



# The Upper Limb VII



## Muscles of the Forearm

Anatomy

RHS 241

Lecture 16

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# Skeleton of the hand

- **Carpals** (wrist bones)
- **Metacarpals** (long bones of the palm)
- **Phalanges** (bones of the fingers)

# Carpals

- Proximal row (lateral to medial):  
**scaphoid, lunate, triquetrum, pisiform**
- Distal row (lateral to medial):  
**trapezium, trapezoid, capitate, hamate**

# Metacarpals & phalanges

- Enlarged ends (epiphysis)
- Distinct shaft (diaphysis)
  
- Numbered 1-5 from lateral to medial
- 14 phalanges in each hand: 2 in thumb, and 3 in each of the 4 digits
  
- Palpate: 1) the **pisiform**; 2) the **scaphoid**

# Interphalangeal joints (IPJ)

- Synovial
- Hinge joints...??

# Extrinsic flexors of the digits

- **Flexor digitorum superficialis:** primary flexor of the proximal interphalangeal joints (PIPJ)
- **Flexor digitorum profundus:** primary flexor of the distal interphalangeal joints (DIPJ)
- **Flexor pollicis longus:** the only flexor of the IPJ of the thumb

# Extrinsic extensors of the digits

- **Extensor digitorum:** extension of PIPJ & DIPJ of fingers 2-5
- **Extensor pollicis longus:** the only extensor of the IPJ of the thumb

# Extensors of the digits

- Extension of IPJ of digits is also assisted by **intrinsic** muscles of the hand which are attached to the dorsal or **extensor expansion** of the fingers



# Intrinsic extensors of the digits

- **Lumbricals (1-4 lateral to medial):**
  - take their common attachment from the tendons of the **flexor digitorum profundus**
  - pull through the central and lateral slips of the extensor expansion
  - assist extension of both PIPJ & DIPJ

# Intrinsic extensors of the digits

- **Interossei:**

- Attached to and lie between the metacarpals
- pull through the central and lateral slips of the extensor expansion
- assist extension of both PIPJ & DIPJ

# Metacarpophalangeal joints (MPJ)

- Between the metacarpals & proximal phalanges
- Biaxial joints.....?

# Flexors of the MPJ

- **Lumbricals & interossei:** assist flexion of MPJ of digits 2-5
- **Flexor digiti minimi:** assist flexion of MPJ of finger 5
- **Flexor pollicis brevis:** assist flexion of MPJ of the thumb

# Extensors of the MPJ

- **Extensor digitorum:** primary extensor of MPJ of digits 2-5
- **Extensor indicis:** independent extensor of the 2<sup>nd</sup> digit (pointing index finger )
- **Extensor digiti minimi:** independent extensor of the 5<sup>th</sup> digit
- **Extensor pollicis brevis:** primary extensor of MPJ of the thumb

# Abduction/adduction of the MPJ

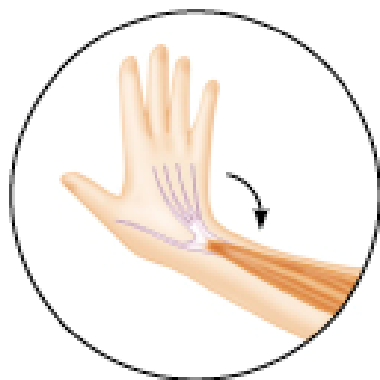
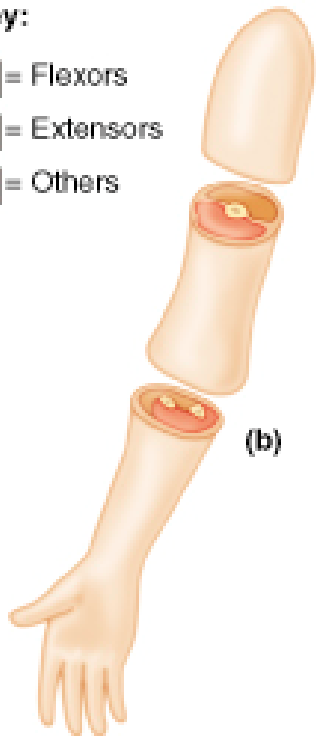
- Described relative to the long axis of the hand which extends distally through the 3<sup>rd</sup> or middle finger
- Frontal plane movement
- About an antero-posterior axis

# Abduction/adduction of the MPJ

- **Palmar interossei:** adduct the fingers- move fingers 2, 4, & 5 toward the 3<sup>rd</sup> finger (fingers closing)
- **Dorsal interossei:** abduct the fingers- move fingers 2, 3, & 4 relative to the long axis of the hand (fingers spreading)
- The thumb & 5<sup>th</sup> digit have their own abductors

**Key:**

- = Flexors
- = Extensors
- = Others



Posterior compartment of forearm  
(extends wrist and fingers)

Radius

Abductor  
pollicis  
longus

Pronator teres

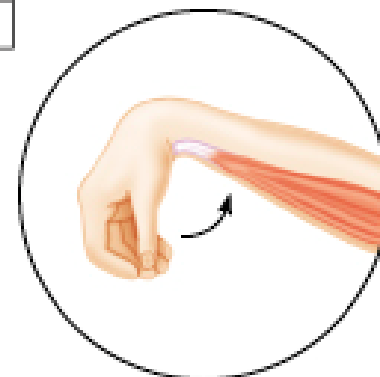
Brachioradialis  
(elbow flexor)

Extensors

Ulna

Flexors

(b)



Anterior compartment of forearm  
(flexes wrist and fingers)



# Flexors of the wrist & hand

- Lie within the **anterior** muscle compartment of the **forearm**
- Cross the wrist joint anterior to its axis of function
- Take their common origin from the **medial epicondyle** (site of golfer's elbow = medial epicondylitis)

# Flexors of the forearm

- **Superficial muscles:**
  - Pronator teres
  - Palmaris longus
  - **Flexor carpi radialis**
  - **Flexor carpi ulnaris**

# Pronator teres

- **Origin:**

- Medial epicondyle of humerus
- Coronoid process of ulna

- **Insertion:**

- Lateral surface of mid-shaft of radius

# Pronator teres

- **Action:**

- Pronation of forearm

- **Innervation:** median nerve

# Palmaris longus

- **Origin:** medial epicondyle of humerus (common flexor tendon)
- **Insertion:** Palmar aponeurosis
- **Action:** Flexion of hand
- **Innervation:** median nerve

# Flexor carpi radialis

- **Origin:** medial epicondyle of humerus (common flexor tendon)
- **Insertion:** base of 2<sup>nd</sup> metacarpal (possibly 3<sup>rd</sup>)
- **Action:** Flexion & abduction (radial deviation)
- **Innervation:** median nerve

# Flexor carpi ulnaris

- **Origin:** medial epicondyle of humerus (common flexor tendon)
- **Insertion:** pisiform bone
- **Action:** Flexion & adduction (ulnar deviation)
- **Innervation:** ulnar nerve

# Flexors of the forearm

- **Intermediate muscles:**
  - Flexor digitorum superficialis
- **Deep muscles:**
  - Flexor digitorum profundus
  - Flexor pollicis longus
  - Pronator quadratus



# Flexor digitorum superficialis

- **Origin:** medial epicondyle of humerus  
(common flexor tendon)
- **Insertion:** base of middle phalanx of 4 digits
- **Action:** Flexion of PIPJ of medial 4 digits
- **Innervation:** median nerve

# Flexor digitorum profundus

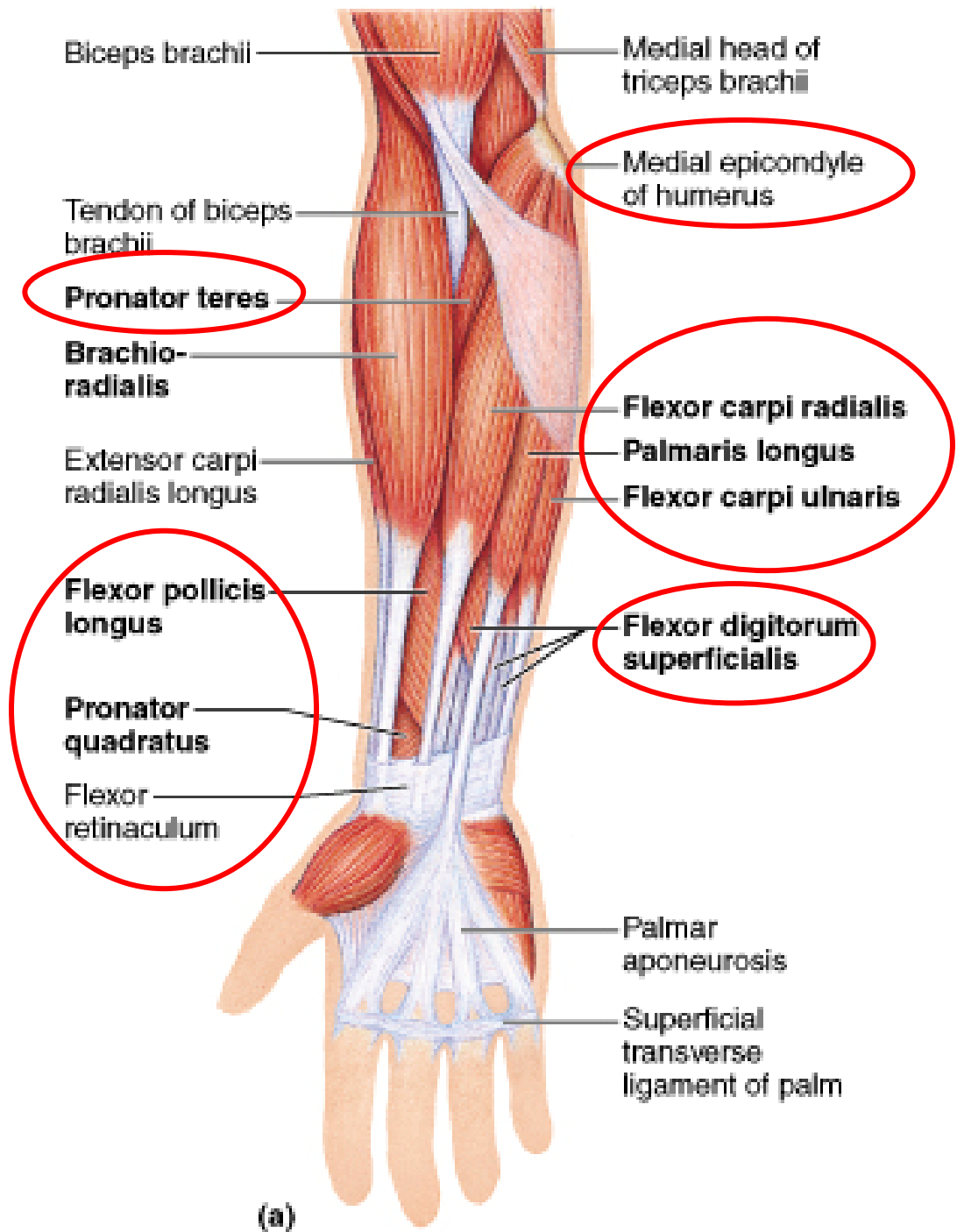
- **Origin:** anterior & medial surface of proximal ulna; aponeurosis of flexor carpi ulnaris
- **Insertion:** distal phalanx of medial 4 digits
- **Action:** Flexion of DIPJ of medial 4 digits
- **Innervation:** median & ulnar nerves

# Flexor pollicis longus

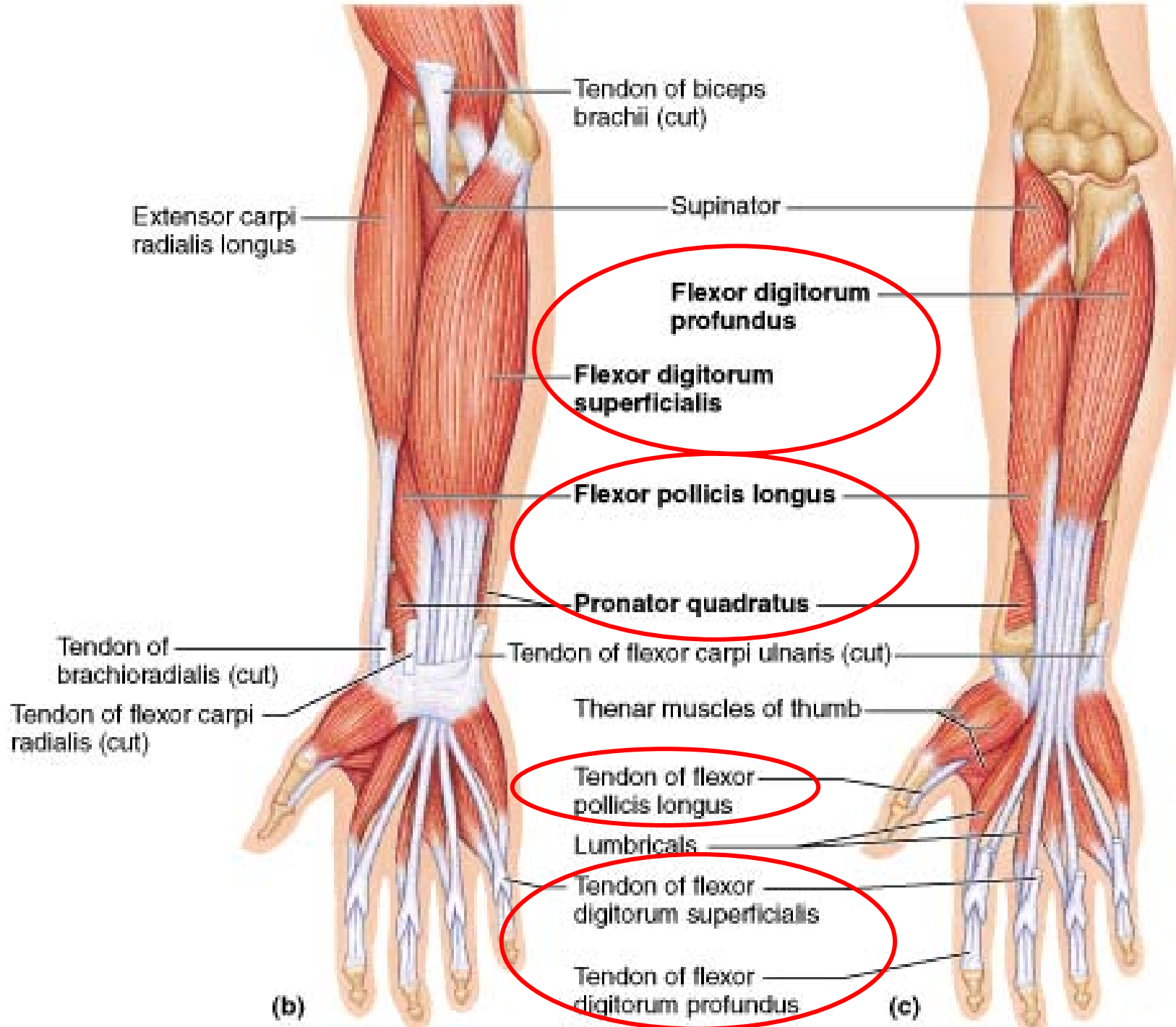
- **Origin:** anterior surface of middle half of radius
- **Insertion:** distal phalanx of thumb
- **Action:** Flexion of DIPJ of thumb
- **Innervation:** median nerve

# Pronator quadratus

- **Origin:** distal fourth of ulna
- **Insertion:** distal part of radius
- **Action:** pronation of forearm
- **Innervation:** median nerve



(a)



# Extensors of the wrist & hand

- Lie within the **posterior** muscle compartment of the **forearm**
- Cross the wrist joint posterior to its axis of function
- Take their common origin from the **lateral epicondyle** (site of tennis elbow = lateral epicondylitis)

# Extensors of the forearm

- **Superficial muscles:**
  - Brachioradialis
  - **Extensor carpi radialis longus**
  - **Extensor carpi radialis brevis**
  
  - Extensor digitorum
  - Extensor digiti minimi
  
  - **Extensor carpi ulnaris**



# Brachioradialis

- **Origin:** lateral supracondylar ridge of humerus
- **Insertion:** lateral side of distal end of radius
- **Action:** flexion of forearm
- **Innervation:** radial nerve

# Extensor carpi radialis longus

- **Origin:** lateral supracondylar ridge of humerus & common extensor tendon (lateral epicondyle)
- **Insertion:** base of 2<sup>nd</sup> metacarpal
- **Action:** extension & abduction (radial deviation)
- **Innervation:** radial nerve

# Extensor carpi radialis brevis

- **Origin:** common extensor tendon (lateral epicondyle)
- **Insertion:** base of 3<sup>rd</sup> metacarpal
- **Action:** extension of hand
- **Innervation:** radial nerve

# Extensor digitorum

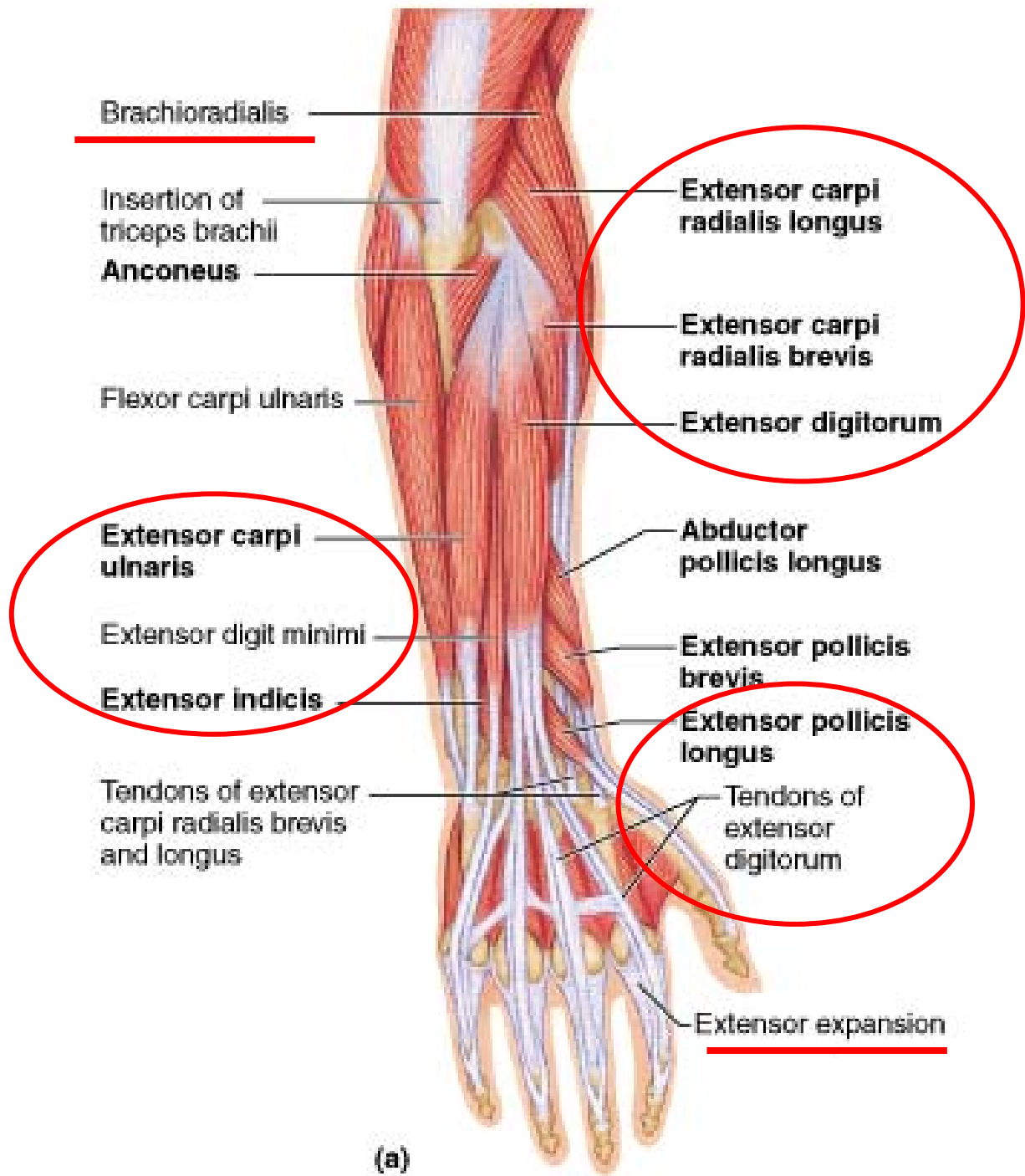
- **Origin:** common extensor tendon (lateral epicondyle)
- **Insertion:** middle & distal phalanges of 4 digits
- **Action:** extension of PIPJ & DIPJ of 4 digits
- **Innervation:** radial nerve

# Extensor digiti minimi

- **Origin:** common extensor tendon
- **Insertion:** middle & distal phalanges of little finger
- **Action:** extension & abduction of little finger
- **Innervation:** radial nerve

# Extensor carpi ulnaris

- **Origin:** common extensor tendon (lateral epicondyle)
- **Insertion:** base of 5<sup>th</sup> metacarpal
- **Action:** extension & adduction (ulnar deviation)
- **Innervation:** radial nerve







# Extensors of the forearm

- **Deep muscles:**

- Supinator

- Abductor pollicis longus

- Extensor pollicis brevis

- Extensor pollicis longus

- Extensor indicis

# Movement of the thumb

- 1<sup>st</sup> **carpometacarpal joint**: between the base of the 1<sup>st</sup> metacarpal & the trapezium
- Synovial; **saddle**:
  - flexion/extension (occur in a near frontal plane)
  - adduction/abduction (occur in near frontal plane)
  - **opposition** (carries the thumb medially toward the tip of the 5<sup>th</sup> finger- to bring together the tip of the thumb and fingers)

# Primary movers of the thumb

- **Flexors:**

- flexor pollicis longus
- flexor pollicis brevis

- **Extensors:**

- extensor pollicis longus
- extensor pollicis brevis

# Primary movers of the thumb

- **Adductors:**

- adductor pollicis

- **Abductors:**

- abductor pollicis longus

- abductor pollicis brevis

- **Opposition:**

- opponens pollicis

# Vulnerable peripheral nerves

## Upper limb

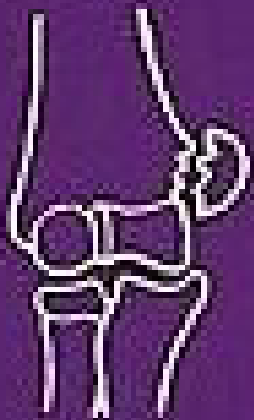
- Median nerve
  - Most common: compression at the wrist (carpal tunnel)
  - Fluid retention in pregnancy
  - Repetitive movement (flexor tenosynovitis)
  - Sensory distribution: thumb, index, and middle fingers, half the ring finger

# Vulnerable peripheral nerves

## Upper limb

- Ulnar nerve:
  - Most common: irritation at the elbow
  - Sensory distribution: little finger & ulnar half of the ring finger
- Radial nerve:
  - Vulnerable in the medial side of the upper arm (e.g., axillary crutches)
  - Drop wrist (few sensory symptoms)

Medial  
Epicondyle



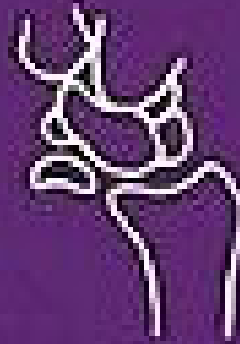
ULNA

Inability to  
Abduct  
Little Finger



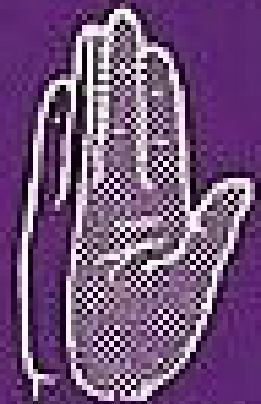
PARALYSIS  
INTEROSSEI  
+ Sensory Loss

Dislocated  
Lunate



MEDIAN

Paralysis  
Abduction  
Thumb



Sensory  
Loss

Fractures of the medial epicondyle causing an **ulnar nerve** paralysis.

Dislocation of the lunate causing a **median nerve** palsy.

- Which muscles serve as the primary adductors of the wrist?
- Where is/are the axis/axes of movement of the IP joints, and which movement do they permit?