

Chapter 8
Joints & Skeletal Movement

Classification of joints is by **functional group** (the amount of movement possible), and **structural group** (how the bones are held together).

Functional Group Structural Group	Synarthrosis (immobile)	Amphiarthrosis (slight movement)	Diarthrosis (free mobility)
Fibrous (bones connected by short, fibrous filaments)	<p>Suture <i>cranium</i></p> <p>Gomphosis <i>joint btwn teeth & maxilla/mandible</i></p>	<p>Syndesmosis <i>-carpal/tarsal bones, -btwn radius & ulna</i></p>	
Cartilagenous (bones connected by cartilage)	<p>Synchondrosis <i>-epiphyseal plate -joint between first rib & manibrium</i></p> <p>CTLGE=HYALINE</p>	<p>Symphysis <i>-intervetebral disc -pubic symphysis</i></p> <p>CTLGE=FIBROCTLGE</p>	
Synovial (bones separated by fluid-filled cavity)			<p>Synovial Joint <i>all joints of limbs most joints of body</i></p>

A few notes about fibrous joints:

- Some **sutures** ossify completely, such as in the frontal bones, and become synostosis.
- **Gomphosis** joints have a peg-in-socket structure...one bone surrounds the other. The fibrous connection is the periodontal ligaments.
- Most fibrous joints are **immovable**
- Sutures have **very short CT fibers**
- In syndesmosis the bones are connected by a **ligament**

A few notes about cartilaginous joints:

- **Epiphyseal plates** are temporary and become synostoses
- **Symphyses** are designed for strength with flexibility
- **Fibrocartilage** is compressible, acts as a shock absorber

Synovial Joints

Common features of synovial joints:

- Articular cartilage (one on each bone)
 - Hyaline cartilage reduces friction
- Joint cavity (space between bones – “potential space”)
 - Contains small amount of synovial fluid

- Articular capsule (2 layers)
 - Outer layer is tough fibrous DICT that continues with the periosteum
 - Inner layer is synovial membrane
 - Some parts are thicker than others. The thicker parts are intrinsic ligaments
- Synovial fluid
 - Clear, viscous filtrate of blood produced by synovial membrane
 - Found in joint space and within articular cartilage. This is how hyaline cartilage gets nutrients.
 - Functions of synovial fluid
 - Lubrication of joint
 - Nourishes cartilage
 - Provides cushioning
 - Contains phagocytes to keep joint free of debris

Synovial Membrane...not a "true" membrane.

Epithelial component = fibroblasts and macrophages.

CT component = areolar (a loose connective tissue)

Accessory features of synovial joints (the optional "extras")

- Extracapsular ligaments
 - Fibrous bands separated from articular capsule
 - Span the distance between two bones
- Intracapsular ligaments
 - Ligaments between bone surfaces
- Fat pads
 - Provide cushioning btwn fibrous capsule and synovial membrane or bone.
- Minisci (articular discs)
 - Wedges of fibrocartilage
 - Improve stability
 - Bowl-shaped
- Bursae & tendon sheaths
 - Fibrous sacs lined by synovial membrane
 - Contains synovial fluid
 - Sits between tendon/muscle and bone (bursae), or surrounds tendon (tendon sheath)
 - Smooth movement of tendon over bone
 - Reduces friction

Stability of the synovial joint is influenced by:

- Shape of the joint and the articular surface
- Presence of ligaments
- Muscle tone. The more muscle pulls on it, the more it holds the joint together

Movements of the Synovial Joint – 3 MAIN TYPES

1. Gliding movements (aka "translation").
 - a. The point of contact moves across the surface
 - b. Bones slide past one another

- c. Ex: carpal and tarsal bones
- 2. Angular movements
 - a. Point of contact remains constant
 - b. Angle at which bones meet changes
 - c. Circumduction describes a CONE IN SPACE
 - d. These are flexion, extension, dorsiflexion, plantar flexion, abduction, adduction and circumduction.
 - e. Ex: elbow, bending forward
- 3. Rotation
 - a. Point of contact & angle remain constant
 - b. One bone pivots around axis
 - c. Ex: atlas & axis, hip and shoulder joint

Axes of Movement

Nonaxial	surfaces slide past one another
Uniaxial	one axis of movement
Biaxial	movement in two planes, only one at a time
Multiaxial	movement in all three planes, can be combined

Movement in the sagittal plane (front to back)

FLEXION is described as decreasing the angle at the joint (bending elbow). It is essentially an anterior movement, though one exception is that the knee bends posteriorly, and the ankle has singular movements.

EXTENSION is described as increasing the angle at the joint. It is the opposite of flexion...a return to anatomical position.

HYPEREXTENSION is described as increasing the angle beyond anatomical position.

Movement in the frontal plane (side to side)

ABDUCTION is moving away from the midline

ADDUCTION is moving toward the midline

Ankle movements

DORSIFLEXION brings the toes toward the head

PLANTAR FLEXION is pointing the toes

INVERSION is turning the sole of the foot medially

EVERSION is turning the sole of the foot laterally

Rotations

MEDIAL (INTERNAL) ROTATION is rotating the anterior limb surface toward the midline (femur bones in Uttanasana) – hip or shoulder

LATERAL (EXTERNAL) ROTATION is rotating the anterior limb surface away from the midline (Warrior 2) – hip or shoulder

LEFT OR RIGHT ROTATION is rotating the head or trunk around the midline.

Spinal column movements

Lateral movement of the spinal column is bending neck or torso side to side. The spine can also do extension, flexion, rotation and hyperextension)

Forearm movements

SUPINATION is turning the antebrachium so the hand is facing up. Arm is in anatomical position. You can hold a bowl of soup!

PRONATION is turning the palm down, or posteriorly from anatomical position.

Mandible/clavicle movements

PROTRACTION is moving the jaw or shoulders forward. This is moving anteriorly in the transverse plane.

RETRACTION is moving the jaw or shoulders back. This is moving posteriorly in the transverse plane.

Mandible/shoulder movements

ELEVATION is raising the jaw or shoulder

DEPRESSION is lowering the jaw or shoulder

Synovial Joint Shapes! There are 6 😊

1. Plane Joint
 - a. Movement = gliding
 - b. Axis = non axial
 - c. Ex = carpal bones
2. Hinge Joint
 - a. Movement = angular
 - b. Axis = Uniaxial
 - c. Ex = elbow, interphalangeal joint
3. Pivot Joint
 - a. Movement = rotation

- b. Axis = Uniaxial
 - c. Ex = Atlas & Axis, radioulnar joint
- 4. Candyloid joint (aka ellipsoid)
 - a. Movement = angular
 - b. Axis = Biaxial
 - c. Ex = metecarpal phalanges (knuckles)
- 5. Saddle joint
 - a. Movement = angular
 - b. Axis = biaxial
 - c. Ex = thumb joint (trapeziometacarpal joint...only one!)
- 6. Ball and socket
 - a. Movement = angular
 - b. Axis = multiaxial
 - c. Ex = shoulder and hip (only ones)

Disorders of Joints

A **SPRAIN** occurs when a ligament is torn or stretched. Dense regular CT takes a while to heal and is difficult to repair.

CARTILAGE DAMAGE occurs in an overstressed joint. Cartilage is avascular, so it does not repair well.

DISLOCATION (aka luxation) occurs when the bone is forced out of location. Subluxation is a partial dislocation.

Inflammatory and degenerative disorders include **BURSITIS**, which is caused by a blow or excessive friction; **TENDONITIS**, which is caused by excess use of the tendon; and **ARTHRITIS**, which is the breakdown of articular cartilage. There are over 100 different types of arthritis.

Marieb, E. N. (2006). *Essentials of human anatomy & physiology* (8th ed.). San Francisco: Pearson/Benjamin Cummings.

Martini, F., & Ober, W. C. (2006). *Fundamentals of anatomy & physiology* (7th ed.). San Francisco, CA: Pearson Benjamin Cummings.