ARTICULATIONS IN THE BODY

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science concerned with the anatomy, function, dysfunction and treatment of joints.
Joints (articulations)
unions or junctions between two or more bones or rigid parts of the skeleton

Whether or not movement occurs still called a joint.

Some joints have no movement

Others only slight movement

Some freely movable
Classification of Joints

according to the tissues that lie between the bones:

1) **Fibrous joints**

2) **Cartilaginous joints**

3) **Synovial joints**
Fibrous joints

Bones are united by fibrous tissue.

Sutures of the cranium
Fibrous joints

**Syndesmosis** type of fibrous joint
unites the bones with a sheet of fibrous tissue
either a ligament or a fibrous membrane
partially movable

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

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Cartilaginous joints

Bones are united by hyaline cartilage or fibrocartilage.
Cartilaginous joints

Primary cartilaginous joints - **synchondroses**
hyaline cartilage - growth of a bone during early life

Secondary cartilaginous joints - **symphyses**
strong, slightly movable joints united by fibrocartilage
Synovial joints

Most common type of joints

- Bones united by a joint capsule enclosing an articular cavity.

- Provide free movement between the bones they join.

**Joint cavity**

Potential space contains lubricating synovial fluid, secreted by the synovial membrane.

**Articular cartilage**

Articular surfaces are covered by hyaline cartilage.

**Articular capsule**

Surrounds the joint and formed of two layers.
**Articular capsule:** surrounds the joint*
two layers.*

**Fibrous capsule**

**Synovial membrane**

Some synovial joints have other distinguishing features, such as a fibrocartilaginous **articulare disc or meniscus**, which are present when the articulating surfaces of the bones are incongruous.
Ligaments
a cord or band of connective tissue uniting two structures.

- Articular capsules are usually strengthened by articular ligaments.
- Connect the articulating bones to each other.
- Limit the undesired and/or excessive movements of the joints.
Articular disc: Help to hold the bones together.

Labrum: A fibrocartilaginous ring which deepens the articular surface for one of the bones.
Bursa

- Flattened sacs that contain synovial fluid to reduce friction.
- Walls are separated by a film of viscous fluid.
- Found wherever tendons rub against bones, ligaments, or other tendons.
Stability of Joints

1) Negative pressure within the joint cavity

2) Shape, size, and arrangement of the articular surfaces

3) Ligaments

4) Tone of the muscles around the joint
Joint vasculature and innervation

- Joints receive blood from articular arteries that arise from the vessels around 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.
Types of synovial joints
according to shape of articulating surfaces- type of movement they permit

1. Plane joints
   - Uniaxial joints - gliding or sliding
   - Acromioclavicular joint

2. Hinge joints
   - Uniaxial joints - flexion & extension
   - Knee & elbow joints
Types of synovial joints

3. Saddle joints
biaxial joints- flexion & extension, abduction & adduction
carpometacarpal joint at the base of the 1st digit (thumb)

4. Condyloid (ellipsoid type)
biaxial joints- flexion & extension, abduction & adduction
metacarpophalangeal joints (knuckle joints)
radiocarpal joint (wrist)
5. Ball and socket joints (spheroidal joints)

- multiple axes and planes: flexion and extension, abduction and adduction, medial and lateral rotation, and circumduction

- Hip & Shoulder joints
Types of synovial joints

6. Pivot joints
uniaxial joints - rotation around a central axis
proximal & distal radioulnar joints
SUTURAE

**form of articulation**

*of* bones united by a thin layer of fibrous tissue

**LAMBDOID SUTURE**

Parietal bones

Occipital bones

**CORONAL SUTURE**

Frontal bones

Parietal bones

**SAGITTAL SUTURE**

Parietal bones

Superior (vertical) aspect

- Frontal bone
- Bregma
- Coronal suture
- Sagittal suture
- Parietal bone
- Vertex
TEMPOROMANDIBULAR JOINT

A modified hinge type of synovial joint

**Movements**

- gliding (translation)
- small degree of rotation (pivoting)
- flexion (elevation)
- extension (depression)
TEMPOROMANDIBULAR JOINT

- mandibular fossa & articular tubercle of temporal bone
- head of the mandible

articular disc of the TMJ
The vertebral column in an adult typically consists of 33 vertebrae arranged in five regions: 7 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 4 coccygeal.

- Joints of the vertebral bodies: symphyses (secondary cartilaginous joints)
- Joints of the vertebral arches: facet joints
- Craniovertebral (atlanto-axial and atlanto-occipital) joints
- Costovertebral joints
- Sacroiliac joints
Joints of the vertebral bodies
developed for weight-bearing and strength

- Two vertebrae connected by intervertebral (IV) discs and ligaments.
- Discs provide strong attachments between the vertebral bodies.
1. **anulus fibrosus** (L. anus, a ring)
bulging fibrous ring forming the circumference of the IV disc

2. **anterior longitudinal ligament**
covers and connects the anterolateral aspects of the vertebral bodies and IV discs.

3. **posterior longitudinal ligament**
runs within the vertebral canal along the posterior aspect of the vertebral bodies.
Joints of the vertebral arches
between superior & inferior articular processes of adjacent vertebrae

The adjacent vertebral arches are joined by broad, pale yellow bands of elastic tissue called the **ligamenta flava** (L. flavus, yellow).

**PLANE TYPE SYNOVIAL JOINT**
GLIDING MOVEMENTS
MOVEMENTS OF THE VERTEBRAL COLUMN

The range of movement varies according to the region and the individual.

The mobility results primarily from the **compressibility and elasticity of the intervertebral discs**.

Movements by the vertebral column include **flexion, extension, lateral flexion, rotation, and circumduction**.
Craniovertebral joints

A. atlanto-occipital joints
between atlas (C1 vertebra), & occipital bone of the cranium

B. atlanto-axial joints
between atlas & axis (C2 vertebra)

Their design gives a wider range of movement than in the rest of the vertebral column.
Craniovertebral joints

**Atlanto-occipital joints**

Nodding of the head, such as the flexion and extension of the head.

*Approval "yes" movement*

**3 Atlanto-axial articulations**

2 (right and left) lateral atlantoaxial joints
1 median atlantoaxial joint.

*Head turned from side to side, "no" movement*
JOINTS OF THE UPPER LIMB

**Sternoclavicular joint (SC)**

The sternal end of the clavicle articulates with manubrium & 1st costal cartilage.

- The only articulation between upper limb & axial skeleton.
- During full elevation of the limb, clavicle is raised to 60° angle.

**Acromioclavicular joint**

The acromial end of the clavicle articulates with the acromion of the scapula.
Glenohumeral (shoulder) joint permits a wide range of movement; mobility makes the joint relatively unstable. **Humeral head** articulates w/ **glenoid cavity of the scapula** deepened slightly but effectively by the ring-like, fibrocartilaginous glenoid labrum (L., lip).
Glenohumeral (shoulder) joint
more freedom of movement than any other joint in the body

- results from the laxity of its joint capsule & large size of the humeral head compared with the small size of the glenoid cavity.

- movements around three axes
  flexion-extension, abduction-adduction, rotation (medial and lateral) of the humerus, circumduction
Elbow Joint
located inferior to the epicondyles of the humerus

humeroulnar & humeroradial articulations

Elbow Complex (Anterior View)
collateral ligaments of the elbow joint
strong triangular bands
medial and lateral thickenings of the fibrous layer of the joint capsule

Radial collateral ligament
Ulnar collateral ligament

Flexion and extension occur at the elbow joint.
Intratendinous olecranon bursa
Subtendinous olecranon bursa
Subcutaneous olecranon bursa
**Proximal (superior) radio-ulnar joint**

allows movement of the head of the radius on the ulna
Radial head is held in position by the anular ligament of the radius.

**Distal (inferior) radio-ulnar joint**

The radius moves around the relatively fixed distal end of the ulna.
**Wrist (radiocarpal) joint**

Ulna does not participate in the wrist joint.

Distal end of the radius & articular disc of the distal radio-ulnar joint articulate with proximal row of carpal bones, except for the pisiform.

- Flexion
- Extension
- Abduction
- Adduction
- Radial deviation- ulnar deviation
- Circumduction
Intercarpal joints interconnect the carpal bones.

Carpometacarpal joints
Intermetacarpal joints
Metacarpophalangeal joints
Interphalangeal joints
articulations of the pelvic girdle
lumbosacral joints, sacroiliac joints, and pubic symphysis

- hip joints
- knee joints
- tibiofibular joints
- ankle joints
- foot joints
JOINTS OF THE PELVIS

Pubic symphysis
interpubic disc & surrounding ligaments
unite the bodies of the pubic bones in the median plane.

Lumbosacral joints
L5 and S1 vertebrae articulate

Sacroccygeal joint
**HIP JOINT**

**Feature 1:** Connection between lower limb & pelvic girdle

**Feature 2:** 2nd most movable after the shoulder joint

**Synovial Joint Type:** Ball and socket (Head of the femur & acetabulum)

**Weight transfer:** To the heads and necks of the femurs

acetabular labrum (L. labrum, lip)
fibrocartilaginous rim attached to the margin of acetabulum, increasing acetabular articular area by nearly 10%.
Ligaments

HIP JOINT

Transverse acetabular ligament continuation of acetabular labrum

3 intrinsic ligaments
1) Iliofemoral ligament anteriorly and superiorly, strongest ligament of the body
2) Pubofemoral ligament anteriorly and inferiorly
3) Ischiofemoral ligament posteriorly

Ligament of the head of the femur
MOVEMENTS OF HIP JOINT

- Flexion-extension
- Abduction-adduction
- Medial-lateral rotation
- Circumduction
Feature 1: Largest & most superficial joint

Feature 2: Hing movements (Ext/Flex) combined with gliding & rotation

Synovial Joint Type: Hinge

The knee joint consists of three articulations:
2 femorotibial articulations (lateral and medial) between lateral & medial femoral and tibial condyles
One intermediate femoropatellar articulation between patella & femur

No fibula involvement in the knee joint.
The stability of the knee joint depends on
(1) strength & actions of the surrounding muscles and their tendons
(2) ligaments that connect the femur and tibia.

**muscles are most important.**

*the most important muscle in stabilizing the knee joint* **quadriceps femoris.**
Extracapsular ligaments

1) Patellar ligament
2) Fibular (Lateral) collateral ligament
3) Tibial (Medial) collateral ligament
4) Oblique popliteal ligament
5) Arcuate popliteal ligament
posterior cruciate ligament
femur
lateral meniscus
anterior cruciate ligament
medial collateral ligament
medial meniscus
lateral collateral ligament
patellar ligament
cross ligament of knee
patella
INTRA-ARTICULAR LIGAMENTS
Cruciate ligaments & menisci

**Anterior cruciate ligament (ACL)**

**Posterior cruciate ligament (PCL)**
The lateral collateral ligament (LCL) runs on the outside of your knee. It limits sideways motion.

The anterior cruciate ligament (ACL) connects the femur to the tibia in the center of your knee. It limits rotation and the forward motion of the tibia.

The meniscus is cartilage that absorbs shock in your joint.

Articular cartilage lines the bones, cushioning your joint.

The medial collateral ligament (MCL) runs down the inside of your knee joint. It connects the femur to the tibia and limits the sideways motion of your knee.

The posterior cruciate ligament (PCL) also connects the femur and tibia. It limits backward motion of the tibia.
patella (knee cap)
articular cartilage
lateral collateral ligaments
lateral meniscus
medial meniscus
medial collateral ligaments
the right knee
Menisci of the knee joint
crescentic plates of fibrocartilage on the articular surface of tibia deepen the surface and play a role in shock absorption.
MOVEMENTS OF KNEE JOINT

Flexion and extension main knee movements, some rotation occurs when the knee is flexed.
BURSAE AROUND KNEE JOINT

There are at least 12 bursae around the knee joint because most tendons run parallel to the bones and pull lengthwise across the joint during knee movements.

The **subcutaneous prepatellar** and **infrapatellar bursae** are located at the convex surface of the joint, allowing the skin to be able to move freely during movements of the knee.

The large **suprapatellar bursa** is especially important because an infection in it may spread to the knee joint cavity.
TIBIOFIBULAR JOINTS

(Superior) Tibiofibular joint

Syndesmosis (inferior tibiofibular) joint

In addition, an interosseous membrane joins the shafts of the two bones.
ANKLE JOINT
Talocrural joint
Distal ends of the tibia & fibula & superior parts of the talus

Synovial Joint Type: Hinge

LIGAMENTS OF ANKLE JOINT

1) **Lateral ligaments of the ankle**
   - Anterior talofibular ligament
   - Posterior talofibular ligament
   - Calcaneofibular ligament

2) **Medial ligament of the ankle** (deltoid ligament)
The many joints of the foot involve the tarsals, metatarsals, and phalanges.
ARCHE OF THE FOOT

- weight-bearing capabilities and resiliency of the foot
- foot's ability to adapt to changes in surface contour
- supported by ligaments of the foot and tendons