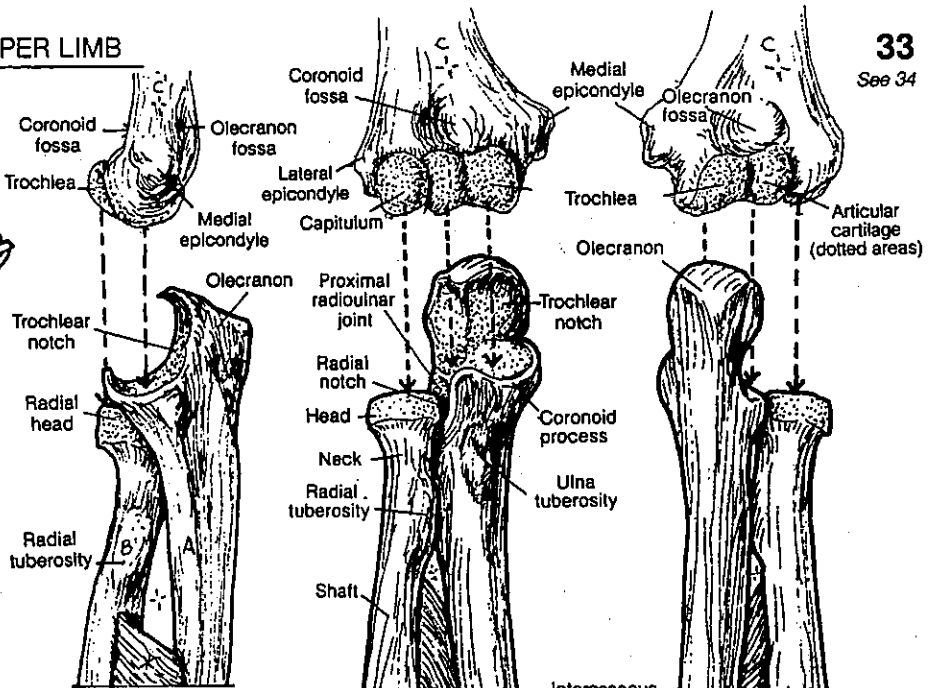
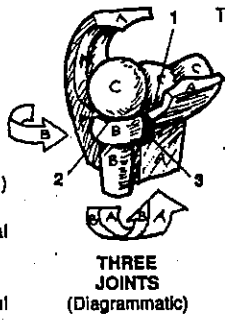


# FOREARM BONES

ULNA<sub>A</sub>  
RADIUS<sub>B</sub>

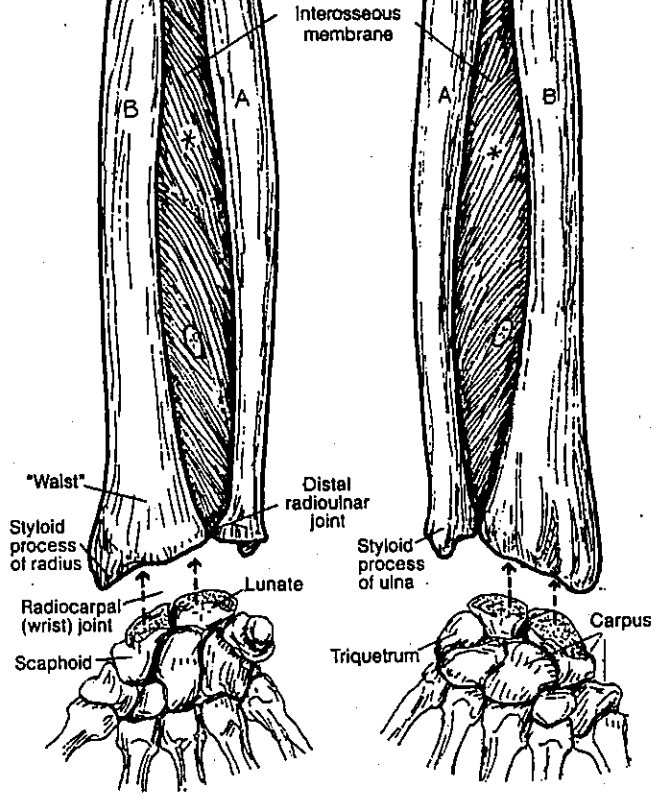
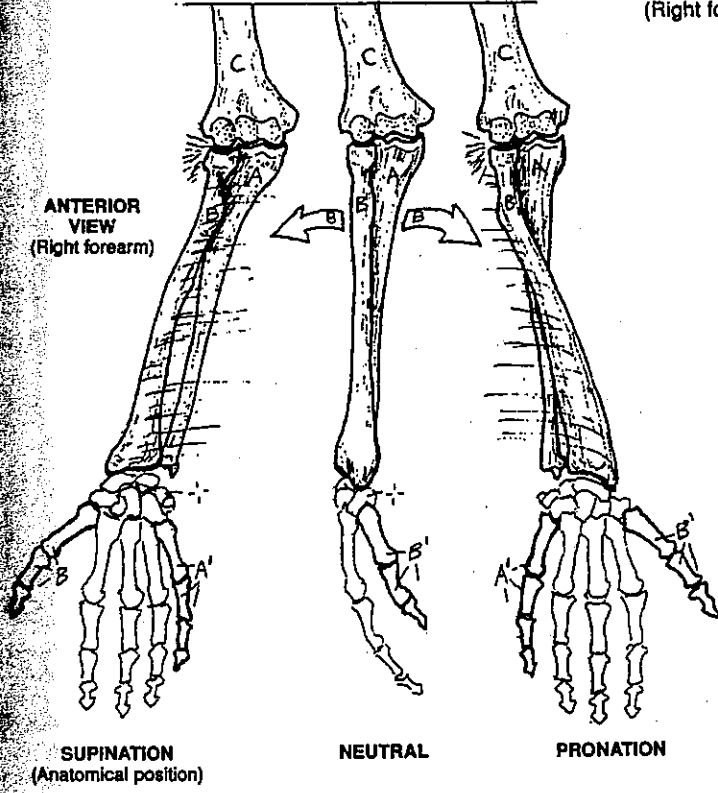
HUMERUS<sub>C</sub>

**CN:** Use very light colors for A and B, and the same color for the humerus (C) that was used on the preceding plate. Note that the distal humerus and carpal bones are left uncolored in the large illustrations. (1) Color the forearm bones in the three views, taking careful note of the callouts referring to surface details. (2) In the supination/pronation diagrams, the thumb and little finger of the hand receive the same colors as the forearm bones to which they relate, regardless of hand position.



**MEDIAL VIEW (Right forearm)**

RADIUS<sub>B</sub> / THUMB SIDE<sub>B</sub>  
ULNA<sub>A</sub> / LITTLE FINGER SIDE<sub>A</sub>



**ANTERIOR VIEW (Right forearm)**

**POSTERIOR VIEW (Right forearm)**

The two bones of the forearm are quite different from one another. The posterior aspect of the proximal extremity of the *ulna* is characterized by a rather massive bone mass called the *olecranon*. You can feel it easily at the back of your elbow. On the anterior side of the olecranon is the *trochlear notch*, which articulates with the *trochlea* of the *humerus* at the *humeroulnar joint* (synovial; hinge). A part of this surface turns to face the *radius* (the radial head); this is the radial notch, which contributes to the *proximal radioulnar joint* (synovial; pivot). The ulnar shaft narrows distally to terminate as the head of the ulna. The head forms a pivot-type, synovial joint with the radius (*distal radioulnar joint*). This joint shares an articular disc that fits between the ulnar head and the lunate and triquetrum bones of the wrist. This disc contributes to the radiocarpal (wrist) joint, but the ulnar head does not. The shaft of the ulna forms a movable, fibrous joint (syndesmosis) with the shaft of the radius by means of the interosseous membrane.

the capitulum of the humerus (*radiohumeral joint*; synovial; pivot) and the radial notch of the ulna (*proximal radioulnar joint*). The shaft of the radius flares distally to form a broad wrist joint with the scaphoid and lunate bones of the carpus. Falls on the hands load the wrist joint and can cause a fracture of the radius at the relatively weak "waist" between the shaft and the flared distal extremity (Colles fracture, Smith fracture). After coloring and studying the supination/pronation movements, put the palm of your right hand out in front of you, palm down (prone). In this position, the radius and ulna are in parallel. Place the fingers of the left hand on your right olecranon. Now supinate your right hand (to palm up). Notice the olecranon did not move. Thus, the ulna does not move during supination/pronation of the hand. Now find and observe the styloid process of the radius at the right wrist (on the thumb side) as you supinate/pronate the right hand. Note that the styloid process moves with the thumb. You have now demonstrated how the radius moves around the ulna during pronation and supination of the hand

# ELBOW JOINTS

CN: Use the same colors for the three bones as were used on 32 and 33. Use light blue for H. (1) Begin with the three joints of the elbow region. Note that each articulating surface (dotted) receives the color of its bone—in the lower, boxed-in illustration and in the sagittal view, those surfaces (H) are colored light blue. Color K yellow. (2) Color the remaining views of the joint capsule and ligaments.

**ELBOW JOINT:**  
**HUMEROULNAR<sub>B</sub>**  
**RADIOHUMERAL<sub>A</sub>**  
**RADIOULNAR<sub>B</sub>**

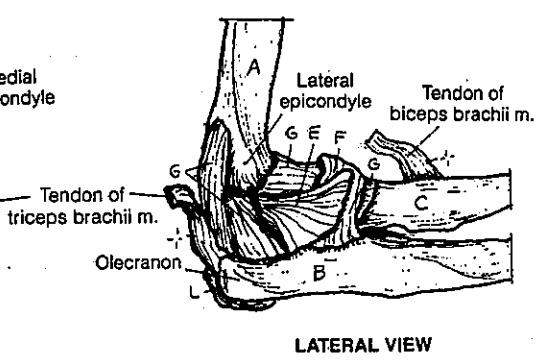
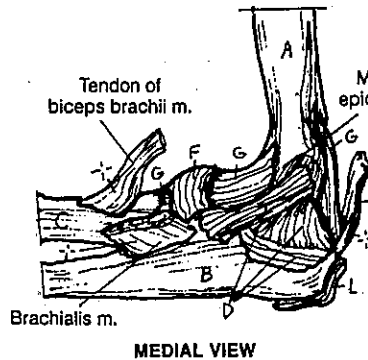
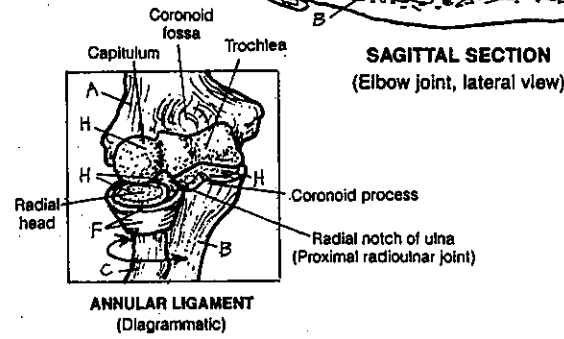
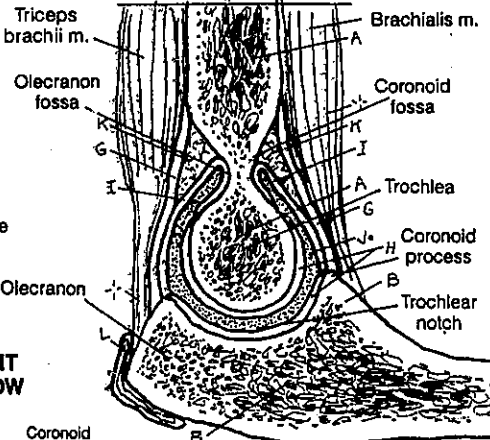
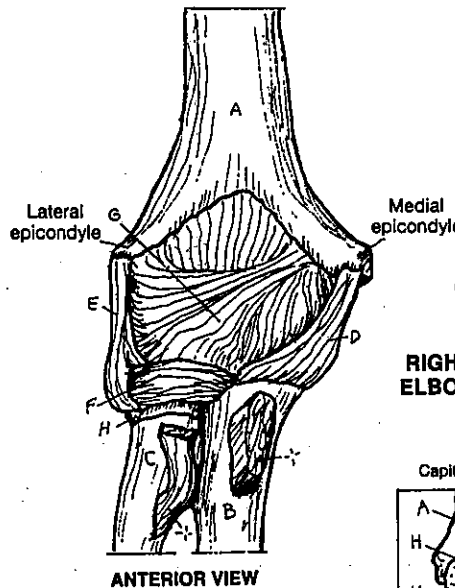
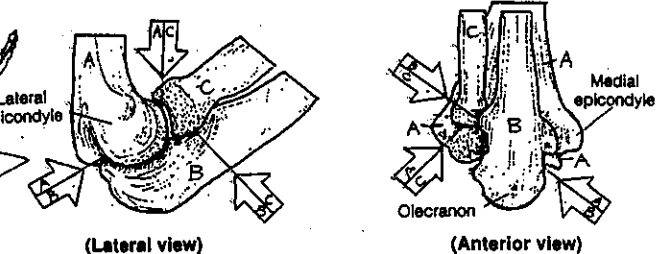
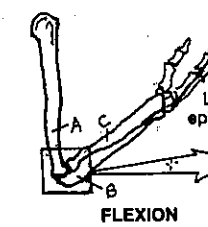
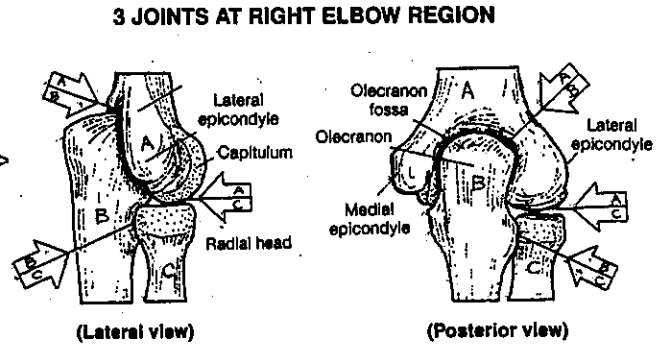
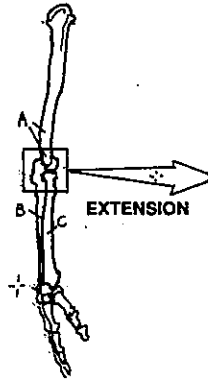
ANNULAR LIG<sub>B,F</sub>

**ULNA:**  
**ULNAR COLLATERAL LIG.<sub>D</sub>**  
**HUMERUS<sub>A</sub>**  
**RADIAL COLLATERAL LIG.<sub>E</sub>**  
**RADIUS<sub>C</sub>**

**JOINT CAPSULE:**  
**ARTICULAR CARTILAGE<sub>H</sub>**  
**SYNOVIAL MEMBRANE<sub>I</sub>**  
**SYNOVIAL CAVITY<sub>J</sub>**  
**FAT PAD<sub>K</sub>**  
**BURSA<sub>L</sub>**

The elbow joint consists of two separate articulations with the humerus: the *humero-ulnar* and *radiohumeral joints* (synovial; hinge type). Movements of this joint are limited to flexion and extension. Note that the C-shaped, articular cartilage-lined trochlear notch of the ulna rotates around the pulley-shaped trochlea of the humerus during these movements. In extension, the upper part of the trochlear notch fits into the olecranon fossa of the humerus. In flexion, the coronoid process of the ulna fits into the coronoid fossa of the humerus (see Plate 33). The ligaments of the elbow joint—essentially, the radial and ulnar collateral ligaments—reinforce the fibrous joint capsule.

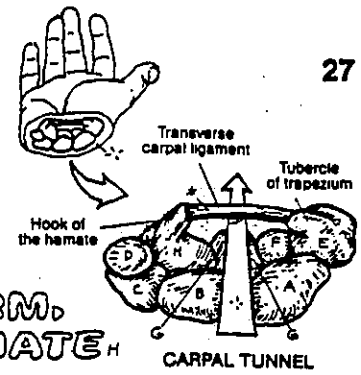
The joint between the radius and the ulna (*proximal radioulnar joint*) permits the radial head to pivot within the radial notch of the ulna. The ulna cannot pivot around anything because of the shape of the humero-ulnar joint. Though the proximal radioulnar joint is not considered part of the elbow joint, its synovial cavity and fibrous joint capsule is continuous with that of the elbow joint, and it is secured by both radial and ulnar collateral ligaments. The annular ligament is attached at both ends to the sides of the radial notch of the ulna. It is more narrow below than above (i.e., it is beveled). It surrounds and secures the head (above) and the neck (below) of the radius and resists its displacement when the hand is pulled away from the shoulder. The lower part of the annular ligament is lined with synovial membrane; the upper part is fibrocartilaginous and is associated with the rotation of the radius at the proximal radioulnar joint. The joint capsule and the radial collateral ligament reinforce the retaining function of the annular ligament.



# III. SKELETAL SYSTEM / UPPER LIMB WRIST AND HAND BONES

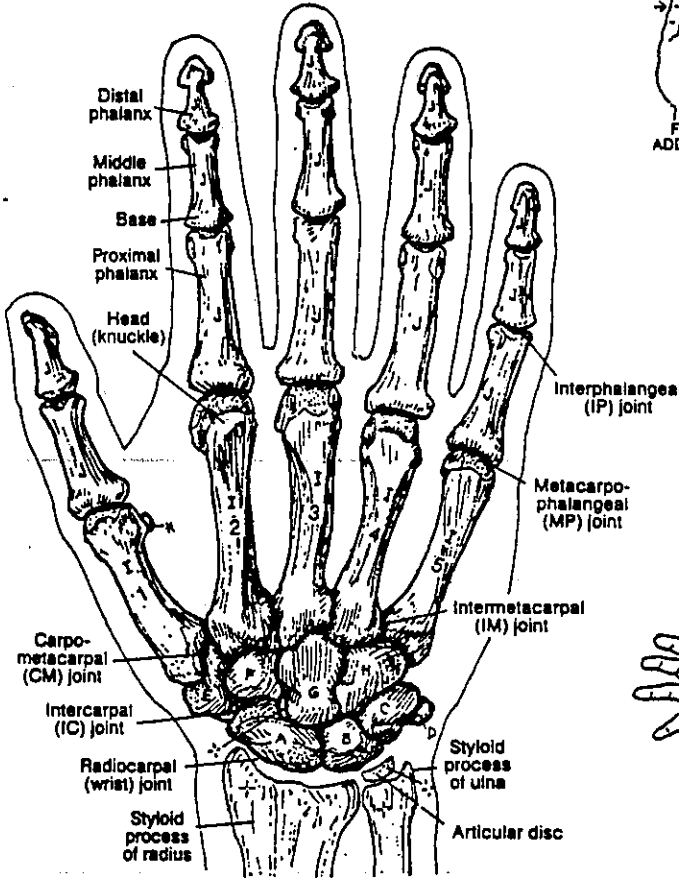
N: Use two light colors other than those used on Plates 25 and 26 for I and J. (1) Color each bone, or bone group, in all three major views simultaneously. Note the hand drawings

which demonstrate movements at the joints. (2) Color the bones and ligament of the carpal tunnel. You may wish to color those bones in their location in the hand to the left.

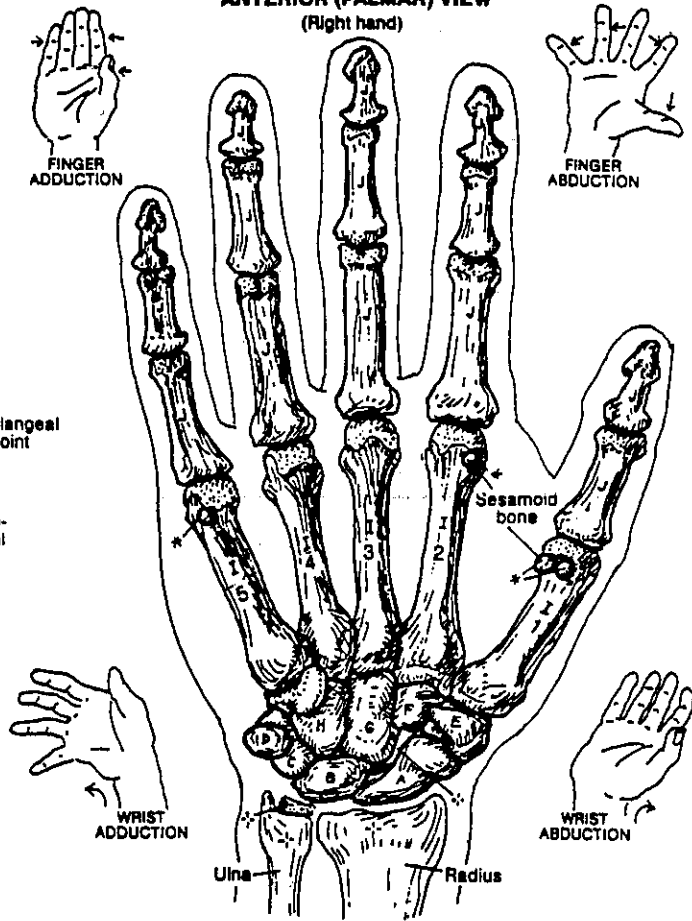


**CARPALS (8):**  
**SCAPHOID, LUNATE, TRIQUETRUM, PISIFORM,**  
**TRAPEZIUM, TRAPEZOID, CAPITATE, HAMATE**  
**METACARPALS (5): PHALANGES (14)**

**POSTERIOR (DORSAL) VIEW**  
(Right hand)

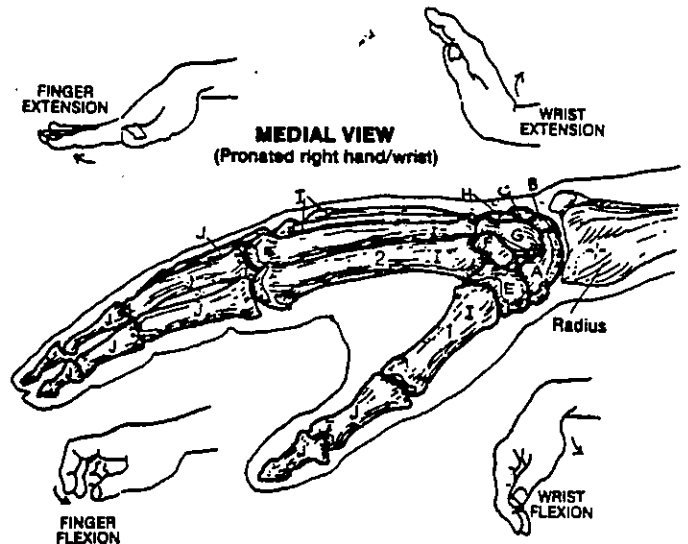


**ANTERIOR (PALMAR) VIEW**  
(Right hand)



The hand is a most remarkable device. It is perhaps the most highly evolved mechanical structure of our bodies. Movement of the hand and wrist is made possible by the architecture of the joints among the bones. The wrist joint is formed by the distal articular surface of the radius and the distal surface of the articular disc (just distal to the ulna) with the proximal articular surfaces of the scaphoid, lunate, and triquetrum bones. Forces transmitted from a fall on the hand to the wrist pass largely through the scaphoid, lunate, and radius; thus, fractures of the scaphoid and distal radius are common. The intercarpal (IC) joints work in linkage with the wrist joint. Note that the carpal bones are arranged in two rows: distal and proximal. A strong handgrip is dependent upon a neutrally positioned or extended wrist, as shown in the small illustration showing finger flexion. With the wrist in flexion, the hand or finger grip is weak.

Using your own hand, in conjunction with coloring, note that each hand normally has 5 digits (there can be fewer or more). Note that each digit has 3 phalanges except the thumb which has two. Note that the interphalangeal (IP) joints are limited to movements of flexion/extension. The metacarpals support the hand proximal to the fingers, and the MP joints permit the added movements of adduction/abduction. Of the CM joints, the thumb has exceptional movement (1st CM joint: saddle type, synovial); when moving the thumb toward the little finger in an arcing motion, note that the thumbnail rotates 90°, reflecting medial rotation of the first metacarpal on the trapezium. The 5th CM joint works during cupping of the hands when the 1st and 5th metacarpals are brought together.



# III. SKELETAL SYSTEM / UPPER LIMB

## FOREARM BONES

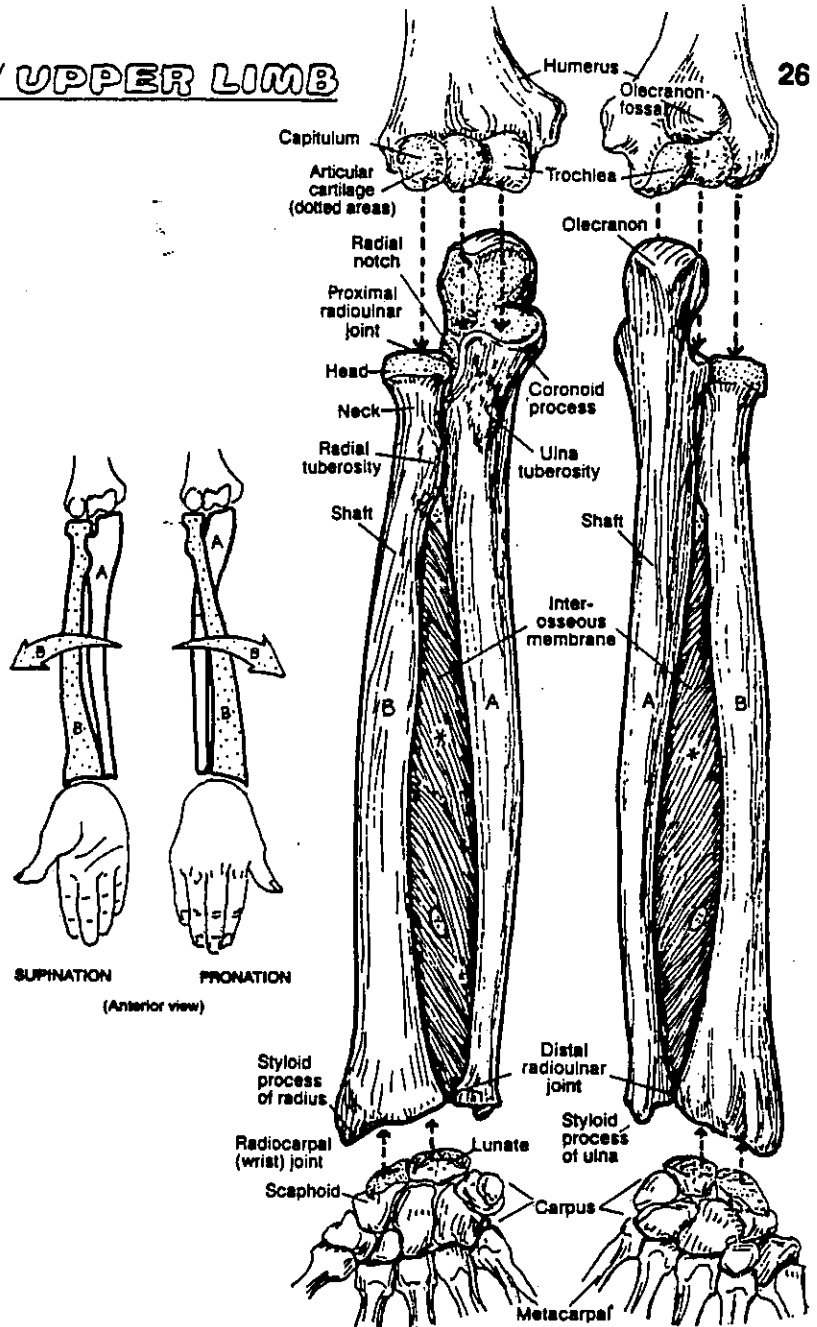
### ULNA<sub>A</sub> RADIUS<sub>B</sub>

CN: Though the humerus is not colored, the titles and arrows (C) that reflect its participation in the elbow joint should be colored with the same color the bone received on Plate 25. (1) Color the two large views, including the interosseous membrane (gray). (2) Color the four views of the elbow joint. (3) Color the ligaments of the region.

The presence of two bones in the forearm make possible the diverse movements seen at the elbow and reflected in hand motion. The *ulna*, the major, stabilizing forearm bone at the elbow, narrows distally to form an inconsequential joint with the radius (distal radioulnar joint; synovial, pivot-type). The *radius*, smaller above, widens and thickens distally to form the major joint at the wrist (radiocarpal joint; synovial, biaxial, ellipsoid-type). At the elbow, the ulna forms a hinge type synovial *humeroulnar joint* with the trochlea of the humerus, and the radius forms a pivot-type synovial *radiohumeral joint* with the capitulum of the humerus. These joints share the same joint capsule with the proximal *radioulnar joint* (synovial, pivot type) between the radial notch of the ulna and the radial head. The three joints constitute the elbow (cubital) joint.

Rotation of the radius at the elbow (involving two of the three joints at the elbow) rotates the forearm, wrist, and hand without moving the ulna. Movement of the hand to a palm-forward (up) position is *supination*; movement of the hand to a palm-back (down) position is *pronation*.

After coloring and studying the supination/pronation and elbow movement diagrams, try this: place the fingers of your left hand on your right olecranon (bump at posterior elbow), elbow flexed so that the palm of your right hand is up (supine). Now rotate (pronate) your right hand so your palm turns away from you, facing down. Move your right hand back and forth in this manner, feeling that the olecranon does not move during these motions. Further, stare at the styloid process of the radius at the base of the right thumb and note that it rotates back and forth with the thumb. You have just demonstrated that the radius moves around the ulna during pronation/supination, and that joint movement occurs at the radiohumeral and proximal radioulnar joints.



SUPINATION (Anterior view) PRONATION (Anterior view)

ANTERIOR VIEW (Right arm)

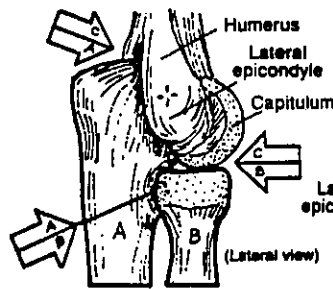
POSTERIOR VIEW (Right arm)

### 3 JOINTS AT THE RIGHT ELBOW:\*

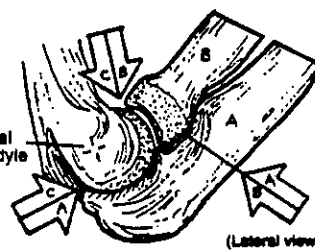
HUMERO-ULNAR<sub>A</sub>

RADIO-HUMERAL<sub>C</sub>

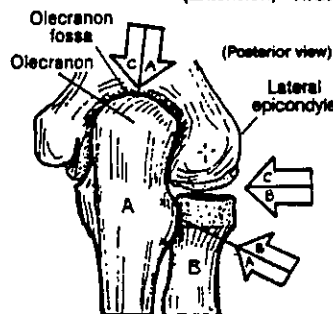
RADIO-ULNAR<sub>B</sub>



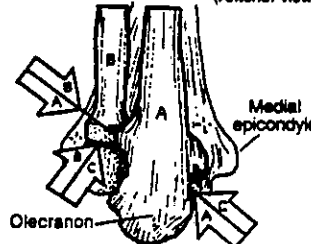
(Extension) RIGHT ELBOW



(Flexion)

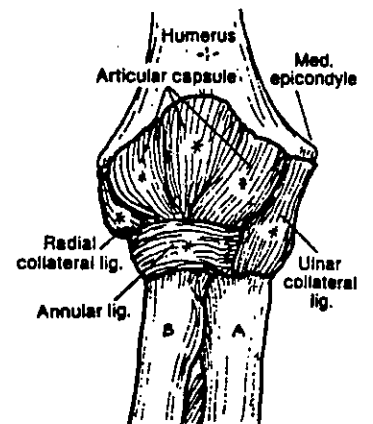


(Posterior view)



(Anterior view)

### LIGAMENTS\*



ANTERIOR VIEW