The Skeletal System
Joints

- Articulations of bones

- Functions of joints
  - Hold bones together
  - Allow for mobility

- Ways joints are classified
  - Functionally
  - Structurally
Functional Classification of Joints

- Synarthroses
  - Immovable joints
- Amphiarthroses
  - Slightly moveable joints
- Diarthroses
  - Freely moveable joints
Structural Classification of Joints

- **Fibrous joints**
  - Generally immovable

- **Cartilaginous joints**
  - Immovable or slightly moveable

- **Synovial joints**
  - Freely moveable
## Summary of Joint Classes

<table>
<thead>
<tr>
<th>Structural class</th>
<th>Structural characteristics</th>
<th>Types</th>
<th>Mobility</th>
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</thead>
<tbody>
<tr>
<td>Fibrous</td>
<td>Bone ends/parts united by collagenic fibers</td>
<td>Suture (short fibers)</td>
<td>Immobile (synarthrosis)</td>
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<td></td>
<td></td>
<td>Syndesmosis (longer fibers)</td>
<td>Slightly mobile (amphiarthrosis) and immobile</td>
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<td></td>
<td></td>
<td>Gomphosis (periodontal ligament)</td>
<td>Immobile</td>
</tr>
<tr>
<td>Cartilaginous</td>
<td>Bone ends/parts united by cartilage</td>
<td>Synchondrosis (hyaline cartilage)</td>
<td>Immobile</td>
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<td></td>
<td></td>
<td>Symphysis (fibrocartilage)</td>
<td>Slightly movable</td>
</tr>
<tr>
<td>Synovial</td>
<td>Bone ends/parts covered with articular cartilage and enclosed within an articular capsule lined with synovial membrane</td>
<td>Plane</td>
<td>Freely movable (diarthrosis; movements depend on design of joint)</td>
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<td></td>
<td></td>
<td>Hinge</td>
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<td></td>
<td>Pivot</td>
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</tbody>
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Fibrous Joints

- Bones united by fibrous tissue

**Example:**

- Sutures
- Syndesmoses
  - Allows more movement than sutures
  - **Example:** Distal end of tibia and fibula
Fibrous Joints

Figure 5.28a–b
Cartilaginous Joints

- Bones connected by cartilage
- **Example:**
  - Pubic symphysis
  - Intervertebral joints
Synovial Joints

- Articulating bones are separated by a joint cavity
- Synovial fluid is found in the joint cavity
Synovial Joints

Figure 5.28f–h
Features of Synovial Joints

- Articular cartilage (hyaline cartilage) covers the ends of bones
- A fibrous articular capsule encloses joint surfaces
- A joint cavity is filled with synovial fluid
- Ligaments reinforce the joint
Structures Associated with the Synovial Joint

- **Bursae**—flattened fibrous sacs
  - Lined with synovial membranes
  - Filled with synovial fluid
  - Not actually part of the joint
- **Tendon sheath**
  - Elongated bursa that wraps around a tendon
The Synovial Joint

Acromion of scapula

Ligament

Bursa

Ligament

Joint cavity containing synovial fluid

Articular (hyaline) cartilage

Synovial membrane

Fibrous articular capsule

Tendon sheath

Tendon of biceps muscle

Humerus

Figure 5.29
Types of Synovial Joints

(a) Plane joint
(b) Hinge joint
(c) Pivot joint

Figure 5.30a–c
Types of Synovial Joints

(d) Condyloid joint

(e) Saddle joint

(f) Ball-and-socket joint

Figure 5.30d–f
Inflammatory Conditions Associated with Joints

- **Bursitis**—inflammation of a bursa usually caused by a blow or friction
- **Tendonitis**—inflammation of tendon sheaths
- **Arthritis**—inflammatory or degenerative diseases of joints
  - Over 100 different types
  - The most widespread crippling disease in the United States
Clinical Forms of Arthritis

- **Osteoarthritis**
  - Most common chronic arthritis
  - Probably related to normal aging processes

- **Rheumatoid arthritis**
  - An autoimmune disease—the immune system attacks the joints
  - Symptoms begin with bilateral inflammation of certain joints
  - Often leads to deformities
Clinical Forms of Arthritis

- Gouty arthritis
  - Inflammation of joints is caused by a deposition of uric acid crystals from the blood
  - Can usually be controlled with diet
Developmental Aspects of the Skeletal System

- At birth, the skull bones are incomplete.
- Bones are joined by fibrous membranes called fontanels.
- Fontanels are completely replaced with bone within two years after birth.
Ossification Centers in a 12-week-old Fetus

Figure 5.32
Skeletal Changes Throughout Life

- **Fetus**
  - Long bones are formed of hyaline cartilage
  - Flat bones begin as fibrous membranes
  - Flat and long bone models are converted to bone

- **Birth**
  - Fontanels remain until around age 2
Skeletal Changes Throughout Life

- **Adolescence**
  - Epiphyseal plates become ossified and long bone growth ends
- **Size of cranium in relationship to body**
  - 2 years old—skull is larger in proportion to the body compared to that of an adult
  - 8 or 9 years old—skull is near adult size and proportion
  - Between ages 6 and 11, the face grows out from the skull
Skeletal Changes Throughout Life

(a) Human newborn

(b) Human adult
Skeletal Changes Throughout Life

Figure 5.33b

Newborn  2 yrs.  5 yrs.  15 yrs.  Adult
(b)
Skeletal Changes Throughout Life

- Curvatures of the spine
  - Primary curvatures are present at birth and are convex posteriorly
  - Secondary curvatures are associated with a child’s later development and are convex anteriorly
  - Abnormal spinal curvatures (scoliosis and lordosis) are often congenital
Skeletal Changes Throughout Life

Figure 5.16

Scoliosis

Kyphosis

Lordosis
Skeletal Changes Throughout Life

- **Osteoporosis**
  - Bone-thinning disease afflicting
    - 50% of women over age 65
    - 20% of men over age 70
  - Disease makes bones fragile and bones can easily fracture
  - Vertebral collapse results in kyphosis (also known as dowager’s hump)
  - Estrogen aids in health and normal density of a female skeleton
Skeletal Changes Throughout Life

Figure 5.34
Skeletal Changes Throughout Life

Age 40  
Age 60  
Age 70  

Figure 5.35