THE FOREARM, WRIST AND HAND

I. THE BONES OF THE FOREARM, WRIST AND HAND

A. The forearm bones (Fig. 7.25, p. 234 [238]) Use disarticulated bones and the skeletons to study these bones.

1. **Radius** You do not need to distinguish right from left.
   - Head
   - Radial tuberosity
   - Styloid Process

2. **Ulna** Know right from left.
   - Olecranon process
   - Trochlear notch
   - Radial notch
   - Styloid process
   - Head

3. The lateral bone of the forearm is the _____________________.

B. Wrist and hand bones (Fig. 7.27 [7.26]) Recognize right or left articulated hands.

1. **Carpal bones**
2. **Metacarpals 1-5**
3. **Phalanges** (singular is phalanx)
   - The pollex (digit number 1, the thumb) has a proximal phalanx and a distal phalanx.
   - Digits 2-5 have a proximal, middle and distal phalanx.

C. Helpful tips for learning bones

1. See the definitions of the bone markings on page 13 in this Laboratory Guide to define “process,” “tuberosity,” “notch,” etc.
2. Observe the articulations of the humerus, radius, and ulna on a skeleton. Using the skeleton as a model, join these three disarticulated bones. Observe your own forearm as you supinate and pronate it. (Please do not pronate or supinate the skeletons as they are not made to withstand this.)

a. The “point” of the elbow is formed by the ___________________________ of the __________ bone.

b. The ulna forms the major joint with the humerus; the trochlea of the humerus articulates with the ___________________________ of the ulna.

c. The capitulum ("cap") of the humerus articulates with the ________________ of the radius.

d. The head of the radius articulates medially with the ___________ ___________ of the ulna.

3. Observe the wrist of a skeleton and your own wrist.

a. The forearm bone that articulates with most carpal bones is the ________________.

b. How many carpal bones are there? _____ (We will not learn individual names of this group of bones.)

c. Notice the bump on the posterior, medial side of your wrist. (Fig. 7.26 [7.27] may be helpful.) This is formed by the __________ of the __________.

4. Each phalanx has its own name, based on its position and number of the digit it is in. Each metacarpal has its own number. Study the articulated hand bones.

a. Wedding rings are usually worn on the ___________________________ phalanx of digit _____.

b. The tip of the little finger is the ___________________________ phalanx of digit _____.

c. The knuckles are formed by the ________________ ends of the ____________________________ bones.
II. MUSCLES THAT MOVE THE FOREARM, HAND AND FINGERS

A. Preliminary review: Before you begin to study the muscles below, re-identify Brachioradialis, Pronator teres and Supinator (see page 27 of this Lab Guide) from the previous lab. These muscles are found in the arm or forearm, and all move the forearm.

B. Muscles that flex the hand or fingers (Fig.10.27a,b,c [10.28a,b, c]) These are the strong muscles of the “flexor compartment” on the anterior forearm. Most originate on the large medial epicondyle. Use the hand model for palmaris longus’ insertion.

1. **Palmaris longus**
   - Origin: Medial epicondyle
   - Insertion: Palmar aponeurosis
   - Action: Flexes hand

2. **Flexor carpi radialis**
   - Origin: Medial epicondyle
   - Actions (2): Flexes and abducts hand

3. **Flexor carpi ulnaris**
   - Origin: Medial epicondyle
   - Actions (2): Flexes and adducts hand

4. **Flexor digitorum superficialis**
   - Origin: Medial epicondyle
   - Action: Flexes middle phalanges 2-5

5. **Flexor digitorum profundus**
   - Action: Flexes distal phalanges 2-5

6. **Flexor pollicis longus**
   - Action: Flexes thumb

C. Helpful tips for learning these muscles

1. For the flexor compartment above, use a 3-1-2 pattern to learn the six muscles: 3 superficial ones, 1 intermediate one, and 2 deep ones. Of the two deep muscles, the **flexor pollicis longus** is on the thumb side, and the **flexor digitorum profundus** is on the finger side, as their names suggest.
D. Muscles that extend the hand or fingers (Fig. 10.28a,b [10.29a,b]) These are the muscles of the “extensor compartment” on the posterior forearm. Note that several share the same origin on the lateral epicondyle.

1. **Extensor digitorum**
   - **Origin:** Lateral epicondyle
   - **Action:** Extends digits 2-5

2. **Extensor carpi radialis longus & brevis**
   - **Origin:** Lateral epicondyle
   - **Actions (2):** Extends and abducts hand

3. **Extensor carpi ulnaris**
   - **Origin:** Lateral epicondyle
   - **Actions (2):** Extends and adducts hand

4. **Extensor pollicis longus**
   - **Action:** Extends thumb

5. **Abductor pollicis longus**
   - **Action:** Abducts thumb

E. Helpful tips for learning these muscles

1. Notice that four muscles share the middle name “carpi.” They are flexor carpi radialis, flexor carpi ulnaris, extensor carpi radialis longus, and extensor carpi ulnaris. Based on location, can you see which muscles also abduct or adduct the hand?

F. Special connective tissues (Fig. 10.27a [0.28a]; 10.28a [10.29a]) Each retinaculum holds the tendons in place along the wrists. Use hand models or upper limb or for these structures.

1. **Palmar aponeurosis**

2. **Extensor retinaculum**

3. **Flexor retinaculum**
G. **Anatomy is a precise descriptive science based on observation.** Unlike the common misconception, it is not based on rote memory!

1. Each name is meant to identify some characteristic of the muscle. Make the muscle “show” you its name as you observe its location, shape, size, or action.

2. On the limbs origins are more proximal; insertions are more distal.

3. Make the muscle "show" you its origin or insertion by observing it. In most but not all muscles, you can see the assigned origin and insertion on the models.

4. Muscles on the limbs usually cause movement of the part of the limb distal to their belly.

5. Make the muscle “show” you its action by its position. Muscles cause movement by shortening (contracting), which pulls one bone toward or away from another bone. Notice the direction of the fibers of the muscle, which are the parts that shorten.

6. As you learn each muscle, draw your fingers slowly along the belly from the origin to the insertion. Say the name. Name the origin and name the insertion as you touch each end on the models or yourself. Then, perform the actions with your own muscles as you say the name of the actions aloud. In lab, use the models and your own muscles. At home, use your own muscles.
Optional notes on the bones and muscles of the forearm

1. If you are right-handed, you may have noticed that you prefer to try your left hand when attempting to open a tight lid of a jar. If you are left-handed, you may have noticed that you have a talent for opening tight jar lids. Why? To open a standard jar with the right hand, pronation is required. To open the same jar with the left hand, supination is required. Supination is a stronger action than pronation, since the biceps brachii assists the supinator muscle with supination. There is no such assistance for the pronator teres.

2. Which is larger in the average person—the flexor compartment of the anterior forearm, or the extensor compartment of the posterior forearm? Why? See if you can locate a person who plays the piano daily. Which compartment is especially well developed?

3. “Tennis elbow” refers to inflammation of the lateral epicondyle, where the muscles used to extend the wrist originate.

4. Most people, but not everyone, has the palmaris longus muscle. Do you? Clench your fist tightly and flex your hand. If you see three tendon on the anterior side of your forearm at the wrist, you have a palmaris longus on that forearm. If you see only two tendons and a space in between, you do not have a palmaris longus. You may have the palmaris longus on one limb but not on the other.

5. The hand is a powerful yet delicate tool. It has strong muscles, but they are located in the forearm. The tendons to the fingers make the hand “cable-operated,” and allow for the relatively slender size of the fingers and palm. There are also “intrinsic” muscles of the hand which we will not study.

6. Have you ever watched a movie scene in which one character knocks a weapon out of an assailant’s hand by delivering a sharp blow to the dorsal surface of the hand, causing the hand to flex suddenly? When it does so, the weapon flies out of the hand. Here’s why: The tendons to the extensor digitorum are too short to allow the fingers to flex (grasp) when the wrist is flexed. This is a well-known self-defense maneuver.

7. Carpal tunnel syndrome occurs when fluid accumulates deep to the flexor retinaculum, putting pressure on the median nerve which runs deep to it. It can be relieved conservatively by splinting, rest, or vitamin B6 supplements, or by surgery if necessary.