IV. ARTICULAR SYSTEM
CLASSIFICATION OF JOINTS

Bones are connected at joints (articulations), and all bone movements occur at joints. Joints are structurally classified as fibrous, cartilaginous, or synovial. They are functionally classified as immovable, partly movable, or freely movable. The most secure joints are immovable, the most vulnerable are freely movable. The architecture of freely movable joints determines their directions and ranges of motion.

FIBROUS JOINT
IMMOVABLE, PARTLY MOVABLE
Fibrous joints, where bone is connected to bone by fibrous tissue, are immovable or partly movable. Sutures are immovable fibrous joints; so are teeth and their sockets. Syndesmoses, here represented by the interosseous ligament of the forearm, are partly movable fibrous joints.

CARTILAGINOUS JOINT
IMMOVABLE, PARTLY MOVABLE
Cartilaginous joints, where bone is connected to bone by cartilaginous or fibrocartilaginous tissues, are immovable or partly movable. The epiphyseal growth plates are immovable cartilaginous joints, replaced by bone at skeletal maturity. The intervertebral discs are partly movable fibrocartilaginous joints.

SYNOVIAL JOINT (FREELY MOVABLE)
ARTICULATING BONES
ARTICULAR CARTILAGE
SYNOVIAL MEMBRANE
SYNOVIAL CAVITY (FLUID)
JOINT CAPSULE
BURSA CAPSULE
COLLATERAL LIGAMENT

Synovial joints are all freely movable within the limitations of the bony architecture. Articular bones are capped with articular cartilage at the joint interface. The joint cavity is lined internally with vascular synovial membrane (except over the articular cartilage) and secretes a nutrient, lubricating synovial fluid. The fibrous, sensitive joint capsule is reinforced by ligaments. A cushion of synovial membrane reinforced by dense irregular connective tissue can be found interposed between bone and a moving structure (tendon, muscle). Such a device (bursa) facilitates friction-free movement.

TYPES OF SYNOVIAL JOINTS:

**BALL & SOCKET.**

The ball and socket joint is best seen at the hip and shoulder joints. Movements in all directions are permitted.

**HINGE.**

A hinge joint permits movement in only one plane: flexion/extension. It can be seen at the ankle, interphalangeal, and elbow (humero-ulnar) joints.

**SADDLE.**

The saddle (sellar) joint has two concave surfaces articulating with one another. The carpometacarpal joint of the thumb is the best example of this joint which permits all movements but rotation.

**ELLIPSOID.**

The ellipsoid (condylar, condylar) joint is a reduced ball and socket configuration in which significant rotation is largely excluded, e.g., the bicondylar knee and temporomandibular joints, and radiocarpal (wrist) joints.

**PIVOT.**

A ring of bone (Cl vertebra) rotating about an axle of bone (odontoid process of C2 vertebra) is a pivot joint (atlantoaxial joint). Also the rounded humeral capitulum and the radial head (radialhumeral joint).

**GLIDING.**

A gliding joint consists of generally flat surfaces gliding across one another during movement, such as the facet joints of the vertebrae, acromioclavicular, and intercarpal/intertarsal joints.
**IV. ARTICULAR SYSTEM**

**TERMS OF MOVEMENTS**

CN: Color the arrows pointing to the joints demonstrating the various movements of the body. Note that inversion (I) and eversion (E) occur among bones of the foot, not at the ankle.


Movements of bones occur at joints. Terms of movement are therefore applicable to joints, not bones (flexion of the humerus is to bend it). Ranges of motion are limited by the bony architecture of a joint, related ligaments, and the muscles crossing that joint. It is from the anatomical position that specific directions of movement can be clearly delineated and ranges of motion measured.

**Extension** of a joint is to generally straighten it. In the anatomical position, most joints are in relaxed extension (neutral). In relation to the anatomical position, movements of extension are directed in the sagittal plane. Extreme, even abnormal extension is called hyperextension. At the ankle and wrist joints, extension is termed dorsiflexion.

**Flexion** of a joint is to bend it or decrease the angle between the bones of the joint. Movements of flexion are directed in the sagittal plane. At the ankle joint, flexion is also called plantar flexion.

**Adduction** of a joint moves a bone toward the midline of the body (or in the case of the fingers or toes, toward the midline of the hand or foot). In relation to the anatomical position, movements of adduction are directed medially in the coronal plane.

**Abduction** of a joint moves a bone away from the midline of the body (or hand or foot). Movements of abduction are directed laterally in the coronal plane.

**Circumduction** is a circular movement permitted at ball and socket, condylar, and saddle joints. It consists of the movements of flexion, abduction, extension, and adduction performed in sequence.

**Rotation** of a joint is to turn the moving bone about its axis. Rotation toward the body is internal or medial rotation; rotation away from the body is external or lateral rotation.

**Supination** is an external rotation of the radiohumeral joint. In the foot, it is the combined movements of inversion, abduction around a vertical axis, and plantar flexion.

**Pronation** is an internal rotation of the radiohumeral joint. In the foot, it is the combined movements of eversion, abduction around a vertical axis, and dorsiflexion. The joints involved in both supination and pronation are the tarsal and ankle joints.

**Inversion** turns the sole of the foot inward so that the medial border of the foot is elevated.

**Eversion** turns the sole of the foot outward so that its lateral border is elevated. Both inversion and eversion occur at subtalar (talocalcaneal) and transverse talar joints.