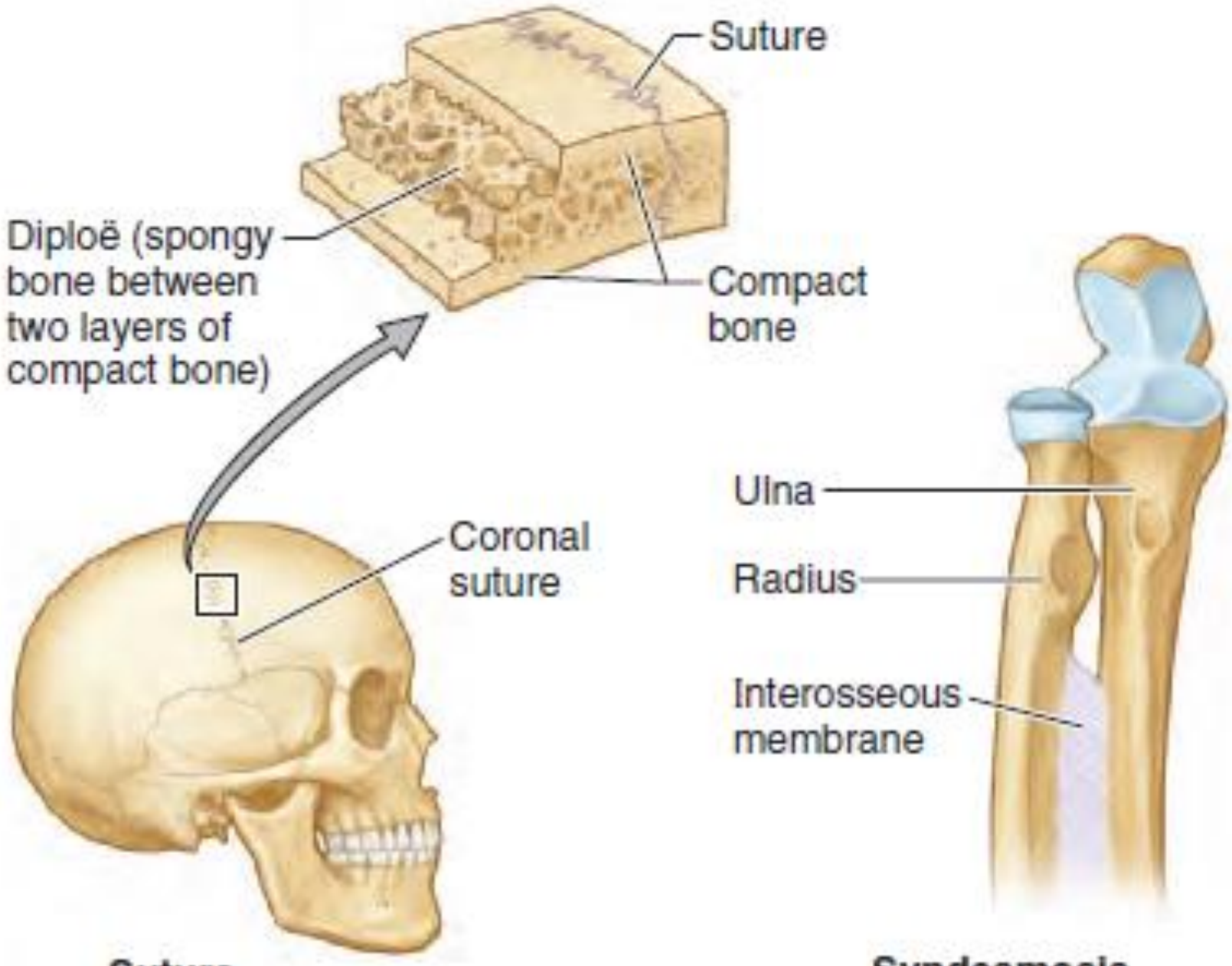
The **sutures of the cranium** are examples of fibrous joints.

These bones are close together, either interlocking along a wavy line or overlapping.

A **syndesmosis** type of fibrous joint unites the bones with a sheet of fibrous tissue, either a ligament or a fibrous membrane. Consequently, this type of joint is partially movable.

The interosseous membrane in the forearm is a sheet of fibrous tissue that joins the radius and ulna in a syndesmosis.

**A dento-alveolar syndesmosis (gomphosis or socket)** is a fibrous joint in which a piglike process fits into a socket articulation between the root of the tooth and the alveolar process of the jaw.




**(B) Fibrous joints**

# 2.Cartilaginous joints

**2.A. cartilaginous joints** are united by hyaline cartilage or fibrocartilage.

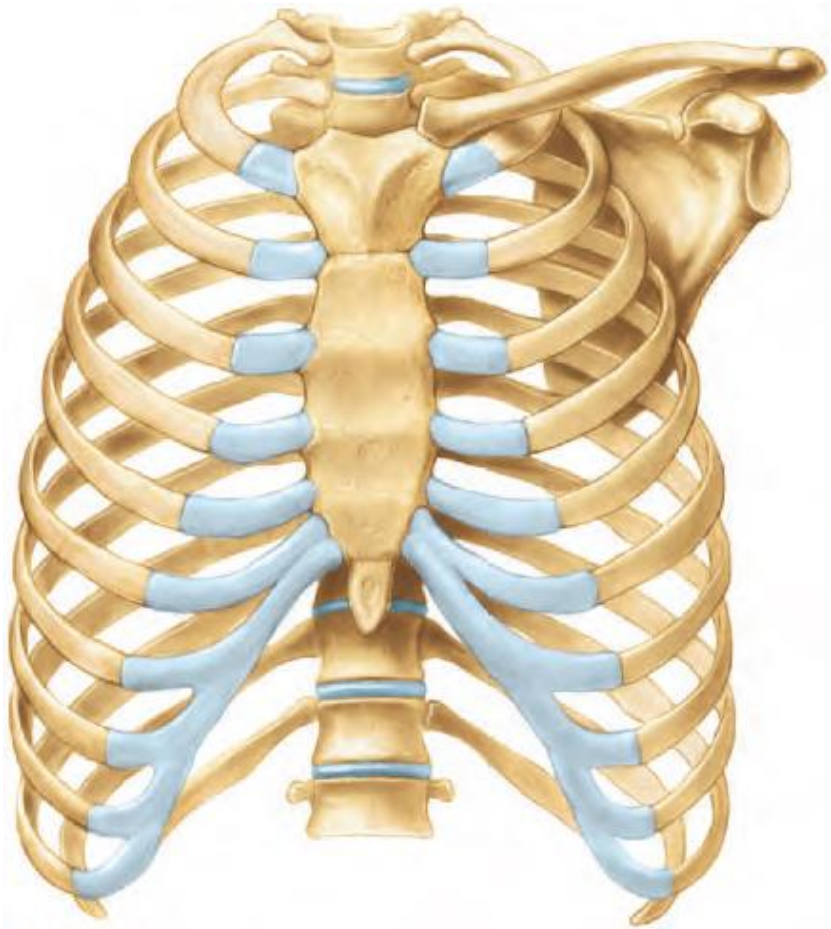
In **primary cartilaginous joints,** or synchondroses, the bones are united by hyaline cartilage, which permits slight bending during early life.

Primary cartilaginous joints are usually temporary unions, such as those present during the development of a long bone, where the bony epiphysis and the shaft are joined by an epiphysial plate.

**2.B. Secondary cartilaginous joints,** or symphyses, are strong, slightly movable joints united by fibrocartilage.

The fibrocartilaginous *intervertebral discs* between the vertebrae consist of binding connective tissue that joins the vertebrae together.

Cumulatively, these joints provide strength and shock absorption as well as considerable flexibility to the vertebral column (spine).



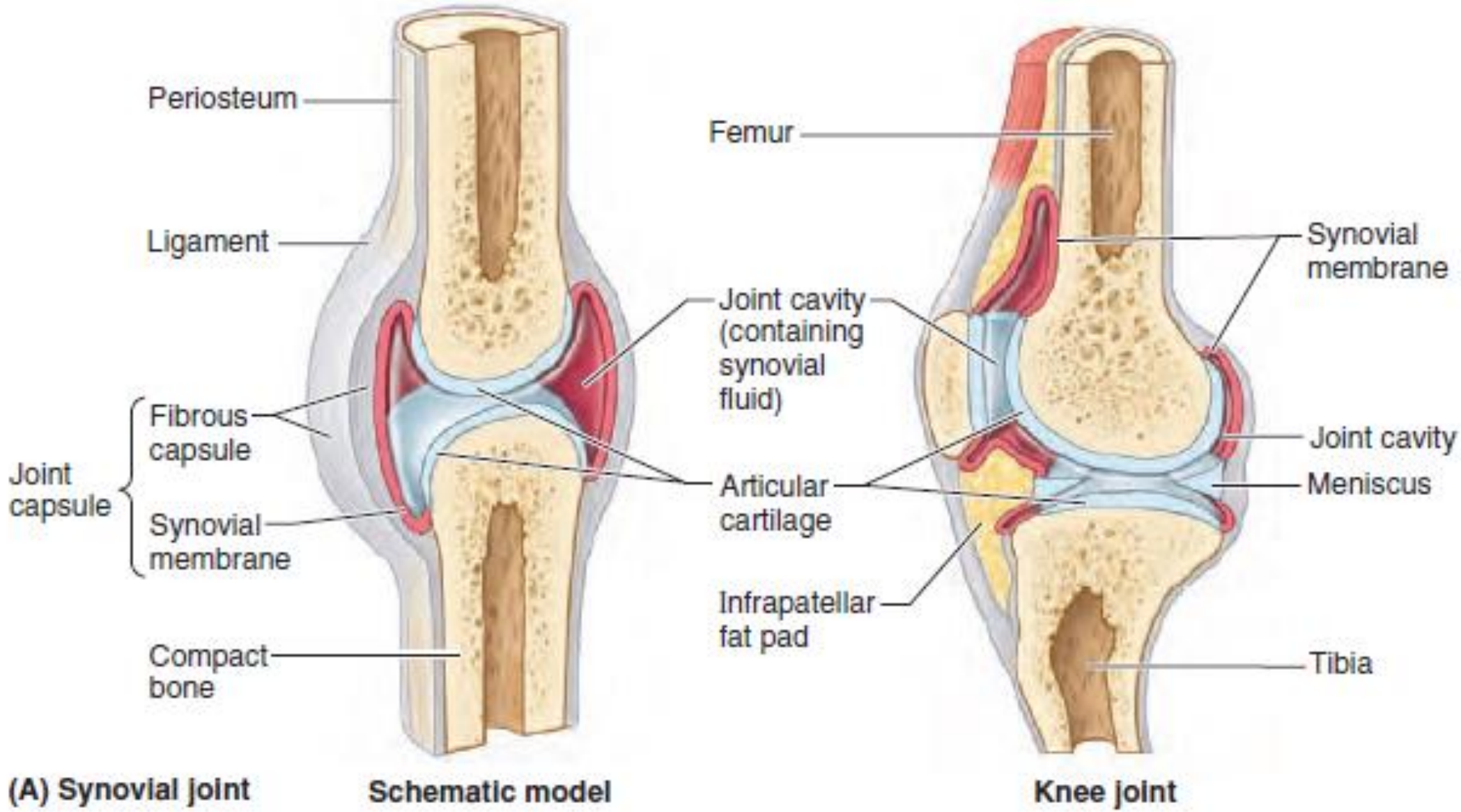

**Secondary**

# 3. Synovial joints

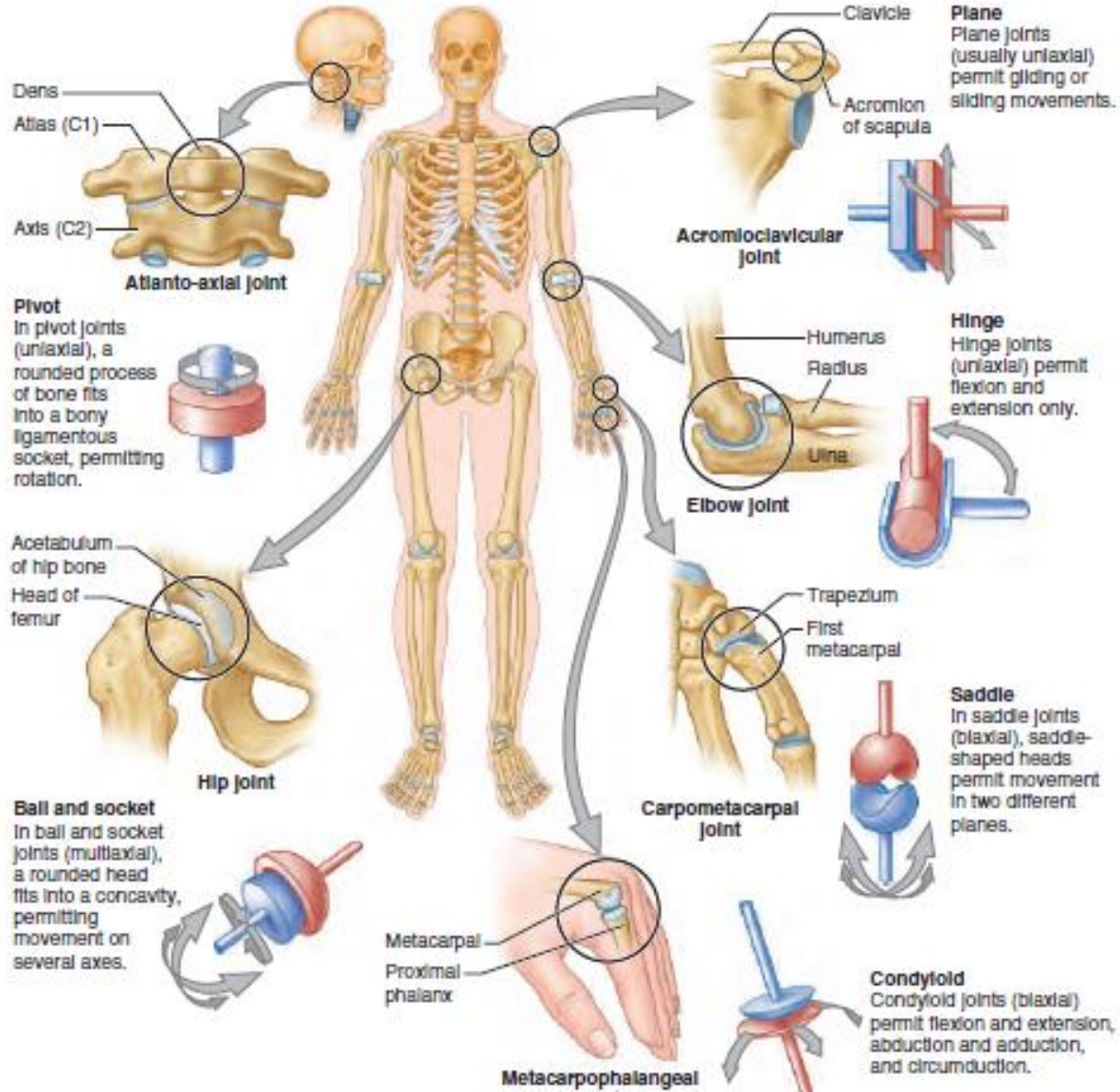
The articulating bones of **synovial joints** are united by a **joint** (articular) **capsule** (composed of an outer **fibrous layer** lined by a serous **synovial membrane**) spanning and enclosing an articular cavity.

The **joint cavity** of a synovial joint, like the knee, is a potential space that contains a small amount of lubricating **synovial fluid,** secreted by the synovial membrane.

Inside the capsule, articular cartilage covers the articulating surfaces of the bones; all other internal surfaces are covered by synovial membrane.


Periosteum
Ligament
Joint capsule
Fibrous capsule
Synovial membrane
Compact bone
Joint cavity (containing synovial fluid)
Articular cartilage
Infrapatellar fat pad
Femur
Synovial membrane
Joint cavity
Meniscus
Tibia
(A) Synovial joint
Schematic model
Knee joint

The six major verities of synovial joints are classified according to the shape of the articulating surfaces and/or the type of movement they permit

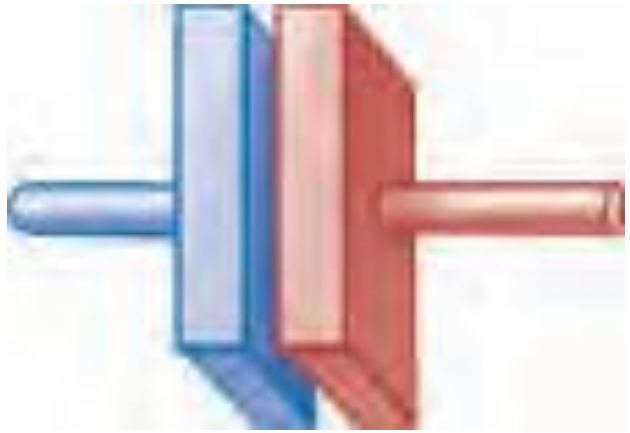

Dens
Atlas (C1)
Axis (C2)
Atlanto-axial joint
Pivot
In pivot joints (uniaxial), a rounded process of bone fits into a bony ligamentous socket, permitting rotation.
Acetabulum of hip bone
Head of femur
Hip joint
Ball and socket
In ball and socket joints (multiaxial), a rounded head fits into a concavity, permitting movement on several axes.
Metacarpal
Proximal phalanx
Metacarpophalangeal
Clavicle
Acromion of scapula
Acromioclavicular joint
Plane
Plane joints (usually uniaxial) permit gliding or sliding movements.
Humerus
Radius
Ulna
Elbow joint
Hinge
Hinge joints (uniaxial) permit flexion and extension only.
Trapezium
First metacarpal
Carpometacarpal joint
Saddle
In saddle joints (biaxial), saddle-shaped heads permit movement in two different planes.
Condyloid
Condyloid joints (biaxial) permit flexion and extension, abduction and adduction, and circumduction.

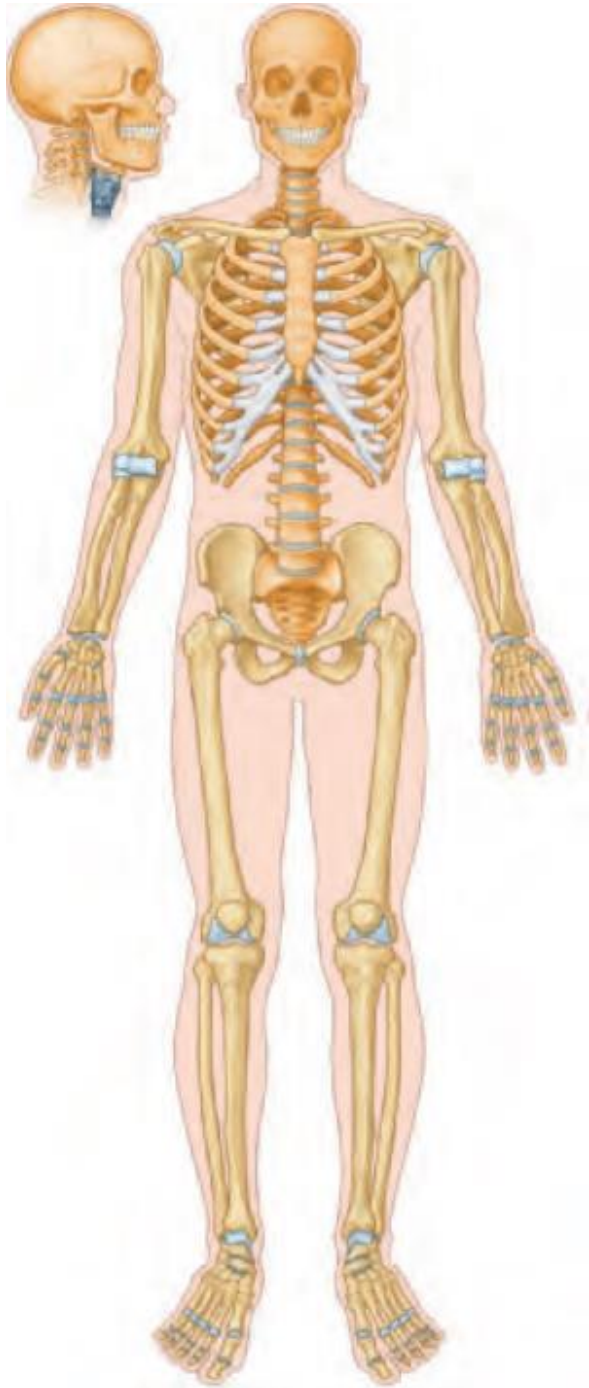
# 3.1. Plane joints

**Plane joints** permit gliding or sliding movements in the plane of the articular surfaces.

The opposed surfaces of the bones are flat or almost flat, with movement limited by their tight joint capsules. Plane joints are numerous and are nearly always small.

An example is the *acromioclavicular joint* between the acromion of the scapula and the clavicle.



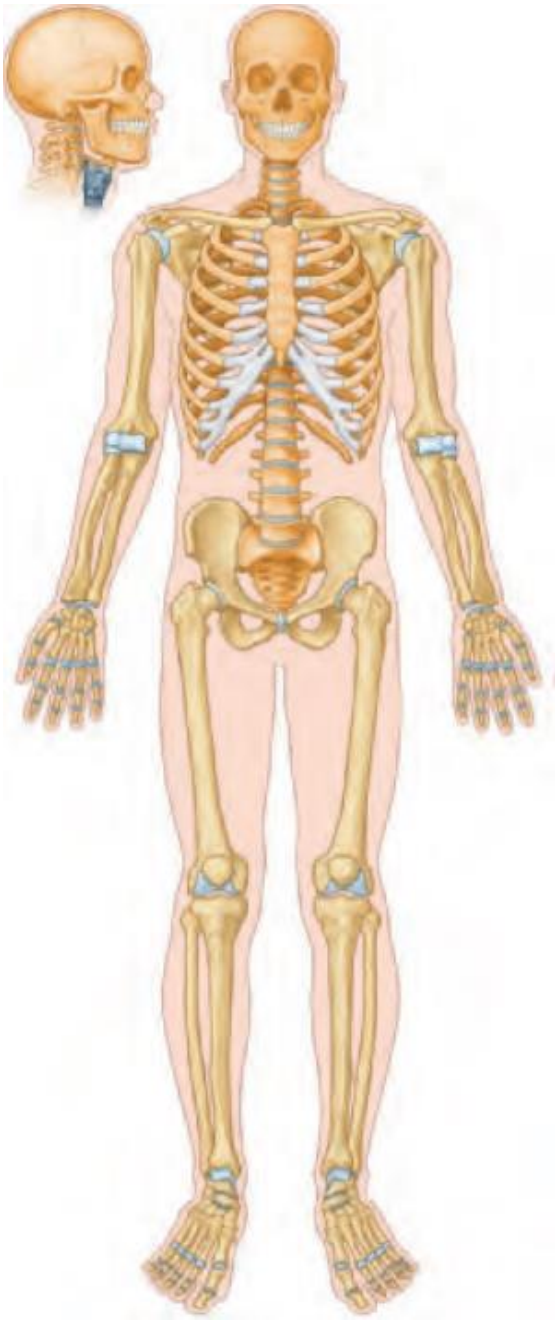


# 3.2. Hinge joints

**Hinge joints** permit flexion and extension only, movements that occur in one plane (sagittal) around a single axis that runs transversely; thus hinge joints are *uniaxial joints.*

The joint capsule of these joints is thin and lax anteriorly and posteriorly where movement occurs; however, the bones are joined by strong, laterally placed collateral ligaments.

The *elbow joint* is a hinge joint.

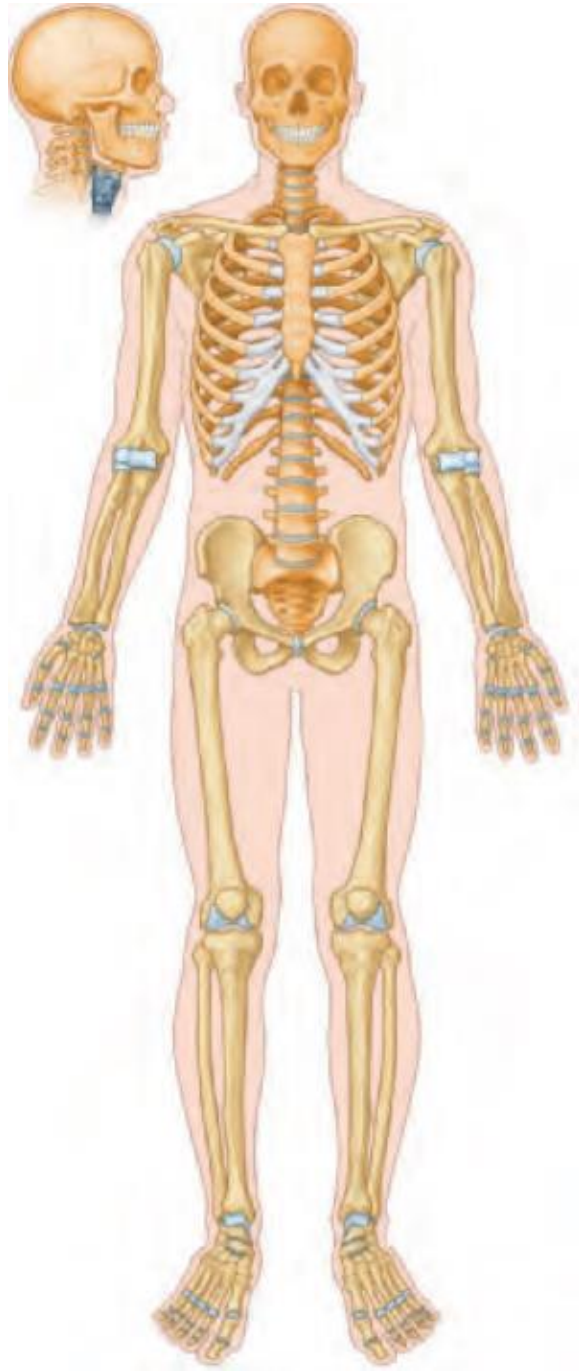


# 3.3. Saddle joints

**Saddle joints** permit abduction and adduction as well as flexion and extension, movements occurring around two axes at right angles to each other; thus saddle joints are *biaxial joints* that allow movement in two planes, sagittal and frontal.

The opposing articular surfaces are shaped like a saddle (i.e., they are reciprocally concave and convex).

The *carpometacarpal joint* at the base of the 1st digit (thumb) is a saddle joint



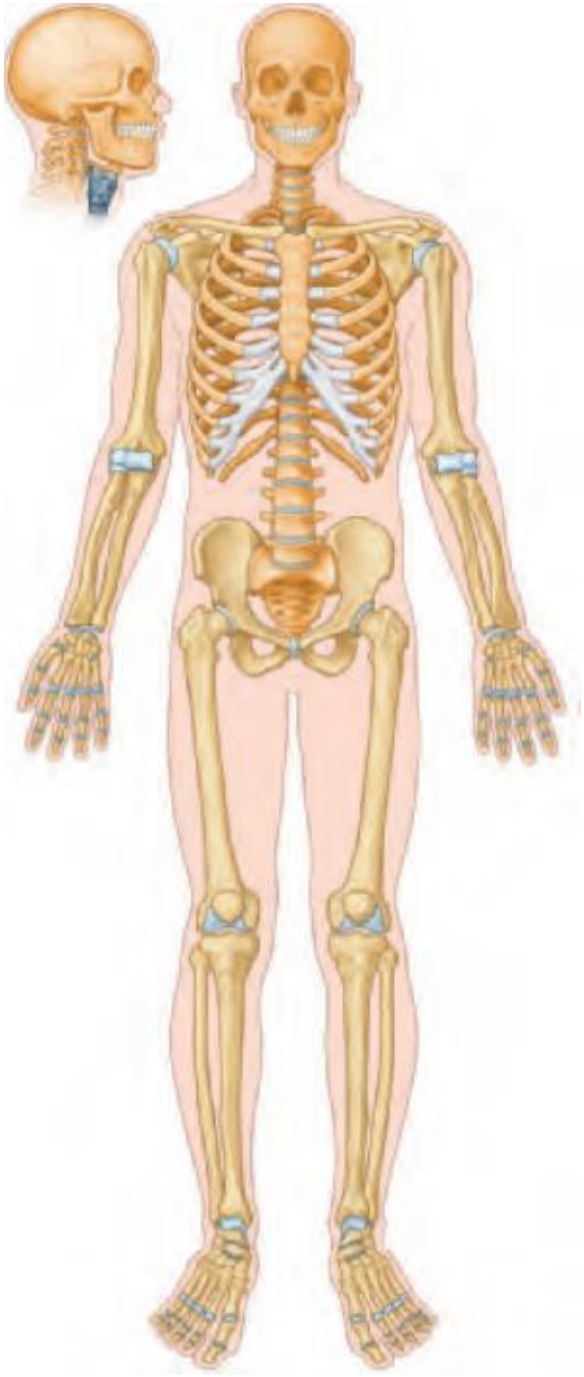
# 3.4. Condyloid joints

**Condyloid joints** permit flexion and extension as well as abduction and adduction; thus condyloid joints are also biaxial.

However, movement in one plane (sagittal) is usually greater (freer) than in the other.

Circumduction, more restricted than that of saddle joints, is also possible.

The *metacarpophalangeal joints* (knuckle joints) are condyloid joints.

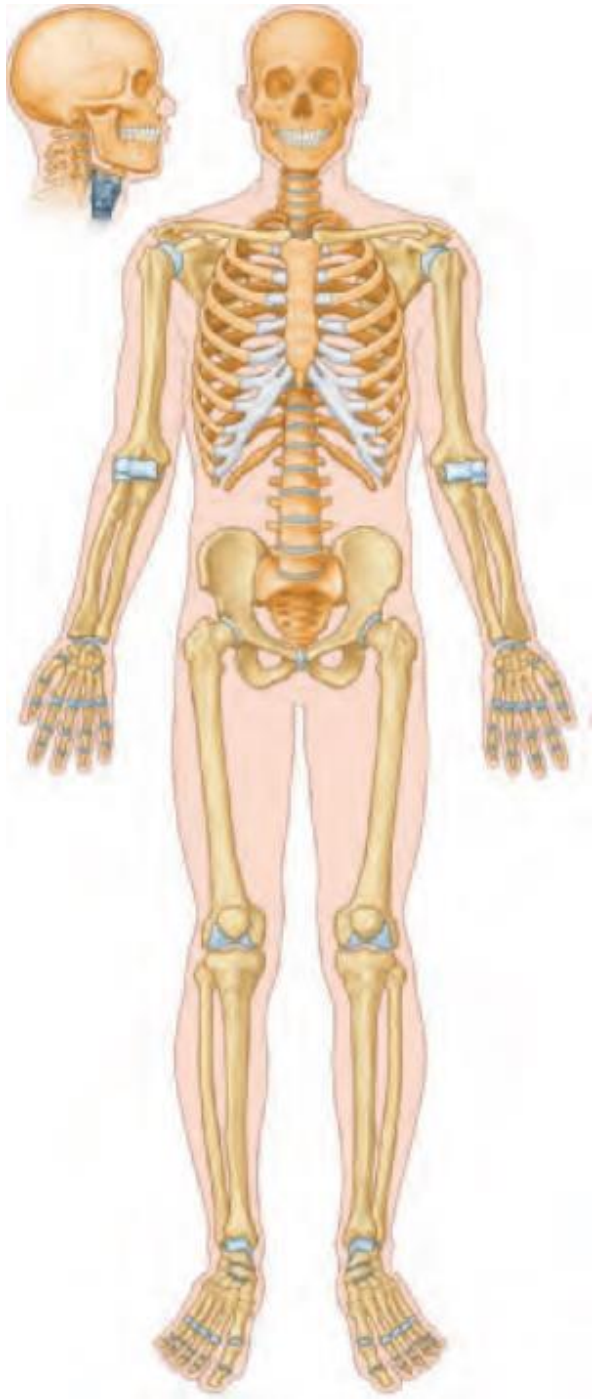


# 3.5. Ball and socket joints

**Ball and socket joints** allow movement in multiple axes and planes: flexion and extension, abduction and adduction, medial and lateral rotation, and circumduction; thus ball and socket joints are *multiaxial joints.*

In these highly mobile joints, the spheroidal surface of one bone moves within the socket of another.

The *hip joint* is a ball and socket joint in which the spherical *head of the femur* rotates within the socket formed by the *acetabulum* of the hip bone.

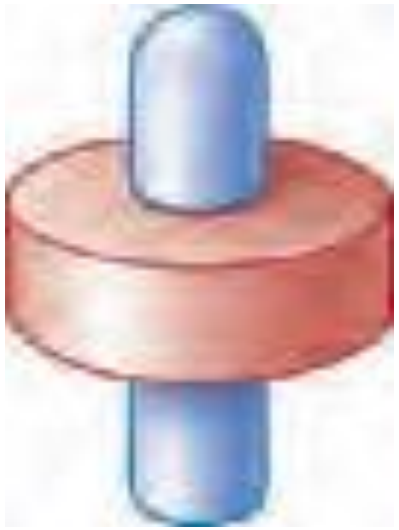


# 3.6. Pivot joints

**Pivot joints** permit rotation around a central axis; thus they are uniaxial.

In these joints, a rounded process of bone rotates within a sleeve or ring.

The *median atlantoaxial joint* is a pivot joint in which the atlas (C1 vertebra) rotates around a finger-like process, the dens of the axis (C2 vertebra), during rotation of the head.



Joints receive blood from **articular arteries** that arise from the vessels around the joint.

The arteries often *anastomose* (communicate) to form networks (*peri-articular arterial anastomoses*) to ensure a blood supply to and across the joint in the various positions assumed by the joint.

**Articular veins** are communicating veins that accompany arteries (L. *venae comitantes*) and, like the arteries, are located in the joint capsule, mostly in the synovial membrane.

*Joints have a rich nerve supply* provided by **articular nerves** with sensory nerve endings in the joint capsule.

In the distal parts of the limbs (hands and feet), the articular nerves are branches of the cutaneous nerves supplying the overlying skin.

However, most articular nerves are branches of nerves that supply the muscles that cross and therefore move the joint.

The **Hilton law** states that the nerves supplying a joint also supply the muscles moving the joint and the skin covering their distal attachments.

Articular nerves transmit sensory impulses from the joint that contribute to the sense of **proprioception,** which provides an awareness of movement and position of the parts of the body.

The synovial membrane is relatively insensitive.

Pain fibers are numerous in the fibrous layer of the joint capsule and the accessory ligaments, causing considerable pain when the joint is injured.

The sensory nerve endings respond to the twisting and stretching that occurs during sports activities

# Thank You