

Joins and Articulations

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Joins (Articulations)

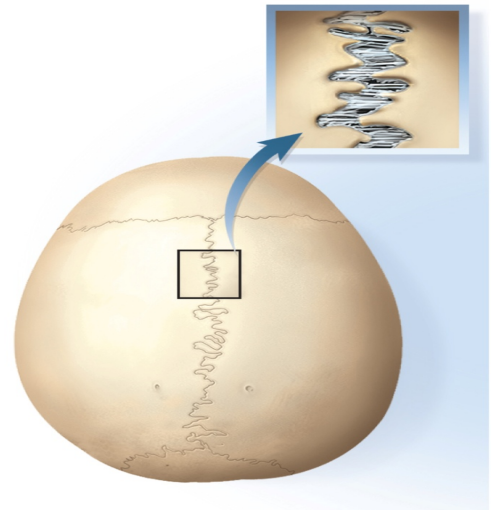
- Joint (articulation) – any point where two bones meet, whether or not the bones are movable at that interface
- Arthrology – science of joint structure, function, and dysfunction
- Kinesiology – the study of musculoskeletal movement
- Joins can be classified by function or structure
 - Functional classification is 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
 - Structural classification is based on:
 - Material that binds bones together
 - Presence or absence of a joint cavity
 - Structural classifications include:
 - Fibrous
 - Cartilaginous
 - Synovial
- Joint name – typically derived from the names of the bones involved
 - atlanto-occipital joint
 - glenohumeral joint
 - radioulnar joint

Four major joint categories

- Bony joints
- Fibrous joints
- Cartilaginous joints
- Synovial joints

Bony Joint (Synostosis)

- Bony joint, or synostosis – an immovable joint formed when the gap between two bones ossify, and they become in effect, a single bone
 - frontal and mandibular bones in infants
 - cranial sutures in elderly
 - attachment of first rib and sternum with old age
- Can occur in either fibrous or cartilaginous joint

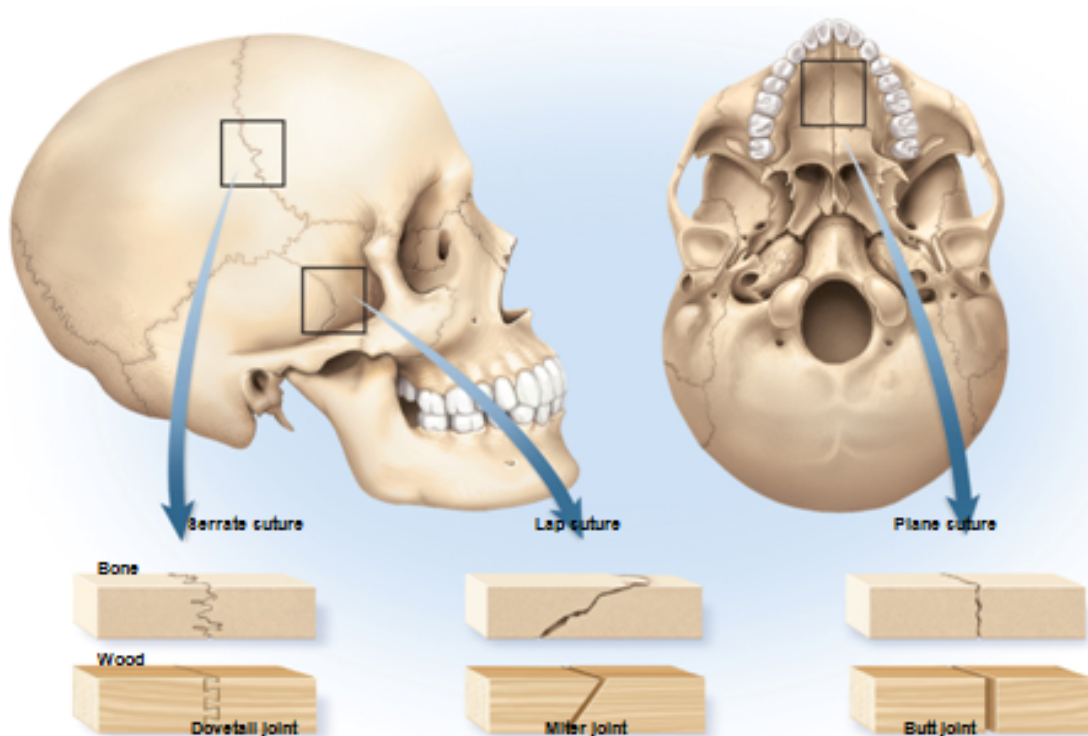


Fibrous Joints (Synarthrosis)

- Fibrous joint, synarthrosis, or synarthrodial joint – a point at which adjacent bones are bound by collagen fibers that emerge from one bone, cross the space between them, and penetrate into the other
 - Do not have a joint cavity
 - Most are immovable or slightly movable
- Three kinds of fibrous joints
 - sutures
 - gomphoses
 - syndesmoses

Fibrous Joints - Sutures

- Sutures - immovable or slightly movable fibrous joints that closely bind the bones of the skull to each other
- Fibrous tissue ossifies in middle age
 - Synostoses—closed sutures
- Sutures can be classified as:
 - serrate – interlocking wavy lines
 - coronal, sagittal and lambdoid sutures
 - lap (squamous)- overlapping beveled edges
 - temporal and parietal bones
 - plane (butt)- straight, nonoverlapping edges
 - palatine processes of the maxillae



Fibrous Joint - Gomphoses

- Gomphosis - attachment of a tooth to its socket
- Held in place by fibrous periodontal ligament
 - collagen fibers attach tooth to jawbone
 - allows the tooth to move a little under the stress of chewing

Fibrous Joint - Syndesmosis

- Bones are connected exclusively by ligaments
- Syndesmosis – a fibrous joint at which two bones are bound by longer collagenous fibers than in a suture or gomphosis giving the bones more mobility
 - interosseus membrane
- Amount of movement depends on length of fibers
- Tibiofibular joint—immovable synarthrosis
 - Interosseous membrane between radius and ulna
 - Freely movable diarthrosis

Cartilaginous Joints

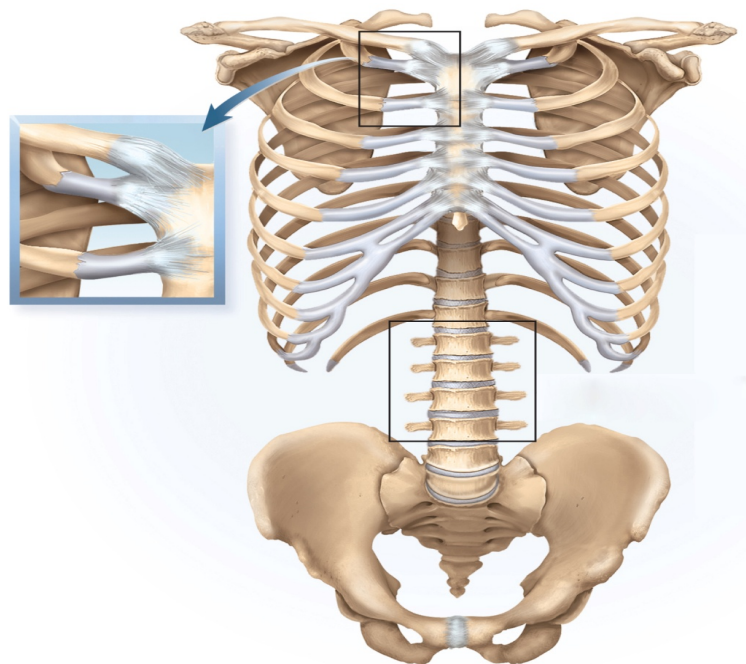
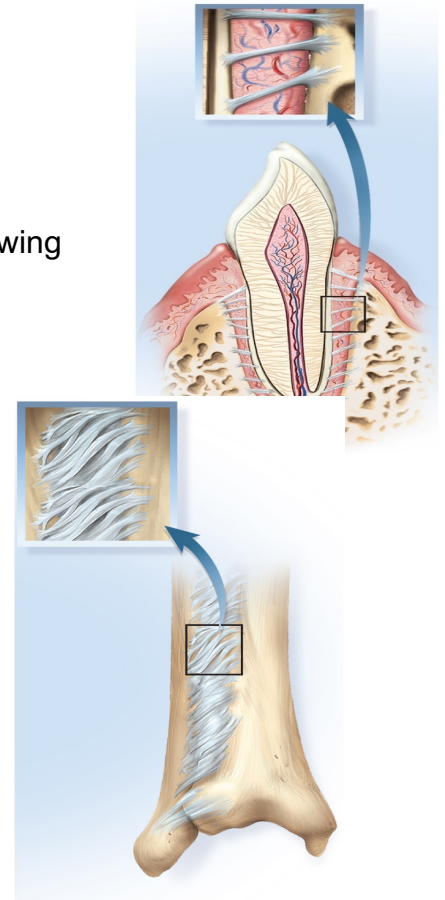
- Two bones are linked by cartilage
 - cartilaginous joint or amphiarthrosis joint or amphiarthrodial joint
- Two types of cartilaginous joints
 - synchondroses
 - symphyses

Cartilaginous Joint - Synchondrosis

- Synchondrosis - bones are bound by hyaline cartilage
 - epiphyseal plate in children
 - first rib attachment to sternum
 - other costal cartilages are joined to sternum by synovial joints

Cartilaginous Joint - Symphysis

- Symphysis - two bones joined by fibrocartilage
 - pubic symphysis in which right and left pubic bones joined by interpubic disc
 - bodies of vertebrae and intervertebral disc

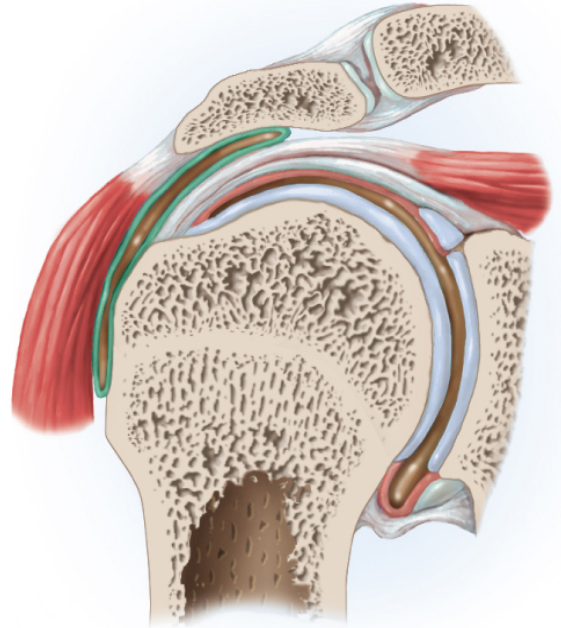


Synovial Joint

- Synovial joint, diarthrosis or diarthrodial joint – joint in which two bones are separated by a space called a joint cavity
- A majority of all joints
- Most are freely movable
- Most structurally complex type of joint
- Most likely to develop painful dysfunction
- Their mobility makes them important to quality of life

General Anatomy

- Articular cartilage – layer of hyaline cartilage that covers the facing surfaces of two bones
- Joint (articular) cavity – separates articular surfaces
- Synovial fluid – slippery lubricant in joint cavity
 - Gives it a viscous, slippery texture like raw egg whites
 - A filtrate of blood
 - Arises from capillaries in synovial membrane
 - Weeping lubrication—Pressure on joints squeezes synovial fluid into and out of articular cartilage
 - Nourishes articular cartilage and removes waste
 - Makes movement of synovial joints almost friction free



Joint (articular) capsule

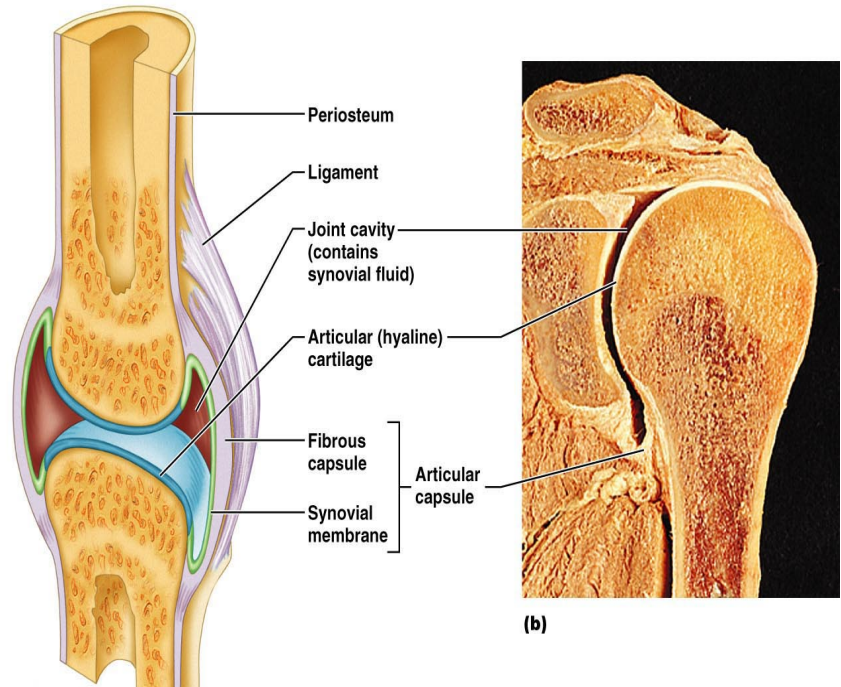
- Connective tissue that encloses the cavity and retains the fluid
 - outer fibrous capsule – continuous with periosteum of adjoining bones
 - Inner synovial membrane – composed mainly of cells that secrete synovial fluid and macrophages that remove debris from the joint cavity
- In a few synovial joints, fibrocartilage grows inward from the joint capsule
 - articular disc forms a pad between bones
 - temporomandibular joint, distal radioulnar joints, sternoclavicular and acromioclavicular joints
 - meniscus – in the knee, two cartilages extend inward from the left and right
 - these cartilages absorb shock and pressure
 - guide bones across each other
 - improve the fit between bones
 - stabilize the joints, reducing the chance of dislocation

Accessory structures associated with synovial joints

- Tendon – attaches muscle to bone
- Ligament – attaches bone to bone
- Bursa – a fibrous sac filled with synovial fluid, located between adjacent muscles, where tendon passes over bone, or between bone and skin
 - cushion muscles
 - helps tendons slide more easily over joints
 - modify direction of tendon pull

General Structure of Synovial Joints

- Reinforcing ligaments
- Often are thickened parts of the fibrous layer
 - Sometimes are extracapsular ligaments—located outside the capsule
 - Sometimes are intracapsular ligaments—located internal to the capsule
- Richly supplied with sensory nerves
 - Detect pain
 - Most monitor how much the capsule is being stretched
- Have a rich blood supply
 - Most supply the synovial membrane
 - Extensive capillary beds produce basis of synovial fluid



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

Bursae and Tendon Sheaths

- Bursae and tendon sheaths are not synovial joints
 - Closed bags of lubricant
 - Reduce friction between body elements
- Bursa—a flattened fibrous sac lined by a synovial membrane
- Tendon sheath—an elongated bursa that wraps around a tendon

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

Exercise and Articular Cartilage

- Exercise warms synovial fluid
- Cartilage then swells and provides a more effective cushion against compression
- Warm-up period before vigorous exercise helps protect cartilage from undue wear and tear
- Compression during exercise squeezes fluid and metabolic waste out of the cartilage
- When weight removed, cartilage absorbs synovial fluid like a sponge taking in oxygen and nutrients
- Without exercise, cartilage deteriorates more rapidly from inadequate nutrition and waste removal

Classes of Synovial Joints

- Ball-and-Socket Joints
- Condylloid Joints
- Saddle Joints
- Plane or Gliding Joints
- Hinge Joints
- Pivot Joints

Ball-and-Socket Joints

- Smooth, hemispherical head fits within a cuplike socket
 - shoulder joint - head of humerus into glenoid cavity of scapula
 - hip joint - head of femur into acetabulum of hip bone

Condylloid Joints

- Oval convex surface on one bone fits into a complementary shaped depression on the other
 - radiocarpal joint of the wrist
 - metacarpophalangeal joints at the bases of the fingers



Saddle Joints

- Both bones have an articular surface that is shaped like a saddle, concave in one direction and convex in the other
 - base of the thumb
 - more movable than a condyloid or hinge joint forming the primate opposable thumb
 - sternoclavicular joint



Plane or Gliding Joints

- Flat articular surfaces in which bones slide over each other with relatively limited movement
 - carpal bones of wrist
 - tarsal bones of ankle
 - articular processes of vertebrae
- Although any one joint moves only slightly, the combined action of the many joints in wrist, ankle, and vertebral column allows for considerable movement



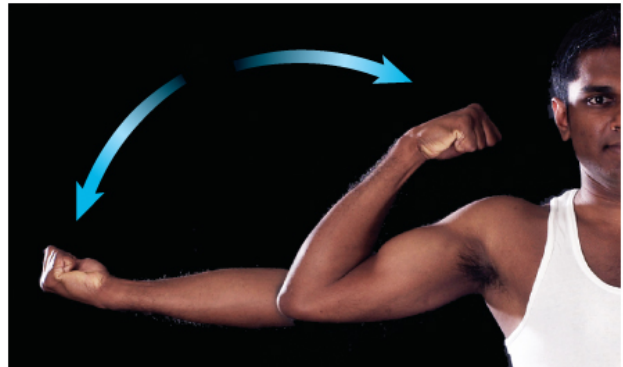
Hinge Joints

- One bone with convex surface that fits into a concave depression on other bone
 - elbow joint - ulna and humerus
 - knee joint - femur and tibia
 - finger and toe joints



Pivot Joints

- One bone has a projection that is held in place by a ring-like ligament bone spins on its longitudinal axis
 - atlantoaxial joint (dens of axis and atlas)
 - proximal radioulnar joint allows the radius to rotate during pronation and supination

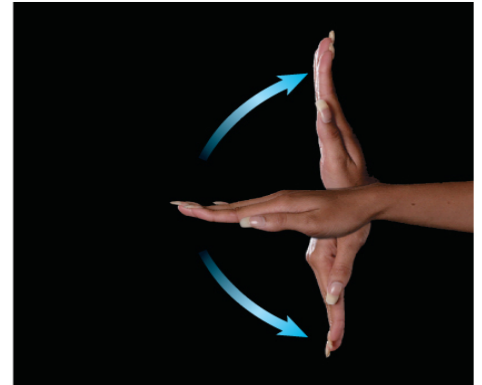


Movement of Synovial Joints

- Flexion and extension
- Abduction and adduction
- Elevation and depression
- Protraction and retraction
- Circumduction and rotation
- Supination and pronation

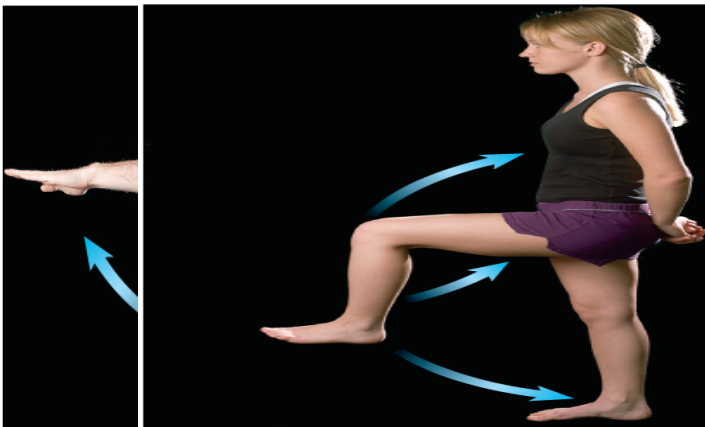
Range of Motion

- Range of motion (ROM) –the degrees through which a joint can move
 - an aspect of joint performance
 - physical assessment of a patient's joint flexibility
- Range of motion determined by
 - structure of the articular surfaces
 - strength and tautness of ligaments and joint capsules
 - action of the muscles and tendons



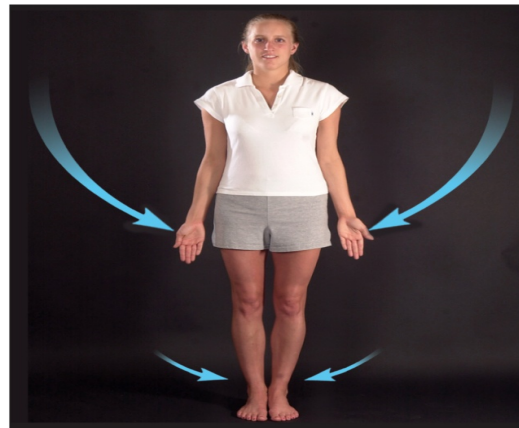
Flexion, Extension and Hyperextension

- Flexion – movement that decreases a joint angle
- Extension – movement that straightens a joint and generally returns a body part to the zero position
- Hyperextension – further extension of a joint beyond the zero position



Abduction and Adduction

- Abduction - movement of a body part away from the midline of the body
- Adduction - movement back toward the midline



Elevation and Depression

- Elevation - a movement that raises a body part vertically in the frontal plane
- Depression – lowers a body part in the same plane

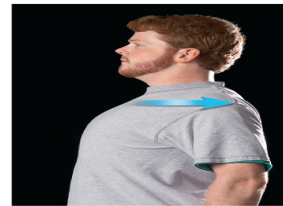


Protraction and Retraction

- Protraction – anterior movement of a body part in the transverse (horizontal) plane
- Retraction – posterior movement

Circumduction

- Circumduction - one end of an appendage remains stationary while the other end makes a circular motion
- Sequence of flexion, abduction, extension and adduction movements
 - baseball player winding up for a pitch



Rotation

- Rotation – movement in which a bone spins on its longitudinal axis
 - rotation of trunk, thigh, head or arm
- Medial (internal) rotation turns the bone inwards
- Lateral (external) rotation turns the bone outwards



Supination and Pronation

- Supination – forearm movement that turns the palm to face anteriorly or upward
 - forearm supinated in anatomical position
- Pronation – forearm movement that turns the palm to face posteriorly or downward

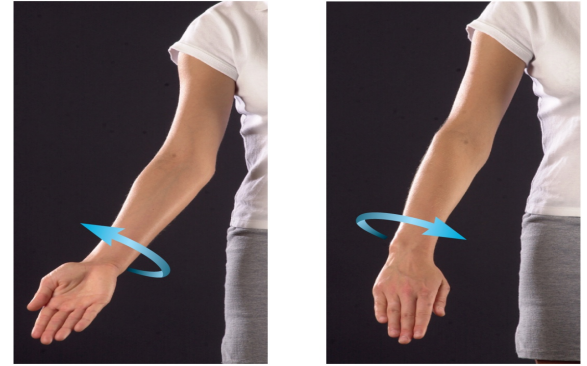


Movements of Head and Trunk

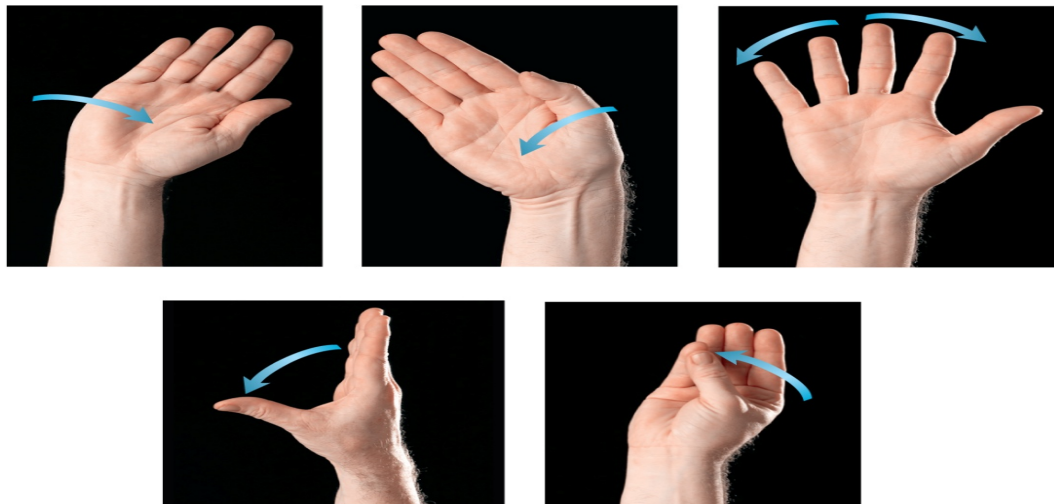
- Flexion, hyperextension, and lateral flexion of vertebral column

Special Movements of Mandible

- Lateral excursion – right or left movement from the zero position
- Medial excursion - movement back to the median, zero position
 - side-to-side grinding during chewing
- Protraction – retraction elevation - depression



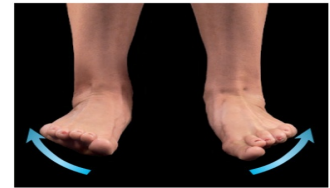
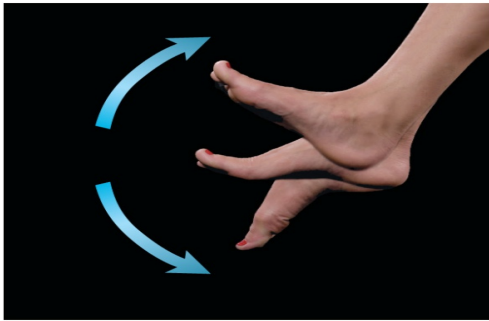
Special Movement of Hand and Digits



- Ulnar flexion – tilts the hand toward the little finger
- Radial flexion – tilts the hand toward the thumb
- Flexion of fingers – curling them
- Extension of fingers – straightening them
- Abduction of the fingers – spread them apart
- Adduction of the fingers – bring them together again
- Flexion of thumb – tip of thumb directed toward palm
- Extension of thumb – straightening the thumb
- Radial abduction – move thumb away from index finger 90°
- Palmar abduction – moves thumb away from hand and points it anteriorly
- Adduction of thumb – moves it to the zero position
- Opposition – move the thumb to touch the tips of any of the fingers
- Reposition – return the thumb to the zero position

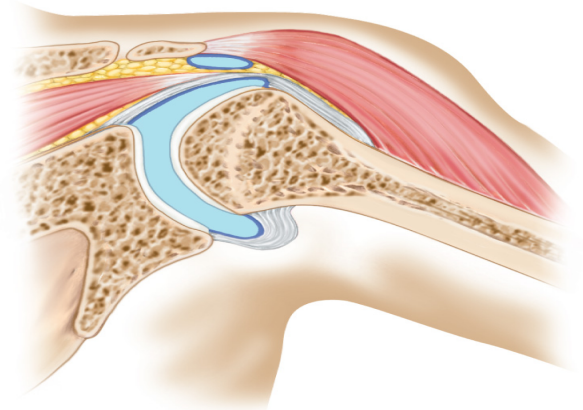
Special Movements of the Foot

- Dorsiflexion – elevation of the toes as you do while swinging the foot forward to take a step (heel strike)
- Plantar flexion - extension of the foot so that the toes point downward as in standing on tiptoe (toe-off)
- Inversion - a movement in which the soles are turned medially
- Eversion - a movement in which the soles are turned laterally



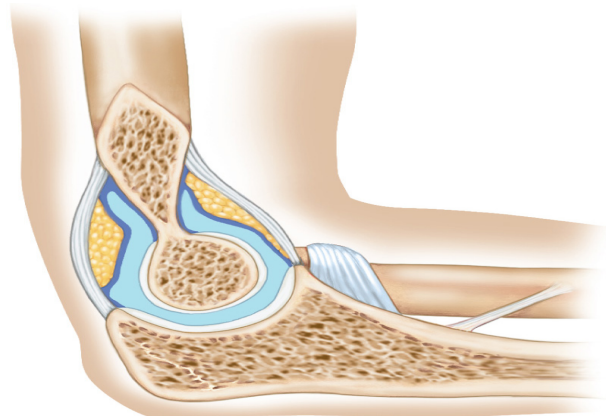
Shoulder Joint

- Ball-and-socket
 - Head of humerus and glenoid cavity of scapula
 - Loose joint capsule
 - Bursae
 - Ligaments prevent displacement
 - Very wide range of movement (circumduction)
- Gliding joint
 - Between acromion process and clavicle



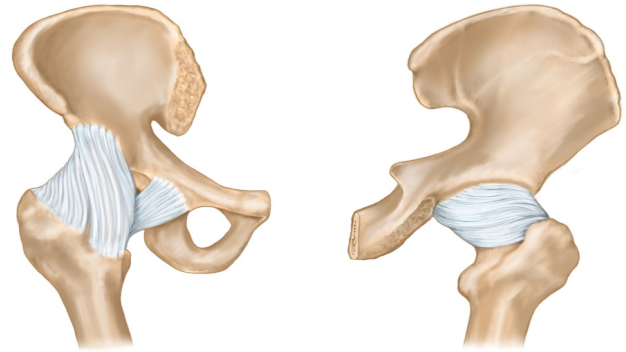
Elbow Joint

- Hinge joint
 - Trochlea of humerus
 - Trochlear notch of ulna
- Gliding joint
 - Capitulum of humerus
 - Head of radius
- Flexion and extension
- Many ligaments
- Stable joint



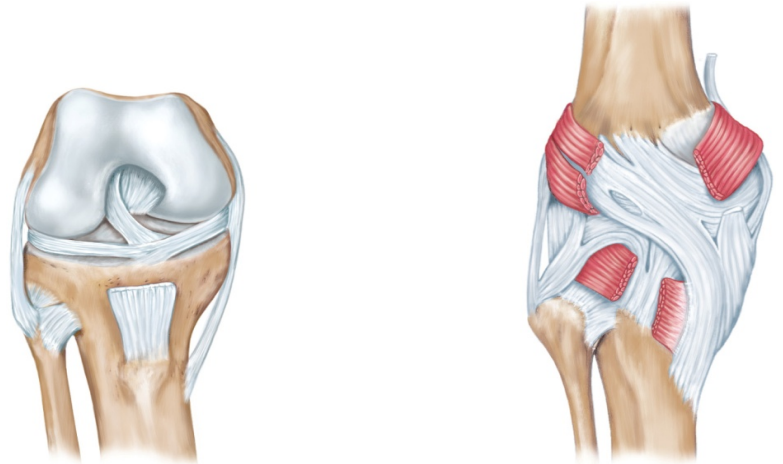
Hip Joint

- Ball-and-socket joint
- Head of femur and acetabulum of coxa
- Heavy joint capsule
- Many reinforcing ligaments
- Less freedom of movement than shoulder joint
- Circumduction



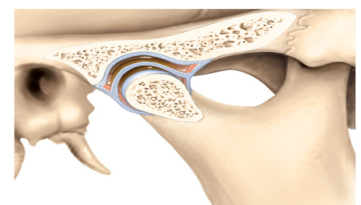
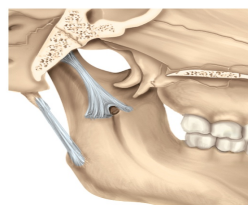
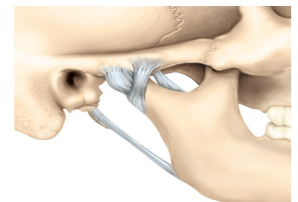
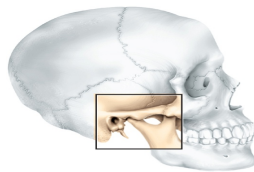
Knee Joint

- Largest joint
- Most complex in body – 3 joints
 - Medial and lateral condyles of distal end of femur and
 - Medial and lateral condyles of proximal end of tibia and
 - Femur articulates anteriorly with patella
- Strengthened by many ligaments and tendons
- Menisci separate femur and tibia
- Bursae



Temporomandibular Joint

- Temporomandibular (jaw) joint (TMJ) – articulation of the condyle of the mandible with the mandibular fossa of the temporal bone
 - combines elements of condylar, hinge, and plane joints
 - synovial cavity of the TMJ is divided into superior and inferior chambers by an articular disc
 - deep yawn or strenuous depression can dislocate the TMJ
 - condyles pop out of fossa and slip forward
 - relocated by pressing down on molar teeth while pushing the jaw backward



TMJ Syndrome

- May affect as many as 75 million Americans
- Signs and symptoms
 - can cause moderate intermittent facial pain
 - clicking sounds in the jaw
 - limitation of jaw movement
 - often severe headaches, vertigo (dizziness), tinnitus (ringing in the ears)
 - pain radiating from jaw down the neck, shoulders, and back
- Cause of syndrome
 - caused by combination of psychological tension and malocclusion (misalignment of teeth)
- Treatment
 - Psychological management, physical therapy, analgesic and anti-inflammatory drugs, corrective dental appliances to align teeth properly

Disorders of Joints

- 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

- Torn cartilage - common injury to meniscus of knee joint
- Sprains - ligament injury
- Strains – tendon injury
- Dislocation - occurs when the bones of a joint are forced out of alignment
- Bursitis - inflammation of a bursa due to injury or friction
- Tendonitis - inflammation of a tendon sheath

Inflammatory and Degenerative Conditions

- Arthritis - describes over 100 kinds of joint-damaging diseases
 - Osteoarthritis - most common type of “wear and tear” arthritis
 - Rheumatoid arthritis - a chronic inflammatory disorder
 - Gouty arthritis (gout) - uric acid buildup causes pain in joints
- Lyme disease - inflammatory disease often resulting in joint pain

The Joints Throughout Life

- Synovial joints develop from mesenchyme
 - By week 8 of fetal development, joints resemble adult joints
 - Outer region of mesenchyme becomes fibrous joint capsule
- Inner region becomes the joint cavity
- During youth - injury may tear an epiphysis off a bone shaft
- Advancing age - osteoarthritis becomes more common
- Exercise - helps maintain joint health

Lifespan Changes

- Joint stiffness is an early sign of aging
- Fibrous joints first to change; can strengthen however over a lifetime
- Changes in symphysis joints of vertebral column diminish flexibility and decrease height (remember water loss from the IVDs)
- Synovial joints lose elasticity
- Disuse hampers the blood supply
- Activity and exercise can keep joints functional longer



A femury
Christmas



and a
hippy
New Year.