Elbow and Forearm Complex
Introduction

- Four articulations within the elbow and forearm

1. humeroulnar joint
2. humeroradial joint
3. proximal radioulnar joint
4. distal radioulnar joint
The motions of flexion and extension of the elbow provide a means to adjust the overall functional length of the upper limb.

This function is used for many important activities, such as feeding, reaching, and throwing, and personal hygiene.

Pronation and supination can be performed in conjunction with, or independent from, elbow flexion and extension.

The interaction between the elbow and forearm joints greatly increases the range of effective hand placement.
Ostelogy
Osteology
The **olecranon process** forms the large, blunt, proximal tip of the ulna, making up the “point” of the elbow.

The **radial notch** of the ulna is an articular depression just lateral to the inferior aspect of the trochlear notch.
The distal end of the radius articulates with carpal bones to form the radiocarpal joint at the wrist.
Normal “valgus Angle” of the Elbow

- In full elbow extension, the normal carrying angle is about 15 degrees.
The articular capsule of the elbow encloses three different articulations.

- Humeroulnar joint
- Humeroradial joint
- Proximal radioulnar joint
Periarticular connective tissue

- The capsule is thin and reinforced anteriorly by oblique bands of fibrous tissue.
- A synovial membrane lines the internal surface of the capsule.
Collateral ligament

Medial aspect

- Annular ligament
- Oblique cord
- Radius
- Ulna
- Medial epicondyle
- Anterior part
- Posterior part
- Transverse part
- Medial collateral ligament

Lateral aspect

- Annular ligament
- Radius
- Ulna
- Supinator crest
- Lateral collateral ligament
- Lateral (ulnar) collateral ligament
Ligaments of the elbow and motions that increase tension

Medial collateral ligament (anterior fibers)
- Valgus, extension and flexion

Medial collateral ligament (posterior fibers)
- Valgus, flexion

Radial collateral ligament
- Varus, external rotation

Lateral (ulnar) collateral ligament
- Varus, external rotation and flexion

Annular ligament
- Distraction of the radius, external rotation
Traumatic causes of elbow joint instability

- The medial collateral ligament is susceptible to injury when the fully extended elbow is \textit{violently forced into excessive valgus}, often from a fall onto an outstretched arm and hand.
- In severe elbow injuries, the trochlear notch of the ulna may dislocate posterior to the trochlea of the humerus.
Elbow flexion provides several important physiologic functions, such as pulling, lifting, feeding, and grooming.

Elbow extension occurs with activities such as throwing, pushing, and reaching.

Long-term flexion may be the result of casting following a fractured bone, an elbow joint inflammation, an elbow flexor muscle spasticity, a paralysis of the triceps muscle, or a scarring of the skin over the anterior elbow.

In addition to the tightness in the flexor muscles, increased stiffness may occur in the anterior capsule and anterior parts of the collateral ligaments.
The maximal range of passive motion generally available to the elbow is from 5 degrees of hyperextension through 145 degrees of flexion.
The humeroulnar joint is the articulation of the concave trochlear notch of the ulna around the convex trochlea of the humerus.
In order for the humeroulnar joint to be fully, passively extended, sufficient extensibility is required in the dermis, flexor muscles, anterior capsule, and anterior fibers of the medial collateral ligament.

During flexion at the humeroulnar joint, the concave surface of the trochlear notch rolls and slides on the convex trochlea.
Arthrokinematics at the Humeroradial Joint

- The arthrokinematics of flexion and extension consist of the fovea of the radius rolling and sliding across the convexity of the capitulum.
Force transmission through the interosseous membrane of the forearm

- Most of the fibers of the interosseous membrane of the forearm are directed away from the radius in an oblique medial and distal direction.
Force transmission through the interosseous membrane of the forearm
This forearm rotation occurs about an axis of rotation that extends from the radial head through the head of the ulna—an axis that intersects and connects both radioulnar joints.
Proximal radioulnar joint

- The radial head is held against the proximal ulna by a fibro-osseous ring.
- This ring is formed by the radial notch of the ulna and the annular ligament.
- About 75% of the ring is formed by the annular ligament and 25% by the radial notch of the ulna.
- The annular ligament is a thick circular band of connective tissue, attaching to the ulna on either side of the radial notch.
The distal radioulnar joint consists of the convex head of the ulna fitting into a shallow concavity formed by the ulnar notch on the radius and the proximal surface of an articular disc.
The articular disc is part of a larger set of connective tissue known as the triangular fibrocartilage complex.

The triangular fibrocartilage complex occupies most of the "ulnocarpal space" between the head of the ulna and the ulnar side of the wrist.

The TFCC is the primary stabilizer of the distal radio-ulnar joint.
The neutral or zero reference position is the “thumb –up” position, midway between complete pronation and supination.

On average the forearm rotates through about 75 degrees of pronation and 85 degrees of supination.
Supination of Arthrokinematics
Pronation of Arthrokinematics