

Articulations

A look at the structural and functional classification of joints and the movements they provide

Joints

- Rigid elements of the skeleton meet at joints or articulations
- Greek root “arthro” means joint
- Articulations can be:
 - Bone to bone
 - Bone to cartilage
 - Teeth in bony sockets
- Structure of joints
 - Enables resistance to crushing, tearing, and other forces

Classifications of Joints

- Joints can be classified by function or structure
- **Functional classification** – based on amount of movement
 - Synarthroses –
 - immovable – common in axial skeleton
 - Amphiarthroses –
 - slightly movable – common in axial skeleton
 - Diarthroses –
 - freely movable – common in appendicular skeleton

Classifications of Joints

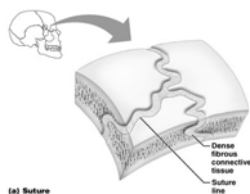
- **Structural classification** based on:
 - Material that binds bones together
 - Presence or absence of a joint cavity
 - Structural classifications include
 - Fibrous
 - Cartilaginous
 - Synovial

Synarthroses

- Immovable joints
- Do not have a joint cavity
- May be Fibrous or Cartilaginous
 - sutures – i.e. coronal suture
 - Synchondrosis – epiphyseal plates
 - Gomphoses – i.e. your teeth!

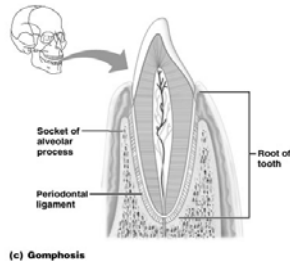
Synarthroses: Sutures

- Bones are tightly bound by a minimal amount of fibrous tissue
- Only occur between the bones of the skull
- Allow bone growth so that the skull can expand with brain during childhood



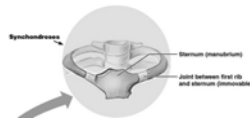
Synarthroses: Gomphoses

- Tooth in a socket
- Connecting ligament – the periodontal ligament

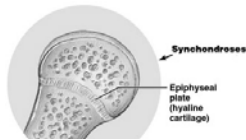


Synarthroses: Synchondroses

- Cartilaginous Synarthritic Joints
 - Joint between first rib and manubrium



- Hyaline cartilage unites bones
 - Epiphyseal plates



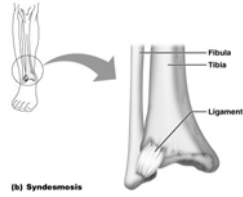
Amphiarthroses

- Slightly movable joints
- No joint cavity
- Amphiarthroses may be
 - Fibrous
 - cartilagenous

Amphiarthroses: Syndesmoses

■ Fibrous Amphiarthritic Joints

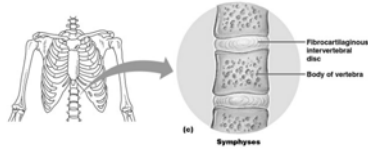
- Bones are connected exclusively by ligaments
- Amount of movement depends on length of fibers



Amphiarthroses: Symphyses

■ Cartilaginous Amphiarthritic Joint

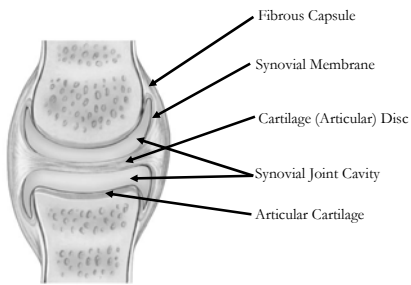
- Fibrocartilage unites bones – resists tension and compression
- Slightly movable joints that provide strength with flexibility
 - Intervertebral discs
 - Pubic symphysis



Diarthroses

- Most movable type of joint
- Diarthroses are synovial
 - Each contains a fluid-filled joint cavity called a synovial cavity.

A Typical Synovial Joint



How Synovial Joints Function

- Synovial joints – lubricating devices
- Friction could overheat and destroy joint tissue
- Are subjected to compressive forces
 - Fluid is squeezed out as opposing cartilages touch
 - Cartilages ride on the slippery film

Factors Influencing Joint Stability

- Articular surfaces
 - seldom play a major role in joint stability
 - *Exceptions:* the elbow, the knee and the hip do provide stability
- Ligaments
 - the more ligaments in a joint, the stronger it is
- Muscle tone
 - the most important factor in joint stability
 - keeps tension on muscle tendons

Movements Allowed by Synovial Joints

- Three basic types of movement
 - Gliding – one bone across the surface of another
 - Angular movement – movements change the angle between bones
 - Rotation – movement around a bone's long axis
- And a host of “special movements”
 - Supination / Pronation
 - Dorsiflexion / Plantar flexion
 - Inversion / Eversion
 - Projection / Retraction
 - Elevation / Depression
 - Opposition

Gliding Joints

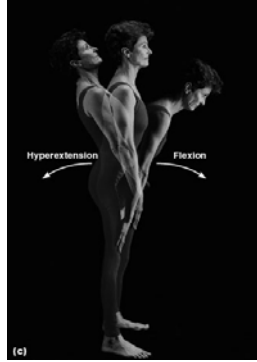
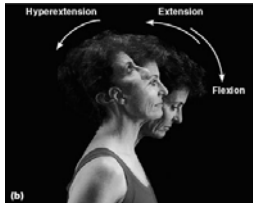
- Flat surfaces of two bones slip across each other
- Gliding occurs between
 - Carpals
 - Articular processes of vertebrae
 - Tarsals



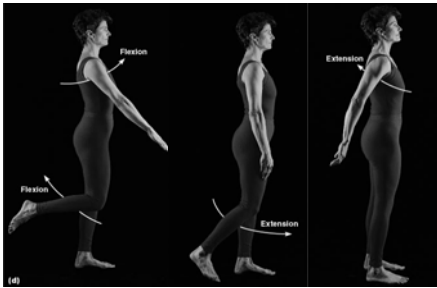
Angular Movements

- Increase or decrease angle between bones
- Movements involve:
 - Flexion and Extension
 - Flexion: movement decreases the joint angle
 - Extension: movement that increases the joint angle
 - Abduction and Adduction
 - Abduction: movement away from midline
 - Adduction: movement towards midline
 - Circumduction
 - Circular motion allowed by a joint

Angular Movements



Angular Movements



Angular Movements

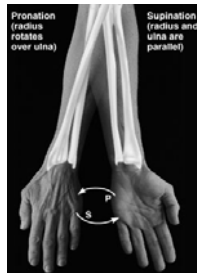


Rotation

- Involves turning movement of a bone around its long axis
 - The only movement allowed between atlas and axis vertebrae
 - Occurs at the hip and shoulder joints

Special Movements

- Supination
 - forearm rotates laterally & palm faces anteriorly
- Pronation
 - forearm rotates medially & palm faces posteriorly



Special Movements

- Dorsiflexion
 - lifting the foot so its superior surface approaches the shin
- Plantar flexion
 - depressing the foot – pointing the toes downward

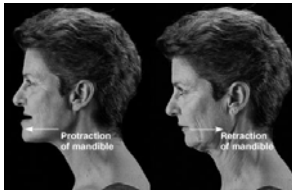
Special Movements

- Inversion
 - turning the sole medially
- Eversion
 - turning the sole laterally



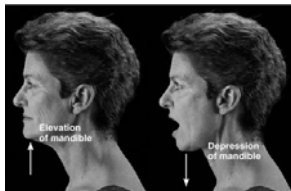
Special Movements

- Protraction
 - nonangular movement of jutting out the jaw
- Retraction
 - opposite movement to protraction



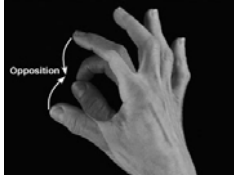
Special Movements

- Elevation
 - lifting a body superiorly
- Depression
 - moving the elevated part inferiorly



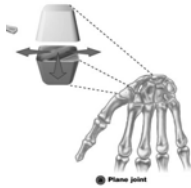
Special Movements

- Opposition
 - movement of the thumb to touch the tips of other fingers



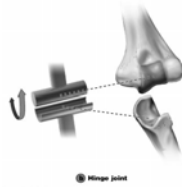
Synovial Joints Classified by Structure

- Plane joint
 - Articular surfaces are flat planes
 - Short gliding movements are allowed
 - Intertarsal and intercarpal joints
 - Movements are **nonaxial**
 - Gliding does not involve rotation around any axis
 - Considered a translational movement



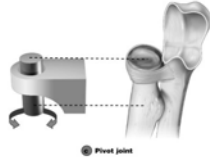
Synovial Joints Classified by Structure

- Hinge joints
 - Cylindrical end of one bone fits into a trough on another bone
 - Angular movement is allowed in one plane
 - Elbow, ankle, and joints between phalanges
 - Movement is **uniaxial** – allows movement around one axis only



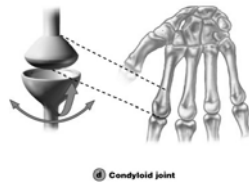
Synovial Joints Classified by Structure

- Pivot joints
 - Classified as **uniaxial**
 - rotating bone only turns around its long axis
 - Examples
 - Proximal radioulnar joint
 - Joint between atlas and axis



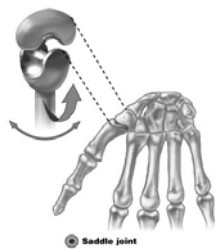
Synovial Joints Classified by Structure

- Condylloid (Saddle) joints
 - Allow moving bone to travel:
 - Side to side – abduction-adduction
 - Back and forth – flexion-extension
 - Classified as **biaxial**
 - movement occurs around two axes



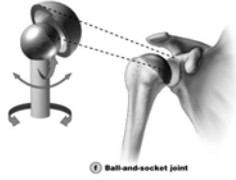
Synovial Joints Classified by Structure

- Saddle joints
 - Each articular surface has concave and convex surfaces
 - Classified as **biaxial** joints



Synovial Joints Classified by Structure

- Ball-and-socket joints
 - Spherical head of one bone fits into round socket of another
 - Classified as **multiaxial** – allow movement in all axes
 - Examples: shoulder and hip joints



General Joint Concerns & Issues

- Structure of joints makes them prone to traumatic stress
- Function of joints makes them subject to friction and wear
- Affected by inflammatory and degenerative processes

Joint Injuries

- Sprains – ligaments of a reinforcing joint are stretched or torn
- Dislocation – occurs when the bones of a joint are forced out of alignment
 - Luxation = complete dislocation
 - Subluxation = partial dislocation
- Torn cartilage – common injury to meniscus of knee joint

Inflammatory and Degenerative Conditions

- Bursitis – inflammation of a bursa do to injury or friction
- Tendonitis – inflammation of a tendon sheath
- Arthritis – describes over 100 kinds of joint-damaging diseases
 - Osteoarthritis – most common type – “wear and tear” arthritis
 - Rheumatoid arthritis – a chronic inflammatory disorder
 - Gouty arthritis (gout) – uric acid build-up causes pain in joints
- Lyme disease – inflammatory disease often resulting in joint pain

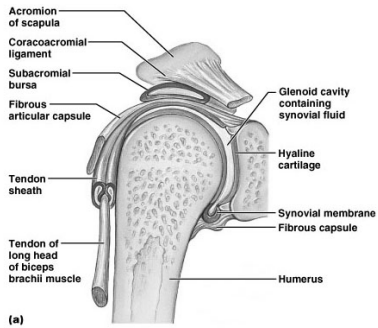
Additional Joint Information

Anatomy of Shoulder, Elbow, Hip & Knee Joints

Selected Synovial Joints - Shoulder

- Shoulder (Glenohumeral) joint – General Characteristics
 - The most freely movable joint – lacks stability
 - Articular capsule is thin and loose
 - Muscle tendons contribute to joint stability

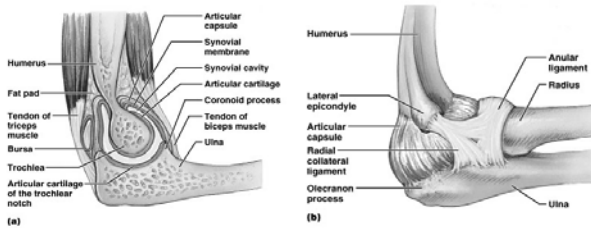
Glenohumeral Joint



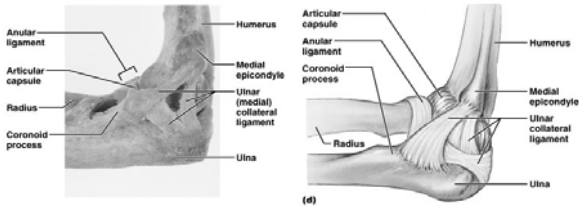
Selected Synovial Joints

- Elbow joint – General Characteristics
 - Allows flexion and extension
 - The humerus' articulation with ulna forms the hinge
 - Tendons of biceps and triceps brachii provide stability

Elbow Joint



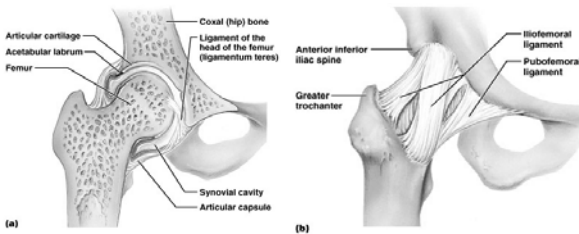
Elbow Joint



Selected Synovial Joints

- Hip joint – General Characteristics
 - A ball-and-socket structure
 - Movements occur in all axes – limited by ligaments and acetabulum
 - Head of femur articulates with acetabulum
 - Muscle tendons contributes to stability, however
 - Stability comes chiefly from acetabulum and capsular ligaments

Frontal Section and Anterior View of the Hip Joint



Posterior View of the Hip Joint

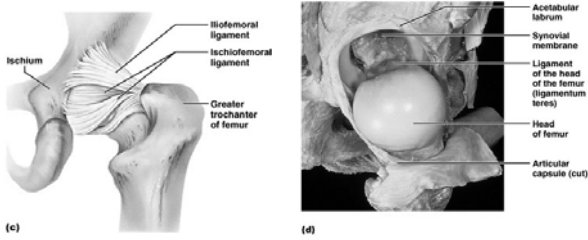


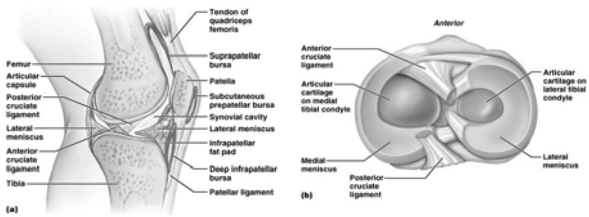
Figure 9.13c, d

Selected Synovial Joints

- Knee joint – General Characteristics
 - The largest and most complex joint
 - Primarily acts as a hinge joint
 - Has some capacity for rotation when leg is flexed
 - Two fibrocartilage menisci occur within the joint cavity

Sagittal Section of Knee Joint

Superior View of Knee Joint



Anterior View of Flexed Knee

