The ability to perform many activities of daily living (ADL) depends upon the elbow.
Activities of Daily Living (ADL)

Can you think of anything that you do to take care of yourself that would not require you to flex your elbow?
Elbow and Forearm Complex

- **Elbow joint includes:**
  - 3 bones (humerus, radius, ulna)
  - 2 joints (humeroulnar, humeroradial)

- **Forearm joint includes:**
  - 2 bones (radius, ulna)
  - 2 joints (proximal radioulnar, distal radioulnar)
Bony landmarks of the scapula important to elbow function:
- Infraglenoid tubercle
- Supraglenoid tubercle
- Coracoid process
Osteology of the Distal Humerus (Anterior)

Humerus
- Medial epicondyle
- Lateral epicondyle
- Radial fossa
- Capitulum
- Trochlea
- Ulnar nerve sulcus
Osteology of the Distal Humerus (Posterior)

Humerus
- Medial epicondyle
- Lateral epicondyle
- Trochlea
- Olecranon fossa
- Lateral supracondylar ridge
Osteology of the Proximal Ulna

Ulna
- Olecranon process
- Trochlear notch
- Coronoid process
- Ulnar tuberosity
Osteology of the Proximal Ulna

Ulna

- Radial notch
Osteology of the Proximal Radius

Radius
- Head
- Neck
- Radial tuberosity
Osteology of the Proximal Structures of the Elbow & Forearm
Osteology of the Distal Structures of the Forearm

Ulna
- Head
- Styloid process

Radius
- Styloid process
Osteology Note:

- The **proximal** radius rotates around the ulna which is stationary.
- The **distal** radius is larger and broader than the distal ulna.
The Elbow Joint

- **2 articulations**
  - The **humeroulnar joint**
    - Hinge joint
    - Allows for flexion, extension
    - Provides most of structural stability of elbow
  - The **humeroradial joint**
    - Articulation of the capitulum of humerus and the head of the radius
    - Not involved in elbow flexion,
      - Only involved in supination and pronation
Carrying Angle? (normal cubitus valgus)

- With the forearm supinated and elbow fully extended, the forearm projects laterally about \(15-20^\circ\) relative to the humerus. This is normal, but tends to be greater in females.
Supporting Structures of the Elbow

- **Articular Capsule:**
  - Thin connective tissue encasing 3 articulations

- **Medial Collateral Ligament:**
  - Crosses the elbow medially from the medial epicondyle to the coronoid and olecranon processes
  - Helps provide stability in resisting cubital valgus forces

- **Lateral Collateral Ligament:**
  - Crosses the elbow laterally from the lateral epicondyle to the proximal forearm
  - Helps provide stability in resisting cubital varus forces

Lippert pg 151
Help I’m falling... an outstretched elbow often suffers.
So how much elbow ROM do you need?

- Usually about 100° for most ADLs, but it occurs between 30 and 130 degrees of flexion
Arthrology of the Forearm

- **Proximal radioulnar joint**
  - Articulation of the head of the radius and the radial notch of the ulna

- **Distal radioulnar joint**
  - Distal end of the radius rotates around the distal end of the ulna

- **Supination and Pronation** occur at both joints and in the FOREARM
Supination & Pronation

- Shoulder rotation can often be functionally substituted for each motion
  - But not if the humerus is held tight against the thorax and the elbow is in 90° of flexion
Supporting Structures of the Forearm

**Annular ligament**
- Attaches anteriorly and posteriorly on the radial notch of ulna
- Hold head of radius against ulna

**Interosseus membrane**
- Located between radius and ulna
- Keeps the 2 bones from separating
Muscles of the elbow and forearm

- Brachialis
- Brachioradialis
- Biceps
- Supinator
- Triceps
- Anconeus
- Pronator teres
- Pronator quadratus
Redundancy is a fact of life/function

- Innervation
  - The musculocutaneous n.
    - Supplies the elbow flexors EXCEPT the brachioradialis
  - The radial n.
    - Supplies the elbow extensors
  - The median n.
    - Supplies all the pronators of the forearm
Redundancy is a fact of life/function

- The elbow flexors are innervated by 3 different nerves*
  - Preservation of “hand to mouth” activities
  - The likelihood of all 3 nerves being injured is “slim”

* mucsuloskeletal n.
  radial n.
  median n.
### Myology of the Elbow

<table>
<thead>
<tr>
<th>Biceps Brachii</th>
<th></th>
</tr>
</thead>
</table>
| **Origin**     | Long Head: Supraglenoid tubercle of the scapula  
                 | Short Head: Coracoid process of the scapula      |
| **Insertion**  | Bicipital tuberosity of the radius                |
| **Innervation**| Musculocutaneous n.                                   |
| **Action**     | Elbow flexion, sh flexion and forearm supination  |
| **“tidbit”**   | “corkscrew” muscle                                    |
## Myology of the Elbow

<table>
<thead>
<tr>
<th><strong>Brachialis</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Anterior aspect of the distal humerus</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Coronoid process of the ulna</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Musculocutaneous n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Elbow flexion</td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
<td>“workhorse” for elbow flexion</td>
</tr>
</tbody>
</table>

![Brachialis muscle diagram](image)
Myology of the Elbow

Brachioradialis

<table>
<thead>
<tr>
<th>Origin</th>
<th>Lateral supracondylar ridge of the humerus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Near the styloid process of the distal radius</td>
</tr>
<tr>
<td>Innervation</td>
<td>Radial n.</td>
</tr>
<tr>
<td>Action</td>
<td>Elbow flexion, Pronation or supination of the forearm to the neutral position</td>
</tr>
</tbody>
</table>
**Myology of the Elbow**

### Triceps Brachii

| **Origin**          | Long Head: infraglenoid tubercle of the scapula  
|                     | Lateral Head: posterior aspect of the superior humerus, lateral to the radial groove  
|                     | Medial Head: posterior aspect of the superior humerus, medial to the radial groove |
| **Insertion**       | Olecranon process of the ulna |
| **Innervation**     | Radial n. |
| **Action**          | Elbow extension  
|                     | Sh extension: *Long head only* |
### Anconeus

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Posterior aspect of the laterals epicondyle of the humerus</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Olecranon process of the ulna</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Radial n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Elbow extension?</td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
<td>Believed to “clear” the joint space of soft tissue to permit full elbow extension. Too small to create torque for elbow extension.</td>
</tr>
</tbody>
</table>
### Supinato

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Origin</td>
<td>Lateral epicondyle of the humerus and supinator crest of the ulna</td>
</tr>
<tr>
<td>Insertion</td>
<td>Lateral surface of the proximal radius</td>
</tr>
<tr>
<td>Innervation</td>
<td>Radial n.</td>
</tr>
<tr>
<td>Action</td>
<td>Forearm supination,</td>
</tr>
</tbody>
</table>
## Myology of the Forearm

### Pronator Teres

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Humeral head: medial epicondyle of the humerus Ulnar head: coronoid process of ulna</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Lateral surface of the midshaft of the radius</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Median n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Forearm pronation, secondary elbow flexion</td>
</tr>
</tbody>
</table>
### Pronator Quadratus

<table>
<thead>
<tr>
<th>Origin</th>
<th>Anterior surface of the distal ulna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Anterios surface of the distal radius</td>
</tr>
<tr>
<td>Innervation</td>
<td>Median n.</td>
</tr>
<tr>
<td>Action</td>
<td>Forearm pronation</td>
</tr>
</tbody>
</table>
- Biceps brachii
- Brachialis
- Coracobrachialis
- Pronator Teres
Identify!

- Triceps brachii
- Anconeus
- Teres Major
- Teres Minor
- Infraspinatus
Identify!

- Biceps Brachii
- Brachialis
- Brachioradialis
- Pronator Teres
- Pronator Quadratus
Common Elbow Pathologies

- **Lateral epicondylitis**
  - Tennis elbow
  - Inflammation of the common extensor tendon at the lateral epicondyle
- **Medial epicondylitis**
  - Golfer’s elbow
  - Inflammation of the common flexor tendon at the medial epicondyle
- **Nursemaid’s elbow**
  - Subluxation of the radial head from under the annular ligament
Colle’s Fracture

- Fracture of the distal radius
  - The weight of the body is transmitted through the hand and wrist, exceeding the strength of the radius
  - The interosseous membrane dissipates some of the force
• How would you stretch the elbow flexors?

• How would you strengthen the elbow extensors?
  ○ Open chain?
  ○ Closed chain?

• How would you strengthen the forearm pronators and supinators?