ARTICULATIONS
PART I: CLASSIFICATION OF JOINTS

Functional Classifications

- Synarthrosis: no movement
- Amphiarthrosis: little movement
- Diarthrosis: more movement

Synarthroses

- Fibrous or cartilaginous connections
- May fuse over time
- Are very strong
- Edges of bones may touch or interlock

4 Types of Synarthrotic Joints

- Suture
  - Bones interlocked
  - Bound by dense fibrous connective tissue
  - only in skull
- Gomphosis
  - Fibrous connection (periodontal ligament)
  - Binds teeth to sockets
- Synchondrosis
  - Rigid cartilaginous bridge between 2 bones:
    - epiphyseal plate
    - between vertebrosternal ribs and sternum
- Synostosis
  - Fused bones, immovable:
    - epiphyseal lines of long bones

Amphiarthroses

- Fibrous or cartilaginous connections
- More moveable than synarthrosis
- 2 Types:
  - Syndesmosis:
    - bones connected by ligaments
  - Symphysis:
    - bones separated by fibrocartilage

Diarthroses = Synovial Joints

- Synovial joints
- Subdivided by type of motion
- At ends of long bones
- Within articular capsules
- Lined with synovial membrane
ARTICULATIONS
PART II (A): SYNOVIAL JOINT COMPONENTS

What is the basic structure of a synovial joint, and what are the common accessory structures and their functions?

Synovial Joints (Diarthroses)

• Joint cavity
• Freely movable
• Lubricated articular cartilage in capsule
  “The more flexible, the less stable”.
• Essential features
  - Synovial cavity
  - Articular capsule
  - Articular cartilage
  - Ligaments

Synovial Cavity

• Space between two articulating bones
• Inside is lined by a synovial membrane
• Outside is made of a fibrous capsule that fuses with accessory ligaments

Synovial Fluid

• Inner synovial membrane secretes and oily synovial fluid
• Functions:
  - Reduces friction in a joint
  - Nutrient distribution
  - Shock absorption

Articular Cartilage

• Pads the articulating surfaces within articular capsules:
  - Hyaline cartilage ‘cap’
  - Prevents bones from touching

Synovial Joints: Accessory Structures

• Fibrocartilage disks
  - Found in the knee and vertebral column
• Fat pads
• Ligaments
• Tendons
• Bursae
Fibrocartilage Disks in Knee

- **Meniscus (articular disc)**
  - Shock absorption
  - Reduces shearing (twisting) forces
  - Adjusts unequal surfaces and stabilizes knee joint

Fibrocartilage Disks in Vertebral Column

- **Intervertebral disk**
  - Tough outer layer fuses with body of vertebrae
  - Shock absorbing gelatinous core

Fat Pads & Bursae

- **Fat Pads:**
  - Superficial to the joint capsule
  - Protect articular cartilages

- **Bursae:**
  - Pockets of synovial fluid
  - Reduce friction in areas where tendons or ligaments rub

Tendons & Accessory Ligaments

- **Tendons:**
  - Attaches muscles around joint to bone
  - Supports joint

- **Ligaments:**
  - Support, strengthen joints
  - Thickens joint capsule

Synovial Joints: Stabilizing Factors

- Prevent injury by limiting range of motion:
  - collagen fibers (joint capsule, ligaments)
  - articulating surfaces and menisci
  - other bones, muscles, fat pads, or bursae
  - tendons of articulating bones
ARTICULATIONS
PART II (B): SYNOVIAL JOINT MOVEMENTS

Terms of movement

- Flexion
  - Close angle of joint
- Extension
  - Increase angle of joint
- Hyperextension
- Abduction
  - Move limbs away from midline of the body (splay out fingers)
- Adduction
  - Move limbs toward the midline of the body (bring fingers together)
- Circumdution
  - Limb movement around in a big circle pattern
- Medial rotation
  - Pivot limb around an axis toward the midline of the body
- Lateral rotation
  - Pivot limb around an axis away from the midline of the body
- Supination
  - Refers to the forearm; palms facing up or anterior
- Pronation
  - Refers to the forearm; palms facing down (turning hand over)
- Inversion
  - Refers to the feet; soles facing medially (weight on outside of feet, if standing)
- Eversion
  - Refers to the feet; soles facing laterally (‘fallen ankles’, weight on medial side)
- Dorsiflexion
  - Refers to the feet; move feet so toes point up (walk on your heels)
- Plantar Flexion
  - Refers to the feet; move feet so toes point down (walk on you tip-toes)
- Opposition
  - Refers to the thumb; move thumb and any of the fingers together (snapping)
- Reposition
  - Refers to the thumb; bring thumb back away from fingers
- Protraction
  - Head or jaw forward or anteriorly
- Retraction
  - Head or jaw moves posteriorly
- Elevation
  - Bring jaw up (close mouth)
- Depression
  - Bring jaw down (open mouth)
ARTICULATIONS
PART II (C): SYNOVIAL JOINT TYPES

What are the types of synovial joints, and the relationship of motion to structure?

Classification of Synovial Joints by Shape

- Gliding
- Hinge
- Pivot
- Ellipsoidal
- Saddle
- Ball-and-socket

Gliding Joints

- Flattened or slightly curved faces
- Limited motion (nonaxial)

Gliding (plane)

- Biaxial
- Flat articular surface
- Mostly small joints
  - Adjacent vertebrae, acromioclavicular joint, atlantoaxial (lateral) and between some carpal & tarsal bones

Hinge Joint

- Angular motion in a single plane (monaxial)
- Uniaxial
- Convex surface and concave surface
- Strong collateral ligaments
- Thin capsule over flex/ext surfaces
  - Elbow, finger, knee, ankle

Pivot Joint

- Rotation only (monaxial)
- Uniaxial
- Rotate around central axis (i.e. gate hinge)
- Central bony pivot surrounded by a collar (bone & ligament)
  - Atlantoaxial joint

Ellipsoidal Joints

- Oval articular face within a depression
- Motion in 2 planes (biaxial)
Condyloid

- Multiaxial but biaxial
- Ellipsoidal joint - modified ball & socket
- Ligaments and muscles limit movement
- Movements
  - Flexion/extension
  - Abduction/adduction
  - Circumduction

Saddle

- 2 concave faces, straddled (biaxial)
- Multiaxial
- Opposing surfaces shaped like a saddle
- Concave & convex
- Movement
  - Abduction/adduction
  - Opposition/reposition
    - Carpometacarpal

Ball-and- Socket

- Round articular face in a depression (triaxial)
- Multiaxial
- Globe-like head and cup-like socket
- Most freely moving joint
  - Shoulder & hip
ARTICULATIONS
PART III (A): SPECIFIC JOINTS
GLENOHUMERAL (SHOULDER) JOINT

Glenohumeral (Shoulder)

• Round head of humerus
• Shallow concave glenoid fossa
  - Enlarged by glenoid labrum
• Movements
  - Flexion/extension
  - Abduction/adduction
  - Medial/lateral rotation
  - Circumduction

Socket of the Shoulder Joint

• Glenoid labrum:
  - deepens socket of glenoid cavity
  - fibrocartilage lining
  - extends past the bone

Rotator Cuff: Muscles

• Muscles that hold the head of the humerus in the glenoid cavity
  - Supraspinatus
  - Infraspinatus
  - Subscapularis
  - Teres Minor

Shoulder Ligaments & Bursae

• Ligaments
  - Glenohumeral
  - Coracohumeral
  - Coracoacromial
  - Coracoaclavicular
  - Acromioclavicular

• Bursae:
  - Subacromial
  - Subcoracoid
  - Subdeltoid
  - Subscapular
The Elbow Joint

- A stable hinge joint
- With articulations between humerus, radius, and ulna

Articulations of the Elbow

- Humeroulnar joint:
  - largest articulation
  - trochlea of humerus and trochlear notch of ulna
  - limited movement
- Humeroradial joint:
  - smaller articulation
  - capitulum of humerus and head of radius

Elbow Muscles

- Biceps brachii muscle:
  - controls elbow flexion in supinated position
- Brachioradialis muscle:
  - controls elbow flexion in pronated position
- Triceps brachii muscle:
  - controls elbow extension

Elbow Ligaments

- Radial collateral
- Annular
- Ulnar collateral
ARTICULATIONS
PART III (C): SPECIFIC JOINTS
COXAL (HIP) JOINT

Coxal (Hip)

• Round head of femur
• Deep acetabulum
  - Enlarged by acetabular labrum
• Movements
  - Flexion/extension
  - Abduction/adduction
  - Medial/lateral rotation
  - Circumduction

Socket of the Coxal Joint

• Acetabular labrum:
  - deepens socket of acetabulum
  - fibrocartilage lining
  - extends past the bone

Ligaments of the Coxal (Hip) Joint

• Iliofemoral
• Pubofemoral
• Ischiofemoral
• Transverse acetabular
• Ligamentum teres
ARTICULATIONS
PART III (D): SPECIFIC JOINTS
TIBIOFEMORAL (KNEE) JOINT

Tibiofemoral (Knee)

- Largest, most complex, and weakest joint
- Modified hinge, with some rotation
- 3-separate joints
  - Medial femoral & medial tibial condyles
  - Lateral femoral & lateral tibial condyles
  - Patella & femur

Rotation at the Knee

- Foot fixed
  - Extension ends in medial femoral rotation
- Foot free
  - Extension ends in lateral tibial rotation
- Medial condyle articular surface is longer than the lateral condyle

Cruciate Ligaments

- Anterior Cruciate
  - Taut when knee is fully extended
  - Prevents backward dislocation of femur
  - Prevents hyperextension
- Posterior Cruciate
  - Tightens with flexion
  - Prevents forward dislocation of femur

Menisci

- Crescent-shaped fibrocartilagenous plates
- Cushions the ends of femur and tibia
- Deepen the articular surface
  - Adjust for differences in femoral surfaces
  - Increases stability of the knee

7 Ligaments of the Knee Joint

- Patellar ligament (anterior)
- 2 popliteal ligaments (posterior)
- Anterior and posterior cruciate ligaments (inside joint capsule)
- Medial collateral ligament (tibial)
- Lateral collateral ligament (fibular)