Articulations and Movement

Pronation

Supination
Articulations or Joints

• **Articulation or Joint**
  – Place where two bones come together
  – Freely movable to limited to no apparent movement
  – Structure correlated with movement

• **Named**
  – According to bones or parts united at joint
  – According to only one of articulating bones
  – By Latin equivalent of common name
Classification of Joints

• **Structural**: Based on major connective tissue type that binds bones
  – Fibrous
  – Cartilaginous
  – Synovial

• **Functional**: Based on degree of motion
  – Synarthrosis: Nonmovable
  – Amphiarthrosis: Slightly movable
  – Diarthrosis: Freely movable
Fibrous joints

• **Suture**
  – Bones tightly bound by minimal fiber
  – Only found in skull

• **Syndemoses**
  – Bones connected by ligaments
  – E.g. tibiofibular ligament, interosseous membrane of radius/ulna

• **Gomphoses**
  – Peg in socket joint
  – Only found in teeth/alveoli

Fig. 9.1 a, M&M
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Cartilaginous Joints

- **Synchondroses**
  - Hyaline cartilage unites bones
  - Epiphyseal growth plates
  - Costal cartilage-sternum

- **Symphysis**
  - Fibrocartilage unites bones
  - Pubic symphysis
  - Intervertebral disc

Fig. 9.2, M&M
Synovial Joints

• Most common joints in body
• Most mobile joints
• Have
  – Articular surfaces on bone with hyaline cartilage
  – Completely enclosed joint capsule formed from ligamentous connective tissue
  – Synovial fluid within capsule lubricates joint
  – Some have meniscus or articular disc (e.g. knee, jaw joint)
Synovial joints

• Components of synovial joints
  – Articular cartilage
    • Resemble hyaline cartilage
      – Matrix contains more water comparatively
    • Has no perichondrium
    • Slick and smooth, so reduce friction
    • Separated by thin film of synovial fluid
Components of synovial joints (continued)

- **Joint capsule**
  - Dense and fibrous
  - May be reinforced with accessory structures (tendons and ligaments)
  - Continuous with periosteum of each bone
Components of synovial joints (continued)

- **Synovial fluid**
  - Similar in texture to egg whites
  - Produced at the synovial membrane
  - Circulates from areolar tissue to joint cavity
  - Percolates through articular cartilages
  - Total quantity is less than 3 mL
Functions of synovial fluid

- **Lubrication**
  - With articular cartilage compression, synovial fluid is squeezed out and reduces friction between moving surfaces

- **Synovial fluid distribution**
  - Provide nutrients and oxygen, as well as waste disposal for the chondrocytes of articular cartilages
  - Compression and reexpansion of articular cartilages pump synovial fluid in and out of cartilage matrix

- **Synovial fluid absorption**
  - Distributes compression forces across articular surfaces and outward to joint capsule
Joint Accessory

- **Bursa** (a pouch)
  - Small pocket filled with synovial fluid
  - Often form in areas where tendon or ligament rubs against other tissues
  - Reduce friction and act as shock absorbers
Accessory structures in knee (continued)

- **Fat pads**
  - Adipose tissue covered by synovial membrane
  - Protect articular cartilages
  - Act as packing material for joint

- **Meniscus (a crescent)**
  - Pad of fibrous cartilage between bones of synovial joint
  - May subdivide joint cavity and affect fluid flow or allow variations in shapes of articular surfaces
• Accessory structures in knee
  – Tendons of quadriceps
    • Pass across joint
      – Limit movement
    – Provide mechanical support
• Accessory ligaments
• ________________, strengthen, and reinforce joint
• Intrinsic ligaments
  – Localized thickening of joint capsule
  – Example: cruciate ligaments of knee
• ________________ ligaments
  – Separate from joint capsule
  – May pass inside (intracapsular) or outside (extracapsular) the joint capsule
  – Intracapsular example: cruciate ligaments
  – Extracapsular example: patellar ligament
Synovial joints

- **Motion vs. strength in joints**
  - Greater range of motion = ____________ joint
    - Examples:
      - Synarthrosis (strongest type of joint, no movement)
      - Diarthrosis (far weaker but broad range of motion)
- **Displacement (luxation)**
  - Movement beyond normal range of motion
  - Articulating surfaces forced out of position
  - Can damage joint structures
  - No pain from inside joint but from nerves or surrounding structures
Types of Synovial Joints

- Plane or gliding
- Saddle
- Hinge
- Pivot
- Ball-and-socket
- Ellipsoid
Plane and Pivot Joints

- Plane or Gliding joints
  - Monoaxial
  - Example: Articular processes between vertebrae

- Pivot joints
  - Monoaxial
  - Example: Articulation between dens of axis and atlas
Saddle and Hinge Joints

- Saddle Joints
  - Biaxial
  - Example: Thumb

- Hinge Joints
  - Monoaxial
  - Example: elbow, knee
Ellipsoid and Ball-and-Socket Joints

- **Ellipsoid**
  - Modified ball-and-socket
  - Biaxial
  - Example: Atlantooccipital joint

- **Ball-and-socket**
  - Multiaxial
  - Examples: shoulder and hip joints
Types of Movement

• **Gliding**

• **Angular**
  – Flexion and Extension
    • Hyperextension
    • Plantar and Dorsiflexion
  – Abduction and Adduction

• **Circular**
  – Rotation
  – Pronation and Supination
  – Circumduction
Flexion and Extension
Dorsiflexion and Plantar Flexion
Abduction and Adduction
Rotation and Pronation and Supination

Lateral rotation

Medial rotation

Pronation

Supination
Circumduction
Special Movements

• **Unique** to only **one or two** joints

• **Types**
  – Elevation and Depression
  – Protraction and Retraction
  – Opposition and Reposition
  – Inversion and Eversion
Elevation and Depression
Protraction and Retraction
Excursion

Lateral excursion to the right

Lateral excursion to the left

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Opposition and Reposition
Inversion and Eversion
Range of Motion

- Amount of **mobility** demonstrated **at a given joint**
- **Types**
  - Active
  - Passive
- **Influenced by**
  - Shape of articular surfaces forming joint
  - Amount and shape of cartilage covering surfaces
  - Strength and location of ligaments and tendons
  - Location of muscles associated with joint
  - Amount of fluid in and around joint
  - Amount of use/disuse of joint
  - Amount of pain in and around joint
Effects of Aging on Joints

• Tissue repair slows
• Production of synovial fluid declines
• Ligaments and tendons become less flexible
• Decrease in ROM
Joint Disorders

• Arthritis
  – Osteoarthritis: Wear and tear
  – Rheumatoid: Caused by transient infection or autoimmune disease

• Joint infections
  – Lyme disease: Tick vector

• Gout
  – Metabolic disorders of unknown cause (idiopathic)
X-ray of hand affected by arthritis
Artificial Hip Joint