Classification of Joints

Joints or articulations are the functional junctions between bones.

1. the action or manner in which the parts come together at a joint
2. a joint between bones or cartilages in the vertebrate skeleton that is immovable / Synarthrotic when the bones are directly united,
3. slightly movable / Amphiarthrotic when they are united by an intervening substance, or
4. More or less freely movable / Diarthrotic when the articular surfaces are covered with smooth cartilage and surrounded by an articular capsule that holds the synovial fluid in
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<td><strong>Fibrous:</strong> Sutures (between cranial plates)</td>
<td>Synarthroses</td>
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<td><strong>Synovial:</strong> knee joint</td>
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Fibrous Joints
(Synarthrotic and Gomphosis or immoveable joint).

- **Ex: Suture**- flat skull bones joined with a sutural ligament

- **Fibrous joints**: bound with dense connective tissue, allow little movement.
Fibrous Joints

- **Ex: Gomphosis**
  - Teeth anchored to the jaw with a periodontal ligament in a synarthrotic joint.

Articulation between root and jawbone
• Syndesmoses
• A form of fibrous joint in which opposing surfaces that are relatively far apart are united by ligaments; for example, The fibrous union between the radius and ulna (radio-ulnar syndesmoses) The tibia and fibula (tibio-fibular syndesmoses).
Fibrous Joints

(a) Suture between skull bones

(b) Slight movement at suture

(c) Syndesmosis

(d) Interosseous membrane between diaphyses of tibia and fibula
Cartilaginous Joints

Bones connected by cartilaginous joints contain either hyaline or fibrocartilage. There is no fluid inbetween.

a slightly movable joint in which cartilage unites bony surfaces. Two types of articulation involving cartilaginous joints are synchondrosis and symphysis.
• **Synchondrosis:** hyaline cartilage joins the epiphyses to the diaphysis at the epiphyseal disc of long bone (**synarthrotic joint**); also sternocostal joint, **Ex:** Articulation between the first rib and the manubrium of the sternum (Fig. 8.5).

• **Symphysis:** thin layer of hyaline cartilage with a pad of fibro-cartilage in an **Amphiarthrotic joint.** **Ex:** Intervertebral disk and pubic symphysis.
Figure 8.2: Cartilaginous joints, p. 254.

(a) Synchondroses:
- Epiphyseal plate (hyaline cartilage)

(b) Joint between first rib and sternum (immovable):
- Sternum (manubrium)

(c) Fibrocartilaginous intervertebral disc:
- Body of vertebra

Symphyses
General Synovial Joint Structure

- **Articular cartilage**: thin layer of hyaline cartilage lining the ends of the epiphyses.
- **Joint capsule**: two layer capsule, outer layer is dense connective tissue.
- **Synovial membrane**: Inner layer of the joint capsule, vascular loose connective tissue.
- **Ligaments**: collagenous fibers of CT that reinforce the joint capsule.
- **Synovial cavity**: closed sac surrounded by the synovial membrane.
- **Synovial fluid**: clear, viscous fluid that moistens and lubricates articular surfaces.
- **Menisci**: fibrocartilage located between articular surfaces.
- **Bursae**: fluid-filled sacs between the skin and underlying bony prominences.
Most diarthrotic joints are synovial joints. They consist of articular or hyaline cartilage, joint capsule, and a synovial membrane which secretes synovial fluid.
Accessory Ligaments and Articular Discs

- Extracapsular and intracapsular ligaments
- Menisci
- Labrum
- Bursae
- Tendon sheaths
Types of Synovial Joints (Tab. 8.1)

- **Ball and Socket:** shoulder, hip
- **Condyloid:** knee (between the two condyles of femur and between the condyle and meniscus of tibia), metacarpals/phalanges
- **Gliding:** knee (patella/femur); elbow (humerus/radius); wrists; ankles
- **Hinge:** elbow (humerus/ulna)
- **Pivot:** atlas/axis
- **Saddle:** thumb (carpals/metacarpals)
Types of Synovial Joints

- **Ball-and-socket joint**: permits movement in all planes,
- **Ex: hip and shoulder.**
Types of Synovial Joints

- **Condyloid joint**: movement in several planes, does not allow rotation
- **Ex:** metacarpals/phalanges joint; knee
Types of Synovial Joints

- **Gliding joints:** sliding and twisting movements
- **Ex:** wrist and ankle; knee; elbow.
Types of Synovial Joints

- **Hinge joint:** movement in one plane like a door hinge
- **Ex:** elbow (humerus/ulna)
Types of Synovial Joints

- **Pivot joint**: rotation around a central axis
- **Ex**: atlas/axis joint
Types of Synovial Joints (Fig. 8.9)

- **Saddle joint:** movements in two planes
- **Ex:** thumb (carpals/metacarpals)
Joint Movements

- **Flexion/Extension**: elbow, knee
- **Hyperextension**: hand at wrist
- **Dorsiflexion/Plantar flexion**: foot at ankle
- **Abduction/adduction**: limbs away and toward trunk midline
- **Rotation**: moving a part around an axis, maximally at 90°
- **Circumduction**: moving a part in a 360° circle that is anchored in a ball-and-socket joint
- **Supination/Pronation**: “thumbs up” so that palm faces anteriorly; “thumbs down” so that palm faces posteriorly
- **Eversion/Inversion**: sole faces laterally outward and peripherally v. sole faces laterally inward and medially
Joint Movements

- **Flexion**: bending at a joint decreasing the angle, **Ex**: bending the lower leg at the knee
- **Extension**: straightening a joint increasing the angle, **Ex**: straightening the leg at the knee
medial rotation  lateral rotation  flexion  abduction
extension  adduction
Joint Movements

- **Hyper-extension**: excess extension beyond anatomical position
- **Ex**: bending the head back
Joint Movements

• **Dorsiflexion:** bending the foot upward at the ankle

• **Plantar flexion:** bending the foot downward at the ankle
Joint Movements

- **Abduction**: moving a part away from midline, **Ex**: lifting the arm at the shoulder
- **Adduction**: moving a part toward midline, **Ex**: lowering the arm at the shoulder
Joint Movements

- **Rotation**: moving a part around an axis, ex: twisting the head from side to side
- **Circumduction**: moving a part so the end moves in a circular path, ex: moving the finger in a circle without moving the hand
Joint Movements

- **Supination:** turning the palm upward
- **Pronation:** turning the palm downward
Joint Movements

- **Eversion:** turning the foot so the sole faces laterally
- **Inversion:** turning the foot so the sole faces medially
- **Protraction:** moving a part forward
Shoulder Joint

- **Ball and socket joint** - rounded head of the humerus and the glenoid cavity of the scapula; the joint capsule is loose; muscles and tendons reinforce the joint.
- **Wide range of movements** - flexion, extension, abduction, adduction, rotation, and circumduction
- **Ligaments** - coracohumeral, glenohumeral, transverse humeral, and glenoid labrum
- **Bursae** - subscapular, subdeltoid, subacromial, subcorocoid
Acromion process
Articular capsule
Glenoidal labrum

Coracoid process
Glenohumeral ligaments
Glenoid cavity

Shoulder Joint Ligaments (2)
Acromion of scapula
SUBACROMIAL BURSA
ARTICULAR CAPSULE
Head of humerus
Tendon sheath
Tendon of biceps brachii muscle (long head)
Acromioclavicular ligament
Clavicle
Tendon of supraspinatus muscle
GLENOID LABRUM
Scapula
GLENOID CAVITY
Articular cartilage
GLENOID LABRUM
ARTICULAR CAPSULE:
Synovial membrane
Fibrous membrane
Humerus
(c) Frontal section
Elbow Joint

- The elbow joint includes two articulations.
- **Hinge joint** between the troclea of the humerus and the trochlear notch of the ulna.
- **Gliding joint** between the capitulum of the humerus and a fovea on the radius head.
- Movements include **flexion and extension** between the humerus and ulna. The radius allows **rotation and supination** of the hand.
- **Ligaments** include the ulnar collateral and the radial collateral ligament.
Hip Joint

- **Ball and socket** joint consisting of the head of the femur and the acetabulum of the coxal bones; muscles surround the joint capsule
- **Movements:** flexion, extension, abduction, adduction, rotation, and circumduction
- **Ligaments:** iliofemoral, pubofemoral, ischiofemoral ligaments
Knee Joint

- **Most complex synovial joint**: it consists of the medial and lateral condyles at the proximal end of the tibia; the femur articulates with the patella.
- The joint capsule is thin and strengthened by **muscles and tendons**.
- **Ligaments**: patella, oblique popliteal, arcuate popliteal, tibial collateral, fibular collateral ligament strengthen the joint capsule.
- **Cruciate ligaments** prevent displacement of articulating surfaces.
- **Two fibrocartilaginous menisci** separate the articulating surfaces.
Right Tempromandibular Joint

Sphenoid bone
ARTICULAR CAPSULE
Styloid process of temporal bone
SPHENOMANDIBULAR LIGAMENT
STYLOMANDIBULAR LIGAMENT
Sphenoidal sinus
Vomer
Maxilla
Mandible
(b) Left medial view

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Angular Movements at Synovial Joints

- **Hyperextension**
- **Extension**
- **Flexion**

(a) Atlanto-occipital and cervical intervertebral joints
(b) Shoulder joint
(c) Elbow joint
(d) Wrist joint
(e) Hip joint
(f) Knee joint
(g) Intervertebral joints

Mark Nielsen
Angular Movements at Synovial Joints
Angular Movements at Synovial Joints

(a) Shoulder joint
(b) Hip joint
Rotation at Synovial Joints

(a) Atlanto-axial joints

(b) Shoulder joint

(c) Hip joint

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Special Movements at Synovial Joints

• Elevation and depression
• Protraction and retraction
• Inversion and eversion
• Dorsiflexion and plantar flexion
• Supination and pronation
• Opposition
Special Movements at Synovial Joints

(a) Temporomandibular joints (b) Temporomandibular joints
(c) (d)

(e) Intertarsal joints (f) Eversion (g) Ankle joint

(h) Radioulnar joints (i) Carpometacarpal joint

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