Wrist
Clarification of Terms

- **Palmar** is synonymous with anterior aspect of the wrist and hand
- **Ventral** is also synonymous with anterior aspect of the wrist and hand
- **Dorsal** refers to the posterior aspect of the wrist and hand
Clarification of Terms...cont

- The wrist is made up of 2 joints:
  - Radiocarpal joint
  - Midcarpal joint

Mansfield, p123
Osteology of the Wrist (Bones)

- Ten bones are involved: the distal radius, distal ulna, and eight carpal bones (wrist bones)
- The carpal bones are arranged in 2 rows of 4 bones each
  - Starting on the thumb side of the proximal row are the scaphoid, lunate, triquetrum, and pisiform
  - Starting on the thumb side of the distal row are the trapezium, trapezoid, capitate, and hamate

Mansfield, p124 & Lippert, p162
Draw

• Trace your left hand and forearm on a piece of paper
• Label it “Right hand – Anterior View”
• Draw and label the radius and ulna
• Based on the previous slide, draw in the 2 rows of carpal bones and label them
• This will require that you can comprehend and utilize medical terminology!
Osteology of the Wrist (Bones)...cont
Osteology of the Wrist (Bones)...cont
Osteology of the Wrist (Bones)... cont

- Ulnar Styloid Process
- Radial Styloid Process
- Hook of Hamate
- Medial Epicondyle of humerus
- Lateral Epicondyle of humerus
- Supracondylar Ridge of humerus
Radiocarpal Joint: Joint Structure

- Consists proximally of the distal end of the radius and the radioulnar disk
- Consists distally of the scaphoid, lunate and triquetrum
- Synovial joint – condyloid
- The concave distal end of the radius and articular disk articulates with the convex scaphoid, lunate and triquetrum
- Accepts approximately 80% of the force that crosses the wrist

Lippert, p161
Radiocarpal Joint: Joint Movement

- **Osteokinematics:**
  - Biaxial joint allowing flexion, extension, radial deviation and ulnar deviation
  - The combination of all 4 motions is called circumduction
  - There is no rotation at the wrist

- **Arthrokinematics:**
  - The convex-shaped proximal row of carpal bones moves in a direction that is opposite the hand
  - Therefore, during wrist flexion, the carpals glide posteriorly on the radius and articular disk
  - (The same happens for the mid-carpal joint and it happens simultaneously with the radiocarpal joint)

Lippert, p161 & Mansfield, p130
Midcarpal Joint: Joint Structure

- Aka intercarpal joints
- Irregular shape classified as plane joints
- Non-axial joints that allow gliding motions, which collectively contribute to radiocarpal joint motions (flexion, extension, radial deviation and ulnar deviation)

Mansfield, p131 & Lippert, p161
Midcarpal Joint: Joint Movement

- **Osteokinematics**: Non-axial joints that allow gliding motions, which collectively contribute to radiocarpal joint motions (flexion, extension, radial deviation and ulnar deviation)

- **Arthrokinematics**: Follows the concave-convex rule. Roll and slide occur in opposite directions for flexion/extension and radial/ulnar deviation

Mansfield, p131 & Lippert, p161
Supporting Structures of both radiocarpal joint and midcarpal joint

- The joints of the wrist are enclosed within a fibrous capsule
- The capsule is thickened by extrinsic and intrinsic ligaments
  - **Extrinsic ligaments** originate proximally outside the carpal bones and attach distally within the carpal bones
  - **Intrinsic ligaments** have both proximal and distal attachments located within the carpal bones
- Detailed anatomy of the intrinsic ligaments is beyond the scope of this class. As a group, the intrinsic ligaments interconnect various carpal bones, help transfer forces between the hand and the forearm and maintain the natural shapes of the radiocarpal and midcarpal joints

Mansfield, p127
Supporting Structures of both radiocarpal joint and midcarpal joint…cont

- The Four primary extrinsic ligaments supporting the wrist:

<table>
<thead>
<tr>
<th>Ligament</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dorsal radiocarpal ligament</td>
<td>Between radius and dorsal side of carpal bones</td>
<td>Resists extreme flexions</td>
</tr>
<tr>
<td>Radial collateral ligament</td>
<td>Lateral aspect between radius and carpal bones</td>
<td>Resists extremes of ulnar deviation</td>
</tr>
<tr>
<td>Palmar radiocarpal ligament</td>
<td>Thickest ligament of the wrist, on the palmar aspect between the radius and carpal bones</td>
<td>Resists extremes of wrist extension</td>
</tr>
<tr>
<td>Ulnar collateral ligament</td>
<td>located on the ulnar aspect between the ulna and carpal bones</td>
<td>Resists extremes of radial deviation and helps stabilize the distal Radioulnar joint</td>
</tr>
</tbody>
</table>
Supporting Structures of both radiocarpal joint and midcarpal joint...cont

- **Flexor Retinaculum:**

- **Extensor Retinaculum:**
  - A ligament traversing the posterior side of the wrist in a medial-lateral direction, holding the extensor tendons close to the wrist, especially during active wrist extension
Myology of the Wrist (Muscles)

• Muscles crossing the wrist joint and having primary function at the wrist will be discussed here

• **Anterior Muscles**
  • Flexor Carpi Ulnaris (FCU)
  • Flexor Carpi Radialis (FCR)
  • Palmaris Longus

• **Posterior Muscles**
  • Extensor Carpi Radialis Longus (ECRL)
  • Extensor Carpi Radialis Brevis (ECRB)
  • Extensor Carpi Ulnaris (ECU)

Lippert, p164
Myology of the Wrist (Muscles)...cont

- General Statements regarding the wrist muscles:
  - 1. the flexors originate proximally on the medial epicondyle
  - 2. the extensors originate proximally on the lateral epicondyle
  - 3. the distal attachment for all wrist muscles is a metacarpal (except for palmaris longus)
  - 4. the names of the muscles will generally indicate what their action is

Lippert, p164
Myology of the Wrist

**Flexor Carpi Ulnaris (FCU)**

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Medial epicondyle of the humerus-common flexor tendon and posterior border of the middle 1/3 of the ulna</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Base of the 5th metacarpal and pisiform- palmar aspect</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Ulnar n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Wrist flexion, ulnar deviation</td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
<td>What’s in a name? Common origin?</td>
</tr>
</tbody>
</table>
# Myology of the Wrist

## Flexor Carpi Radialis (FCR)

<table>
<thead>
<tr>
<th><strong>Origin</strong></th>
<th>Medial epicondyle of the humerus-common flexor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Base of the 2\textsuperscript{nd} metacarpal-palmar aspect</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Median n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Wrist flexion, radial deviation</td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
<td>What’s in a name?</td>
</tr>
<tr>
<td></td>
<td>Common origin?</td>
</tr>
</tbody>
</table>
## Myology of the Wrist

### Palmaris Longus

<table>
<thead>
<tr>
<th>Origin</th>
<th>Medial epicondyle of the humerus- common flexor tendon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>Transverse carpal ligament and the palmar fascia</td>
</tr>
<tr>
<td>Innervation</td>
<td>Median n.</td>
</tr>
<tr>
<td>Action</td>
<td>Wrist flexion</td>
</tr>
<tr>
<td>“tidbit”</td>
<td>Approximately 10% of the population will NOT have this muscle</td>
</tr>
</tbody>
</table>

大约10%的人口不会拥有这条肌肉。
The Wrist Flexor Muscles

- How do we stretch the wrist flexors?
- How do we strengthen the wrist flexors concentrically? Eccentrically?
# Myology of the Wrist

## Extensor Carpi Radialis Brevis (ECRB)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Lateral epicondyle of the humerus-common extensor tendon</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Base of the 3rd metacarpal-dorsal aspect</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Radial n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Wrist extension, radial deviation</td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
<td>What’s in a name? Common origin?</td>
</tr>
</tbody>
</table>
## Myology of the Wrist

<table>
<thead>
<tr>
<th><strong>Extensor Carpi Radialis Longus (ECRL)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>“tidbit”</strong></td>
</tr>
</tbody>
</table>
## Myology of the Wrist

### Extensor Carpi Ulnaris (ECU)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Lateral epicondyle of the humerus-common extensor tendon <em>and</em> posterior border of the middle 1/3 of the ulna</td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
<td>Base of the 5\textsuperscript{th} metacarpal-dorsal surface</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Radial n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>Wrist extension, ulnar deviation</td>
</tr>
</tbody>
</table>
| **“tidbit”**   | What’s in a name?  
Common origin?                                                            |
Wrist Extensor Muscles

• How do we stretch the wrist extensor muscles?
• How do we strengthen the wrist extensor muscles concentrically? Eccentrically? Isometrically?
• What’s the difference between extending the wrist with the forearm in pronation vs forearm neutral?
Myology of Wrist...cont

- Tendon position of anterior wrist muscles

Figure 12-13. Tendon position of anterior wrist muscles.

Lippert, fig 12-13
• http://www.youtube.com/watch?v=iDXUwErttJA&feature=related
Myology of the Wrist...cont

- **Anatomical Relationships**
  - The wrist flexors are relatively superficial, are located on the anterior aspect of the forearm and originate on the medial epicondyle
  - Beneath the wrist flexors are the flexors of the thumb and hand
  - The wrist extensors are relatively superficial, are located on the posterior aspect of the forearm and originate on the lateral epicondyle
  - From lateral to medial, they go: ECRL, ECRB, ED & EDM (hand muscles), ECU
  - Note: all wrist, hand and thumb tendons are contained by the extensor retinaculum

Lippert, p167
**Myology of the Wrist...cont**

- **Prime Movers:**

<table>
<thead>
<tr>
<th>Action</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>FCR, FCU</td>
</tr>
<tr>
<td>Extension</td>
<td>ECRL, ECRB, ECU</td>
</tr>
<tr>
<td>Radial Deviation</td>
<td>FCR, ECRL</td>
</tr>
<tr>
<td>Ulnar Deviation</td>
<td>FCU, ECU</td>
</tr>
</tbody>
</table>

Lippert, p168
Myology of the Wrist...cont

- **Summary of Muscle Innervation:**

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Nerve</th>
<th>Spinal Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECRL</td>
<td>Radial</td>
<td>C6, C7</td>
</tr>
<tr>
<td>ECRB</td>
<td>Radial</td>
<td>C6, C7</td>
</tr>
<tr>
<td>ECU</td>
<td>Radial</td>
<td>C6, C7, C8</td>
</tr>
<tr>
<td>FCR</td>
<td>Median</td>
<td>C6, C7</td>
</tr>
<tr>
<td>Palmaris Longus</td>
<td>Median</td>
<td>C6, C7</td>
</tr>
<tr>
<td>FCU</td>
<td>Ulnar</td>
<td>C8, T1</td>
</tr>
</tbody>
</table>
Pin the Tail on the Donkey

- Point to the...
  - Wrist flexors
  - Wrist extensors
Identify!

- Flexor Carpi Ulnaris
- Palmaris Longus
- Flexor Carpi Radials
• Extensor carpi radialis brevis
• Extensor carpi radialis longus
• Extensor carpi ulnaris
• Flexor carpi ulnaris
• Extensor retinaculum
Muscles of Forearm (Superficial Layer): Posterior View

SEE ALSO PLATES 439, 447

- Superior ulnar collateral artery (anastomoses distally with posterior ulnar recurrent artery)
- Triceps brachii muscle
- Ulnar nerve
- Brachioradialis muscle
- Extensor carpi radialis longus muscle
- Common extensor tendon
- Extensor carpi radialis brevis muscle
- Extensor digitorum muscle
- Extensor digiti minimi muscle
- Abductor pollicis longus muscle
- Extensor pollicis brevis muscle
- Extensor pollicis longus tendon
- Extensor carpi radialis brevis tendon
- Extensor carpi radialis longus tendon
- Extensor retinaculum (compartments numbered)
- Dorsal branch of ulnar nerve
- Extensor carpi ulnaris tendon
- Extensor digiti minimi tendon
- Superficial branch of radial nerve
- Anatomical snuffbox
- 5th metacarpal bone
References