

JOINTS

Joint = articulation; sites where 2 or more bones meet; weakest part of skeleton

Joint Functions:

- mobility
- hold skeleton together

Classification of Joints

- functional – based on amount of movement allowed at joint
 1. *synarthroses* – immovable joints; restricted to axial skeleton
 2. *amphiarthroses* – slight movable joints; restricted to axial skeleton
 3. *diarthroses* – freely moving joints; predominate in limbs
- structural – based on material binding bones together and whether or not a joint cavity is present
 1. *fibrous* – bones joined by fibrous tissue; no joint cavity present; amount of movement is based on length of connective tissue fibers; 3 types
 2. *cartilagenous* – bones joined by cartilage; no joint cavity present; 2 types
 3. *synovial* – bones are separated by a fluid-filled joint cavity; allows substantial free movement

Structural Classification of Joints

1. fibrous joints
 - a. *suture* (seams) – occur between bones of skull; articulating bone edges interlock and junction is filled by short connective fibers that are continuous with periosteum; are rigid splices that allow bone growth
 - b. *syndesmosis* – bones are connected by ligaments; connecting fibers are longer than in sutures to allow for “give”; e.g. distal end of tibia and fibula attached by ligaments; ligaments attaching radius and ulna
 - c. *gomphoses* – peg in socket joints (teeth)
2. cartilaginous joints
 - a. *synchondrosis* – bar or plate of hyaline cartilage uniting bone; totally immovable; e.g., epiphyseal plates connecting diaphysis and epiphyses; costal cartilage of 1st rib and manubrium
 - b. *symphysis* – bones are covered with hyaline cartilage which fuses to intervening pad of fibrocartilage; (e.g., intervertebral joints and pubic symphysis)

3. synovial joints – articulating bones are separated by fluid-filled cavity; e.g., all joints in limbs; 4 structures common to all synovial joints
 - 1) *articular cartilage* (hyaline) – is spongy; absorbs compression placed on joint; thus keeps bones from being crushed at their ends
 - 2) *joint (synovial) cavity* – filled with synovial fluid
 - 3) *articular capsule* – 2 layered; external layer is tough fibrous capsule (dense irregular tissue) and is continuous with periosteum of articulating bones; internal layer is a synovial membrane (loose connective tissue)
 - 4) *synovial fluid* – filtrate of blood that is viscous (becomes less viscous with joint activity because fluid is warmed up); provides slippery weight-bearing film that reduces friction between cartilages; is forced from cartilages when joint is compressed and seeps back as pressure is released; contains phagocytic cells that clean up cellular debris
 - 5) other structures found in many synovial joints:
 - *reinforcing ligaments* – reinforces and strengthens; can be intrinsic (part of fibrous capsule) or extracapsular; can also be intracapsular and covered with synovial membrane
 - *bursae* – flattened fibrous sacs lined with synovial membrane; contain a thin film synovial fluid; common in sites where ligaments, muscles, skin, tendons or bones rub together
 - *tendon sheath* – elongated bursae that wraps completely around a tendon subjected to friction

Types of Movement in Synovial Joints

1. *gliding* – simplest movement; one flat bone surface glides over another similar surface (e.g., intercarpal and intertarsal joints; articular processes of vertebrae)
2. *flexion* – bending movement; decreases angle of joint and brings bones close together usually over a sagittal plane (e.g., bending knee or body trunk; bending head forward on chest)
3. *extension* – reverse of flexion; increases angle between articulating bones; can hyperextend (bending back beyond upright position)
4. *abduction* – movement of a limb away from midline, along frontal plane (e.g., raising arm or thigh laterally, or spreading toes)
5. *adduction* – opposite of abduction; movement of a limb toward body midline
6. *circumduction* – moving a limb so it describes a cone in space; distal end moves in circle while point of cone (proximal end) remains stationary; consists of flexion, abduction, extension, and adduction performed in succession
7. *rotation* – turning of a bone around its long axis; can be medial or lateral (e.g., movement between first 2 cervical vertebrae and at hip and shoulder joints)
8. *supination* – refers to movements of the radius around the ulna; ulna and radius are parallel to each other (defines anatomical position)
9. *pronation* – refers to movement of the radius around the ulna; radius is rotated over ulna; weaker movement than supination (is position when palm faces downward or posteriorly)

10. *inversion* – special movement of foot; sole of foot turns medially
11. *eversion* – special movement of foot; sole of foot turns laterally
12. *protraction* – nonangular anterior movement in a transverse plane (e.g., jutting out of jaw)
13. *retraction* – nonangular posterior movement in a transverse plane (e.g., moving jaw back to original position after jutting it out)
14. *elevation* – lifting a body part superiorly (e.g., chewing)
15. *depression* – moving an elevated body part inferiorly (e.g., chewing)
16. *opposition* – thumb only; results because of saddle joint between metacarpal 1 and carpals

Types of Synovial Joints – 6 major categories

1. *plane* – articulating surfaces are flat; allow only short slipping or gliding movements; nonaxial joints (e.g., joints between vertebral articular processes and intercarpal/intertarsal joints)
2. *hinge* – motion is along a single plane, like a hinge; occurs when a cylindrical projection of 1 bone fits into a trough-shaped surface on another bone; permits flexion and extension only (e.g., bending and straightening elbow and interpharyngeal joints)
3. *pivot* – movement is uniaxial rotation of one bone around its own long axis; occurs when rounded end of one bone protrudes into a sleeve or ring of another (e.g., joint between atlas and dens of axis; rotation of radius around ulna at proximal end)
4. *condyloid* – ellipsoidal joint; oval articular surface of one bone fits into complementary depression in another; both articular surfaces are oval; permits all angular motions (flexion, extension, abduction, adduction) (e.g., metacarpophalangeal or knuckle joint; radiocarpal or wrist joint)
5. *saddle* – each articular surface has both concave and convex areas; articular surfaces fit together, concave to convex surfaces (e.g., carpometacarpal joints of thumb; allows twiddling of thumbs)
6. *ball and socket* – spherical or hemispherical head of one bone articulates with cuplike socket of another; most freely moving joints in all axes and planes, including rotation (e.g., shoulder and hip joints)

Joint Disorders

1. *bursitis* – inflammation of a bursa (excessive fluid accumulates); usually caused by a blow or friction
2. *sprain* – ligaments reinforcing joint are stretched or torn; heal slowly because ligaments are poorly vascularized
3. *arthritis* – 100 different types of inflammatory or degenerative diseases that damage the joints; symptoms are pain, stiffness, and swelling
 - *osteoarthritis* – chronic; wear and tear arthritis; course is slow and irreversible; theory is that normal joint use prompts release of enzymes that break down articular cartilage, but more cartilage is destroyed than replaced; get softened, roughened, cracked and eroded cartilages and bone tissue thickens and forms bony spurs that may restrict joint movement

- *rheumatoid arthritis* – chronic inflammatory disorder; early stages include joint tenderness and stiffness; get flare-ups and remissions; is an autoimmune disorder where the synovial membrane becomes inflamed and inflammatory cells migrate into joint cavity from blood; synovial fluid accumulates, swelling joint; inflamed membrane thickens into a pannus and this erodes the cartilage; scar tissue forms and attaches to bone ends, eventually ossifying and immobilizing the joint
- *gout* – uric acid gets deposited as needle-shaped crystals in soft tissue of joints; causes inflammatory response and great pain; can result in fusion of articulating bones