Joints

• aka articulations
• Point at which two bones join together
  – Allow movement
  – Transmit forces

• Anatomy
  – Capsule or ligaments
  – Synovial membrane
  – Articular cartilage
  – Joint space filled with synovial fluid
CLASSIFICATIONS

• Structural Categories:
  – Fibrous
  – Cartilaginous
  – Synovial

• Functional Categories:
  – Synarthroses—immoveable
  – Amphiarthroses—slightly moveable
  – Diarthroses—freely moveable
SYNARTHROSES

• Immoveable joints
• Lack synovial cavity
• Held together by fibrous connective tissue
• Structural types:
  – Sutures
  – Syndesmoses
  – Gomphoses
SYNARTHROSES

• Sutures
  – Thin layer of dense fibrous connective tissue
  – Unites bones of skull

• Syndesmosis
  – Joints where bones connected by ligaments
  – i.e. fibula/tibia and radius/ulna

• Gomphosis
  – Conical process fits into socket and is held in place by ligaments
  – i.e. tooth in alveolus (socket), held in place by peridontal ligament
AMPHIARTHROSES

- Slightly moveable
- Connected by hyaline cartilage or fibrocartilage
- i.e. ribs to sternum or vertebrae
DIARTHROSES

- aka synovial joints
- Freely moveable
- Ends of opposing bones are covered with articular cartilage
- Separated by joint cavity
- Components of joints enclosed in dense fibrous joint capsule
SYNOVIAL JOINT

- Muscle
- Synovial cavity
- Bursa
- Joint capsule and synovial lining
- Tendon
- Enthesis
- Enthesis
- Epiphyseal bone
- Articular cartilage
- Ligament
SYNOVIAL JOINTS

- 6 Types Synovial Joints:
  - Pivot joint
  - Gliding joint
  - Hinge joint
  - Condyloid joint
  - Ball-and-Socket joint
  - Saddle joint
PIVOT JOINT

- Freely moveable joint in which bone moves around central axis, creating rotational movement
- Radius, ulna

![Pivot Joint Diagram]

GLIDING JOINT

- Allows bones to make sliding motion
- Carpals and tarsals
- Between vertebrae and spine
HINGE JOINT

- Allows only flexion and extension
- Convex surface of one bone fits concave surface of other
- Knee, elbow, phalanges

CONDYLOID JOINT

- aka ellipsoidal joint
- Bones can move about one another in many directions, but cannot rotate
- Named for condyle-containing bone

- Metacarpals, phalanges

BALL & SOCKET JOINT

• One bone has rounded end that fits into concave cavity on another bone
• Widest range of movement possible
• Hips, shoulders
SADDLE JOINT

- Two bones have both concave and convex regions, shape of two bones complementing one another
- Wide range of movement
- Thumb = only saddle joint in body
MOVEMENTS OF DIARTHROSES

- Flexion
- Extension
- Hyperextension
- Abduction
- Adduction
- Rotation
- Circumduction
- Elevation
- Depression

- Supination
- Pronation
- Plantar flexion
- Dorsiflexion
- Inversion
- Eversion
- Protraction
- Retraction
- Opposition
FLEXION/EXTENSION
ABDUCTION/ADDUCTION

- Abduction—moving a body part away from midline
- Adduction—moving a body part toward the midline
ABDUCTION/ADDUCTION
INTERNAL/EXTERNAL ROTATION

• Internal rotation—rotation towards the center of the body
  – aka medial rotation

• External rotation—rotation away the center of the body
  – aka lateral rotation
INTERNAL/EXTERNAL ROTATION
HIP INTERNAL ROTATION
FOOT: DORSAL/PLANTAR
PLANTAR FLEXION/DORSIFLEXION
SUPINATION/PRONATION
ELEVATION/DEPRESSION
INVERSION/EVERSION

(b) Inversion and eversion

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The Hip

Fig. 34  Neutral position

Fig. 35  Flexion with knee bent

Fig. 36  Flexion with knee extended

Fig. 37  Hyperextension

Fig. 38  Adduction

Fig. 39  Abduction

Fig. 40  External Rotation

Fig. 41  Internal Rotation

Fig. 42  Rotation in flexion

Fig. 43  Permanent flexion (flexor contracture)
JOINTS OF UPPER EXTREMITY

- **Shoulder Joint**
  - Glenohumeral
  - Sternoclavicular
  - Acromioclavicular

- **Elbow Joint**
  - Radiohumeral
  - Humeroulnar
  - Radioulnar

- **Wrist**
  - Radiocarpal
  - Intercarpal
  - Carpalmetacarpal

- **Hand**
  - Intermetacarpal
  - Metacarpalphalangeal
  - Interphalangeal
SHOULDER

- Glenohumeral
- Sternoclavicular
- Acromioclavicular

Glenohumeral joint
SHOULDER

- Clavicle
- Acromioclavicular joint
- Acromion
- Glenohumeral joint
- Scapula
- Humerus
ELBOW

- Radiohumeral
- Humeroulnar
- Radioulnar
WRIST

- Radiocarpal
- Intercarpal
- Carpalmetacarpal
HAN D

- Intermetacarpal
- Metacarpalphalangeal
- Interphalangeal
JOINTS OF LOWER EXTREMITY

- Sacroiliac
- Acetabulofemoral
- Patellofemoral
- Tibiofemoral
- Tibiofibular

- Ankle/Foot
  - Talocural
  - Subtalar
  - Intertarsal
  - Tarsometatarsal
  - Intermetatarsal
  - Metatarsophalangeal
  - Interphalangeal
TIBIOFEMORAL JOINT

Knee Complex
Lateral View

TIBIOFIBULAR JOINT

Ankle Complex
Posterior View
FOOT/ANKLE
SYNOVIAL JOINT INJURIES

- Acute
  - Sprains
  - Synovitis
  - Subluxations
  - Dislocations

- Chronic
  - Osteochondrosis
  - Arthritis
  - Bursitis
  - Capsulitis/synovitis
Sprains

- Injury to ligamentous and capsular tissue
- Traumatic joint twist that results in stretching of total tearing of the stabilizing connective tissue
- One of most common & disabling sports injuries

General Symptoms:
- Joint swelling
- Local temperature increase
- Pain
- Point tenderness
- Skin discoloration
SPRAINS

▶ Grade 1
  ▪ Some pain
  ▪ Minimum LOF
  ▪ Mild point tenderness
  ▪ Little or not swelling
  ▪ No abnormal motion

▶ Grade 2
  ▪ Pain
  ▪ Moderate LOF
  ▪ Swelling
  ▪ Slight to moderate instability

▶ Grade 3
  ▪ Severe sprain
  ▪ Extremely painful initially
  ▪ LOF
  ▪ Severe instability
  ▪ Tenderness
  ▪ Swelling
  ▪ May represent subluxation that reduced spontaneously
SYNOVITIS

- Irritation of synovial membrane
- Causes increase in fluid production, swelling
- Joint pain during motion, skin sensitivity from pressure
- Diminish in few days
ACUTE JOINT INJURIES

Subluxation
• Occurs when bone displaces, then returns to normal position

Dislocation
• Occurs when significant force displaces bone so that the two bone ends in a joint no longer add up
OSTEOCHONDROSIS

• Degenerative changes in the ossification centers of the epiphysis of bones
• During periods of rapid growth in children
• Osteochondritis dissecans
• Suggested causes—
  – aseptic necrosis: circulation to epiphysis disrupted
  – Trauma causes particles of articular cartilage to fx, resulting in fissures that penetrate to subchondral bone
ARTHRITIS

• Inflammation of an entire joint
• Usually involves all tissues of the joint
• Most often in WB joints
• 100 varieties of arthritis
• 10% population
• No cure
RHEUMATOID ARTHRITIS

- Connective tissue disorder resulting in severe inflammation of small joints
- Cause unknown
- Severely debilitating
- Synovial membranes of joint and connective tissues grow abnormally to form layer in joint capsules → destroys cartilage and fuses bones of joint
OSTEOARTHRITIS
OSTEOARTHRITIS
Bursitis

- Inflammation of the synovial cavity caused by excessive stress or tension
OPEN & CLOSED KINEMATIC CHAINS

• Open Kinematic Chain
  – Sequence of action in which the body part farthest from the trunk is free during movement
  – i.e. Seated leg extension

• Closed Kinematic Chain
  – Sequence of action in which the body part farthest from the trunk is fixed during movement
  – i.e. In a squat, feet are fixed and the rest of leg chain moves