MYOLOGY

Definitions

_production_of_movement_ = Skeletal muscle produces movement by exerting force (via a contraction) on tendons, which in turn pull on bones and other structures (i.e. skin)

_Joint_ = Articulation of more than 1 bone; 2 bones make up a joint

Note: 2 bones that make up a joint do not move equally in response to a contraction; 1 bone remains stationary.

_Articulation_ = The meeting of 2 bones

_Muscle Origin_ = Site of muscle attachment on the more stationary bone

_Muscle Insertion_ = Site of muscle attachment on the more movable bone

_Muscle Belly_ = Fleshy part of muscle between the origin and insertion.

_Agonist (Prime Mover)_ = Muscle that contracts to cause an action/movement

_Antagonist_ = Muscle that stretches and provides resistance to the agonist movement

NOTE: Agonist & Antagonist allow for smooth, controlled movements; if both contract together, there will be no movement. Whether a muscle is an agonist or antagonist depends on the movement - different movements have different agonist and antagonist muscles.

*Rule - Muscles that cross 2 joints will perform movements at 2 joints

Example: Biceps cross the Shoulder Joint (originates on Scapula) and Elbow Joint (inserts on Radius), so produces Flexion of the arm and Flexion of the forearm.

Other examples: Triceps - Extension of Forearm and Extension of Arm
SHOULDER JOINT → Glenohumeral Joint

❖ Ball and Socket Joint
❖ Formed by the articulation of the Head of the Humerus and the Glenoid Cavity of the Scapula
❖ Triaxial (produces movement along 3 planes): Flexion/Extension
   Adduction/Abduction
   Lateral/Medial Rotation

❖ Primary muscles to stabilize glenohumeral joint → Rotator Cuff Muscles
❖ Primary site of dislocation since not a solid joint structurally

Anatomical Components of Shoulder Joint:

1. Articular Capsule:
   ❖ Loose joint capsule that completely envelops the joint
   ❖ Extends From → the Glenoid Cavity
      To → Neck of the Humerus

2. Coracohumeral Ligament:
   ❖ Extends From → Coracoid Process of the Scapula
      To → Greater Tubercle of the Humerus

3. Glenohumeral Ligament:
   ❖ Extends From → Glenoid Cavity
      To → Lesser Tubercle & Neck of the Humerus

4. Transverse Humeral Ligament:
   ❖ Extends Horizontally From → Greater Tubercle
      To → Lesser Tubercle

5. Glenoid Labrum:
   ❖ A narrow rim of fibrocartilage around the edge of the Glenoid Cavity
   ❖ It deepens and enlarges the Glenoid Cavity; head of humerus sits in deeper.

ROTATOR CUFF MUSCLES
❖ Main Stabilizer of the Glenohumeral Joint
❖ Called Rotator Cuff because their tendons conjoin to form a "cuff" across the Greater and Lesser Tubercles of the Humerus (wrap around the head)
❖ Muscles act as a group to stabilize the head of the humerus into the glenoid fossa during shoulder movements.
❖ Role as stabilizers is VITAL because the ligaments of the shoulder joint are very loose
❖ “SITS” - - Supraspinatus, Infraspinatus, Teres Minor, Subscapularis
**ELBOW JOINT**

- **Hinge Joint**
  - Formed by the articulation of the distal humerus and proximal radius/ulna

- **3 Articulations**
  - Capitulum (of distal humerus) and Head of Radius
  - Trochlea (of distal humerus) and the Ulna
  - Olecranon Fossa (of distal humerus) and Olecranon of the Ulna

- **Biaxial Movement** (movement along 2 planes):
  - Flexion/Extension
  - Supination/Pronation

- **Articulation between Radius and Ulna @ 3 sites**:
  1. **Interosseous Membrane** - connective tissue between shafts of both bones
  2. **Proximal Radioulnar Joint** - between Head of the Radius and Radial Notch of Ulna
  3. **Distal Radioulnar Joint** - between Ulna and Ulnar Notch of the Radius

**Anatomical Components of the Elbow Joint**:
(Ligaments stabilize the Elbow Joint)

1. **Articular Capsule**:
   - Fibrocartilage that envelops the entire elbow joint (provides stability)
   - Extends across the Distal Humerus and Proximal Radius/Ulna

2. **Ulnar Collateral Ligament (Medial Aspect)**:
   - Thick, triangular ligament that extends
     From → Medial Epicondyle of the Humerus
     To → Coronoid Process and Olecranon of Ulna

3. **Radial Collateral Ligament (Lateral Aspect)**:
   - Strong, triangular ligament that extends
     From → Lateral Epicondyle of the Humerus
     To → Annular Ligament of Radius and Radial Notch of Ulna

4. **Radial Annular Ligament**:
   - Encircles the Head/Neck of Radius and Radial Notch of Ulna

5. **Olecranon Bursa**
   - Fluid filled sac that lines the olecranon and provides lubrication of the joint
WRIST JOINT

♦ Condyloid Joint (Ellipsoidal) → the Convex, oval shaped projection of 1 bone (Carpals) fits into the oval shaped Concavity (Radius) of another bone

♦ Formed by 3 Separate Joint Articulations:
  1. Radiocarpal Joint → Distal End of the Radius and the Proximal Row of Carpals = Scaphoid, Lunate, Triquetrium
  2. Midcarpal Joint → articulation between the 2 rows of Carpal Bones (Proximal Row and the Distal Row)
  3. Carpometacarpal Joint → Distal Carpal Bones and the Metacarpal Bones of the Hand

IMPORTANT NOTE: The ULNA is NOT involved with the articulation of the Wrist

♦ Bi-Axial Movement (movement along 2 planes): Flexion/Extension
  Radial/Ulnar Deviation (more ROM w/Ulnar)

Anatomical Components of the Wrist Joint:

1. Radiocarpal Ligament: MAIN LIGAMENT
   • Connects the Styloid Process of the Radius and Distal Aspect of the Ulna with the Scaphoid and Lunate (1st 2 carpal bones on thumb-side).

2. Ulnar Collateral Ligament: Stabilizer on Ulna side
   • Attaches the Styloid Process of the Ulna to the Pisiform

3. Radial Collateral Ligament: Stabilizer on Radial side
   • Attaches the Styloid Process of the Radius to the Scaphoid and Trapezium
MUSCLES of the HAND

- 3 Muscle Groups of the Hand characterized by location and movement:
  1. Muscles that control the THUMB → Thenar Eminence (located on radial side)
  2. Muscles that control the PINKY → Hypothenar Eminence (located on ulna side)
  3. Muscles that control fingers 2-4 → Central Compartment

- **Thenar Eminence**: "wad" underneath the Thumb
  - ALL originate on Carpal Bones on Radial Side (Scaphoid and/or Trapezium)
  - ALL insert onto the Thumb; all involved with Thumb movements (agonist muscles of Thumb); Opponens inserts on Metacarpal vs. Phalanges
  - Comprised of 3 Muscles based on DEPTH:
    - Most Superficial = Abductor Pollicis Brevis
    - Intermediate = Flexor Pollicis Brevis
    - Deep Layer = Opponens Pollicis
  - ALL innervated by the MEDIAN Nerve
  - NO Referral Pain

- **Hypothenar Eminence**: Ulna side
  - ALL originate on Carpal Bones on Ulna Side (Pisiform or Hamate)
  - ALL insert onto the Little Finger #5; all involved with movement of the Pinky (agonist muscles of the Pinky); Opponens inserts on Metacarpal vs. Phalanges
  - Comprised of 3 Muscles based on DEPTH:
    - Most Superficial = Abductor Digiti Minimi Manus
    - Intermediate = Flexor Digiti Minimi Manus
    - Deep Layer = Opponens Digiti Minimi Manus
  - All innervated by the ULNAR Nerve
  - NO Referral Pain
  - "Manus" refers to the Hand

- **Central Compartment**: Central Portion of Hand and Fingers 2-4
  - 4 Muscles: Adductor Pollicis (2 Heads)
    - Lumbricals Manus (No bony Origin or Insertion; O&I on Tendons)
    - Palmer Interossei (deep in Palm - palmar aspect)
    - Dorsal Interossei Manus (dorsal aspect)
  - ALL ULNAR Nerve except Lumbricals innervated by Median Nerve at fingers 2-3; Ulnar Nerve at fingers 4-5 (same as Flexor Digitorum Profundus - - its origin site)
**HIP JOINT** (similar to Shoulder or Glenohumeral Joint)

- Ball and Socket Joint
- Formed by the articulation of the **Head of the Femur** and the **Acetabulum of the Pelvis**
- Triaxial (produces movement along 3 planes): Flexion/Extension  
  Adduction/Abduction  
  Lateral/Medial Rotation

**Anatomical Components of Hip Joint:**

6. **Articular Capsule:**
   - Dense/Strong fibrocartilage to stabilize the joint
   - Considered to be one of the strongest structures of the body
   - Extends From → the Rim of the Acetabulum  
     To → Neck of the Femur

7. **Iliofemoral Ligament:**
   - Thickened Portion of the Articular Capsule (Left side)
   - Extends From → AIIS of the Pelvis  
     To → Intertrochanteric Crest of the Femur

8. **Pubofemoral Ligament:**
   - Thickened Portion of the Articular Capsule (Right side)
   - Extends From → Pubic Ramus  
     To → Neck of the Femur

9. **Ischiofemoral Ligament:**
   - Thickened Portion of the Articular Capsule
   - Extends From → Ischium  
     To → Neck of the Femur

10. **Ligament of the Head of the Femur (Fovea Centralis):**
    - Flat, Triangular Band
    - Extends From → Acetabulum  
      To → Head of the Femur

11. **Acetabular Labrum:**
    - Fibrocartilage rim around the margin of the Acetabulum
    - Enhances the depth (deepens and enlarges) the Acetabulum (head of Femur sits in deeper).

**Note:** Dent on Head of the Femur = Fovea Centralis (or Fovea Capitis) - a ligament runs from Fovea Centralis into the Acetabulum for stability - - to prevent dislocation.
KNEE JOINT → Tibiofemoral Joint
(similar to Elbow Joint)

♦ Hinge Joint
♦ Formed by the articulation of the Distal Femur and Proximal Tibia & Fibula
♦ Consists of Three Joints within a single joint capsule
♦ 3 Articulations → Lateral Femoral Condyle and Lateral Tibial Condyle
     → Medial Femoral Condyle and Medial Tibial Condyle
     → Patella and Anterior Aspect of Femur (not a "true" joint/articulation)
♦ Biaxial Movement (movement along 2 planes): Flexion/Extension
     Lateral/Medial Rotation

NOTE: Knee Joint must be FLEXED in order to perform Lateral/Medial Rotation @ Knee

Anatomical Components of the Knee Joint:

6. Articular Capsule:
   ♦ Composed of Fibrocartilage and Expansions of Muscle Tendons (provides stability)

7. Medial and Lateral Patellar Retinacula:
   ♦ Fused tendons of Quadricep Muscles (Vastus Medialis and Lateralis) and TFL that strengthen the anterior surface of the joint.

8. Patellar Ligament (stabilizes the anterior aspect of Knee joint):
   ♦ Continuation of the Common Tendon of the Quadricep Muscles
   ♦ Extends From → Patella
     To → Tibial Tuberosity

9. Medial (Tibial) Collateral Ligament:
   ♦ Broad, flat ligament on medial surface of knee that extends
     From → Medial Femoral Condyle
     To → Medial Tibial Condyle

10. Lateral (Fibular) Collateral Ligament:
    ♦ Strong, round ligament on lateral surface of knee that extends
     From → Lateral Femoral Condyle
     To → Lateral Aspect of the Fibular Head

11. Anterior Cruciate Ligament - Limits excessive hyperextension of the knee
    ♦ Intracapsular (within the joint capsule) ligament that extends
     From → Anterior Aspect of Tibia (Medial Tibial Spine)
     To → Posteromedial Aspect of the Lateral Femoral Condyle

12. Posterior Cruciate Ligament - Resists excessive hyperflexion of the knee (MVA; knee hits dash)
    ♦ Intracapsular (within the joint capsule) ligament that extends
     From → Posterior Aspect of Tibia (Lateral Tibial Spine)
     To → Anterolateral Aspect of the Medial Femoral Condyle
13. Medial/Lateral Menisci:
   ♦ Fibrocartilage Discs located between the Femoral and Tibial Condyles that help compensate for the irregular shape of the bones
   ♦ Help to circulate synovial fluid throughout the joint space

14. Bursa (fluid-filled sac - lubricant)
   a) Prepatellar Bursa - located between the Patella & Skin
   b) Intrapatellar Bursa - located between Superior Aspect of Tibia & Patellar Ligament
   c) Suprapatellar Bursa - located between the Inferior Aspect of Femur & Surface of Quadriceps Muscles.
ANKLE JOINT \(\rightarrow\) Talocrural Joint or Mortise Joint

\* Hinge Joint

\* Formed by the Articulation of:
   1. Medial Malleolus of Distal Tibia and Talus
   2. Lateral Malleolus of Distal Fibula and Talus

INTERTARSAL JOINT

\* Planar Joint \(\rightarrow\) articular surfaces are flat or slightly curved

\* Formed by 3 Joint Articulations:
   4. Subtalar Joint \(\rightarrow\) articulation between the Talus and Calcaneus
   5. Talocalcaneovavicular Joint \(\rightarrow\) between the Talus, Calcaneus (medial) and Navicular
   6. Calcaneocuboid Joint \(\rightarrow\) articulation between Calcaneus (distal) and Cuboid

\* Bi-Axial Movement (movement along 2 planes):
   Dorsiflexion/Plantarflexion (Ankle joint)
   Eversion/Inversion (Intertarsal joint)

Anatomical Components of the Ankle and Intertarsal Joints:

3. Articular Capsule:
   \* Composed of Fibrocartilage and is Thin Anteriorly and Posteriorly
   \* Extends from Malleoli to the Talus

4. Deltoid Ligament: *Made up of 3 Ligaments*
   \* Reinforces the Medial Aspect of Articular Capsule - very strong; not commonly injured.
   \* Extends From \(\rightarrow\) Medial Malleolus
     To \(\rightarrow\) portions of the
     Talus - Tibiotalar Ligament
     Calcaneus - Tibiocalcaneal Ligament
     Navicular - Tibionavicular Ligament

5. Plantar Calcaneonavicular (Spring) Ligament:
   \* Extends From \(\rightarrow\) Medial Aspect of Calcaneus (superior)
     To \(\rightarrow\) Navicular

6. Anterior Talofibular Ligament: *Most Commonly Injured*
   \* Extends From \(\rightarrow\) Lateral Malleolus
     To \(\rightarrow\) Talus
   \* One of the most injured ankle ligaments associated with ankle sprains - inversion sprain

5. Posterior Talofibular Ligament
   \* Extends From \(\rightarrow\) Lateral Malleolus
     To \(\rightarrow\) Talus

6. Calcaneofibular Ligament
   \* Extends From \(\rightarrow\) Lateral Malleolus
     To \(\rightarrow\) Lateral Aspect of the Calcaneus
♦ One of the most injured ankle ligaments associated with ankle sprains

Other Notes:

1. **Tensor Fascia Latae**
   ♦ TFL gets its name because it tenses the *fascia latae* (aka *Iliotibial Band*), which is a broad covering of fascia that lies over the muscles of the thigh.
   ♦ TFL muscle inserts on Iliotibial Band.

2. **The Pes Anserine Tendon**
   ♦ Located on the Anteromedial Aspect of the Tibia
   ♦ 3 Muscles attach (insertion) to this region of the Tibia:
     A. Sartorius - attaches most ANTERIOR
     B. Semitendinosus - attaches most POSTERIOR
     C. Gracilis - attached/located in between Sartorius and Semitendinosus
   
   “SGT Duck” to remember muscles and order:  
   “S”artorius (Anterior)  
   “G”racilis (in between)  
   Semi“T”endinosus (Posterior)

3. **Deep Rotators**
   ♦ Muscles run Medial to Lateral to perform Lateral Rotation (all perform same action and only one action)
   ♦ All innervated by Lumbar Spine Nerve except for Obturator Externus (Obturator Nerve)
   ♦ Most insert on Greater Trochanter of Femur (4 of 6) except Obturator Externus (Medial Aspect of Femur) and Quadratus Femoris (Inter trochanteric Crest of Femur)
   ♦ Only Piriformis refers pain - sciatica-like pain.

4. **Quadricep Muscles**
   ♦ Rectus Femoris is the only Quad muscle that crosses 2 planes - hip & knee so performs movements of both the thigh (flexion) and leg (extension).
   ♦ ALL Quads perform Extension of Leg
   ♦ ALL are innervated by the Femoral Nerve
   ♦ ALL insert on Tibial Tuberosity
   ♦ All 3 “Vastus” have same Origin - Posterior Aspect of mid shaft of Femur (Linea Aspera)

5. **Adductor Muscles**
   ♦ Medial Aspect of the Thigh
   ♦ Site of “Groin Pull” - when adductor muscles are strained and pain is felt in their proximal attachment (all Originate on the Pubis - Adductor Magnus also originates on Ischial Tuberosity)
   ♦ ALL innervated by the Obturator Nerve except Pectineus (Femoral Nerve) and Adductor Magnus - innervated by Sciatic Nerve (known as the 4th Hamstring Muscle)

6. **Hamstring Muscles**
   ♦ Posterior Aspect of Thigh
   ♦ ALL Originate on the Ischial Tuberosity (Biceps Femoris short head on the Linea Aspera)
   ♦ As a group, ALL Extension of Thigh and Flexion the Leg (main)
   ♦ ALL innervated by Sciatic Nerve
♦ Biceps Femoris unique in that it also performs Lateral Rotation of Leg
♦ ALL refer pain into posterior knee
♦ Name given because butchers would hang pig carcasses by their hamstring tendons