SCOREBUILDERS

SPOTLIGHT *Series*

"Let's Get a Grip" on Distal Upper Extremity Anatomy

Presented by Holly Daniel, PT

Objectives

- Review muscles of the forearm, wrist, and hand
- Discuss methods to help “make it stick”
- Correlate anatomy to relevant clinical conditions

Habit 4: “Think Win-Win”

- The 7 Habits of Highly Effective People
- First published in 1989
- Written by Stephen Covey
- New York Times Bestseller for 5 years

Muscles of the Volar (Anterior) Forearm

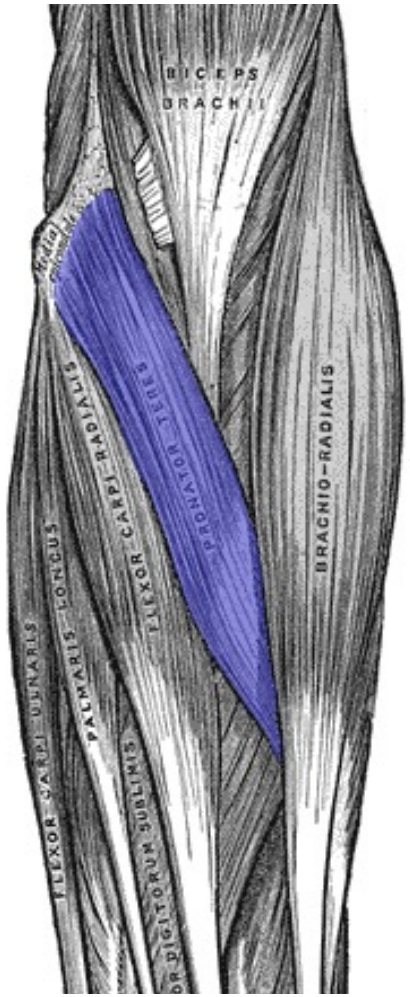
- **Pronators**
- **Primary wrist flexors**
- **Extrinsic flexors to the digits**

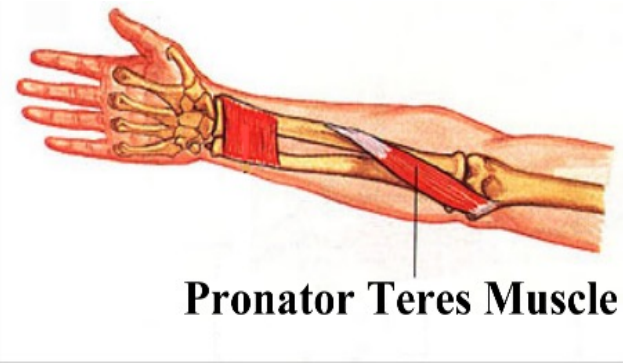
3 Layers of the Anterior Forearm

- **Superficial:** Pronator teres, flexor carpi radialis, palmaris longus, and flexor carpi ulnaris
- **Intermediate:** Flexor digitorum superficialis
- **Deep:** Flexor digitorum profundus, pronator quadratus, and flexor pollicis longus

Forearm Pronators

- **Pronator teres**
- **Pronator quadratus**





Pronator teres

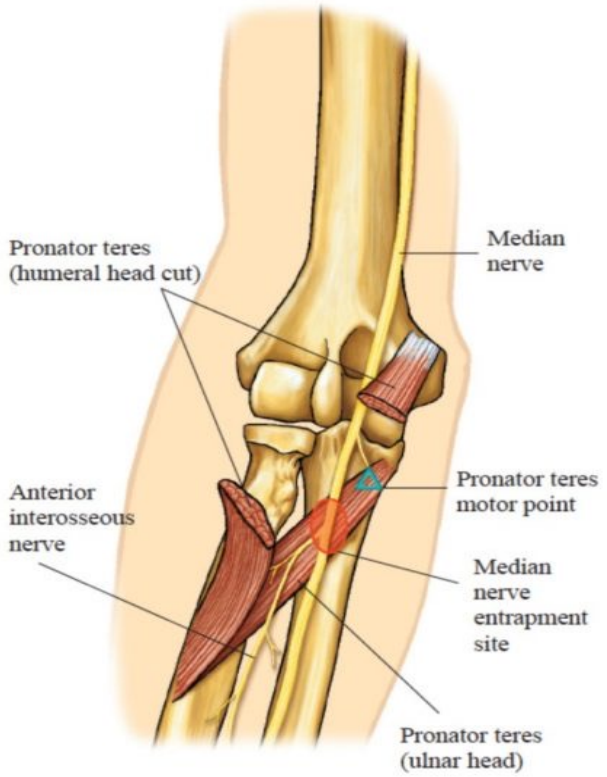
- **Proximal attachment**
  - **Humeral head**: medial epicondyle of the humerus
  - **Ulnar head**: medial aspect of the coronoid process
- **Distal attachment**
  - Lateral surface of the mid radius
- **Innervation**
  - Median nerve
- **Actions**
  - Forearm pronation; (assists in elbow flexion)

Clinical Relevance
Pronator syndrome

Median nerve entrapment between the two heads of pronator teres

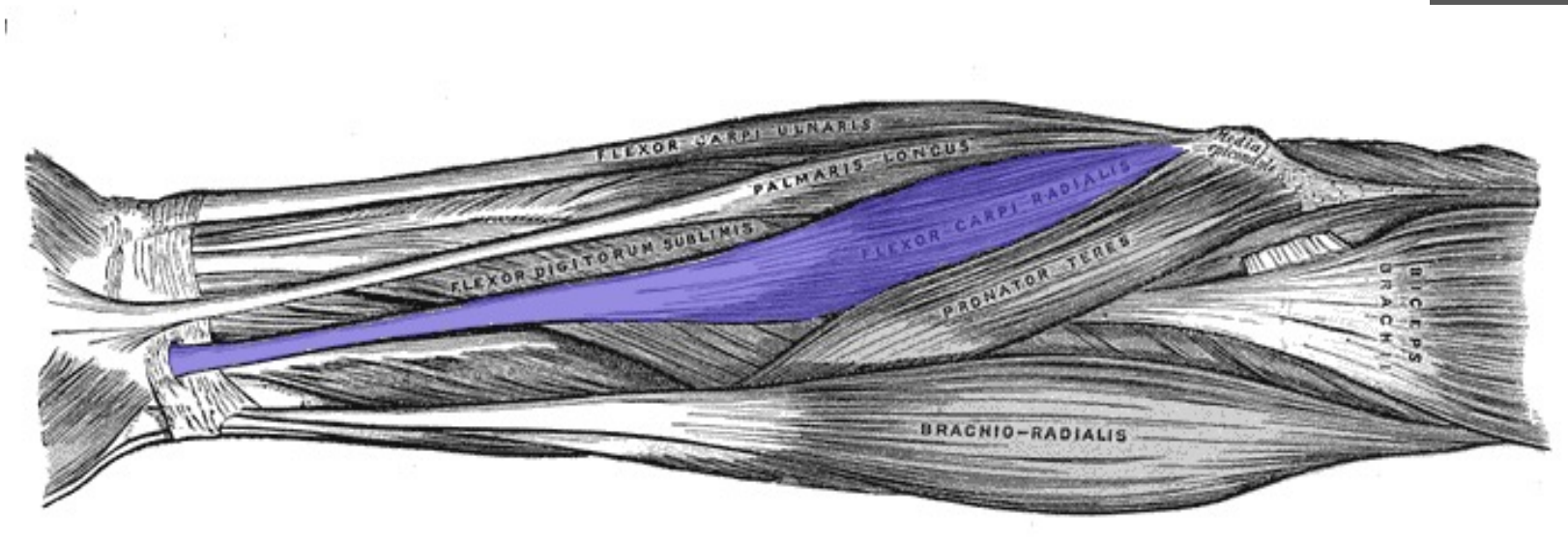
Paresthesias (distribution of median nerve); tenderness at pronator teres; pain with resisted pronation

Negative Phalen's test; negative Tinel's sign at wrist



Primary Wrist Flexors

- Flexor carpi radialis
- Palmaris longus
- Flexor carpi ulnaris



Clinical Relevance
Medial Epicondylitis

Overuse injury to tendons attaching to medial epicondyle of humerus (e.g., wrist flexors, pronator teres, flexor digitorum superficialis)

Tendons of flexor carpi radialis and pronator teres most often affected

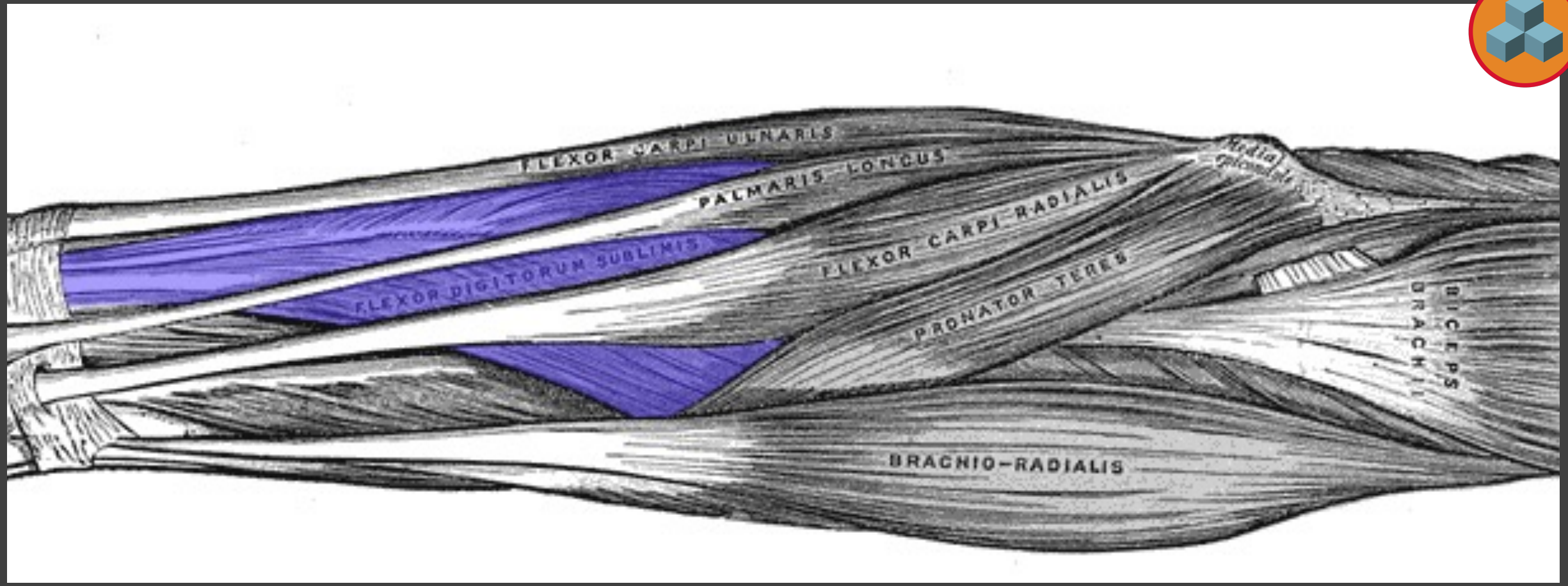
Pain and tenderness over medial epicondyle; pain with resisted wrist flexion, pronation, and with gripping

If ulnar nerve affected, pain and paresthesias into the forearm and 4^{th} & 5^{th} digits (e.g., cubital tunnel syndrome)

Extrinsic Finger Flexors

Flexor digitorum superficialis

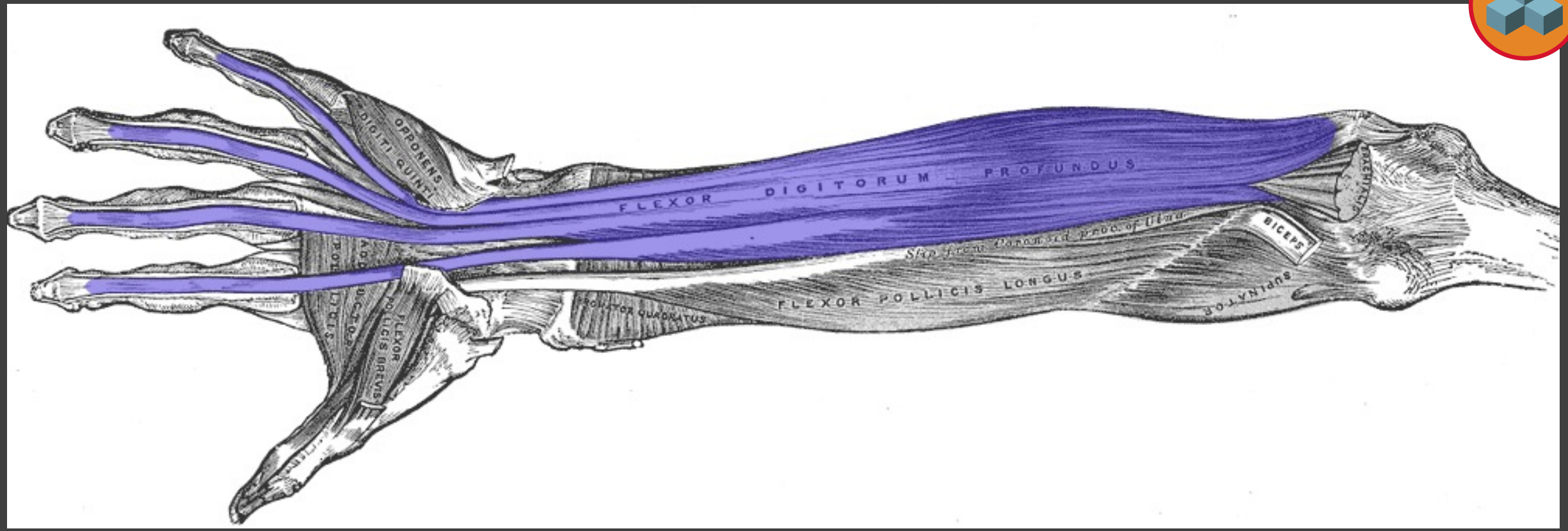
Flexor digitorum profundus



Flexor Digitorum Superficialis (FDS)

Flexes the PIPs, not the DIPs

Innervation: Median nerve



Flexor Digitorum Profundus (FDP)

Flexes the DIPs (and other proximal joints it crosses)
Dual innervation: Median (digits 2&3); Ulnar (4&5)

Clinical Relevance
Extrinsic Finger Flexors

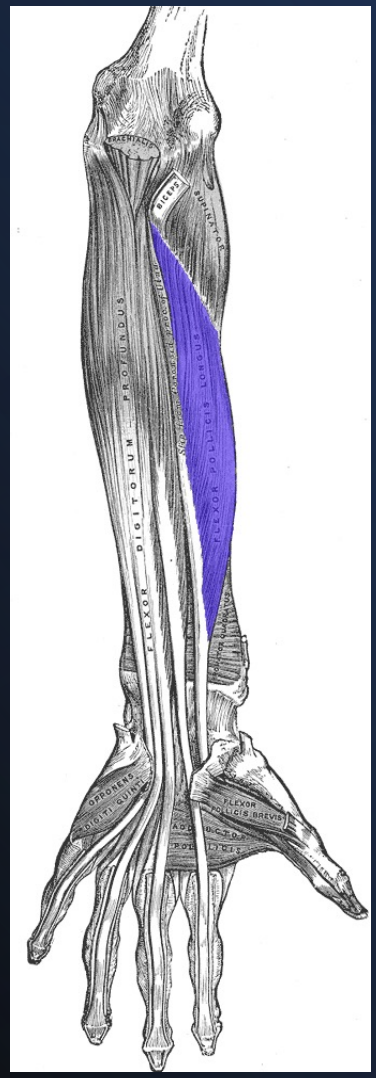
- MMT differentiation (FDS vs. FDP)
- Tendon injuries (e.g., Jersey finger)
- Carpal tunnel syndrome (compression of median nerve; 9 flexor tendons in the carpal tunnel)

Flexor Pollicis Longus

Innervation: Median nerve (anterior interosseous branch)

Clinical Relevance:

- Trigger thumb (tenosynovitis)
- MMT differentiation (FPL vs. FPB)
- Anterior interosseous syndrome (test with OK sign)



Muscles of the Dorsal (Posterior) Forearm Superficial Layer

- **Brachioradialis**
- **Primary wrist extensors**
- **Extensor digitorum**
- **Extensor digiti minimi**

Brachioradialis (Paradoxical Muscle)

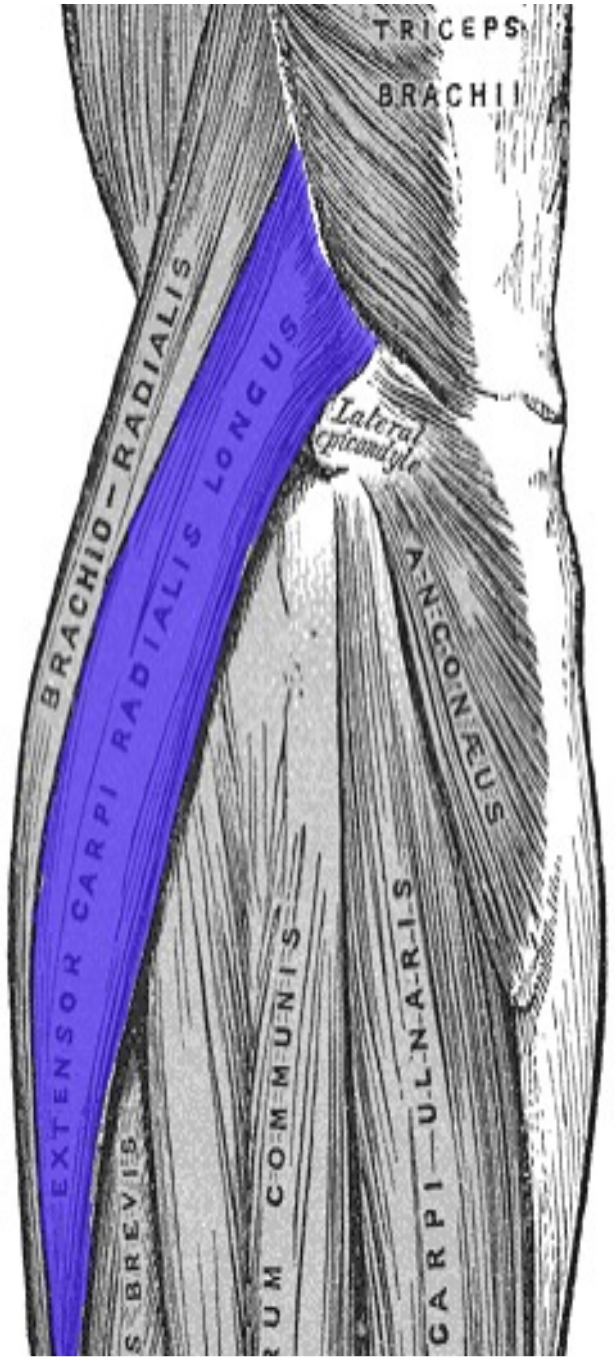
- Primary elbow flexor
- Origin and innervation more characteristic of an extensor
- Pronation or supination of forearm (to neutral position)

- Brachioradialis reflex used clinically to test **C6** innervation level

Primary wrist extensors

- Extensor carpi radialis longus
- Extensor carpi radialis brevis
- Extensor carpi ulnaris

- All innervated by **radial nerve**

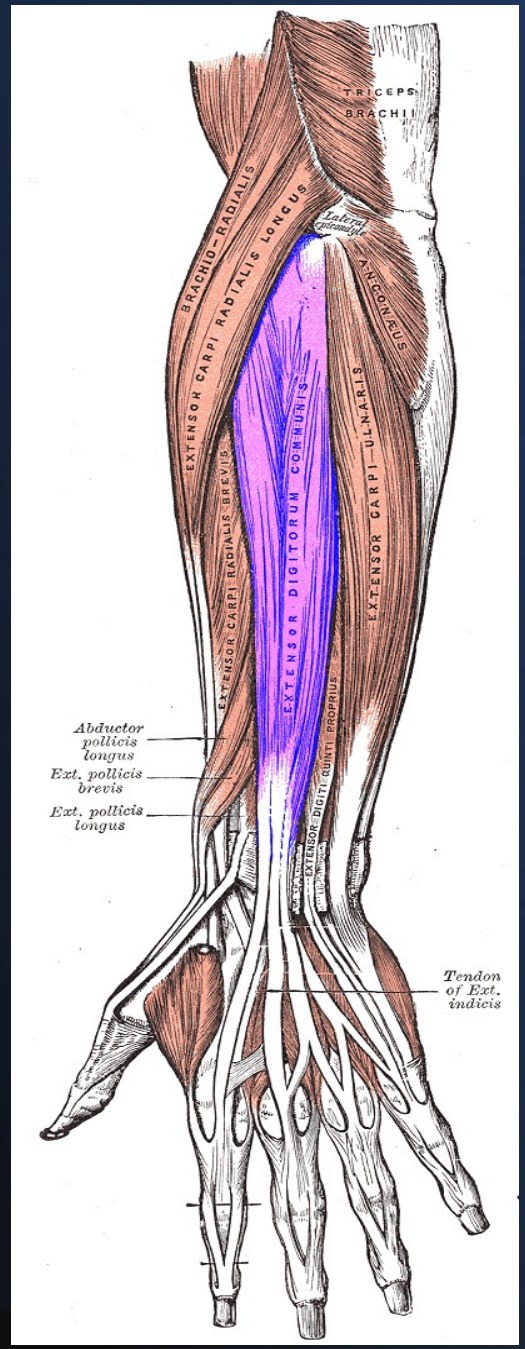


Clinical Relevance
Lateral Epicondylitis

- Overuse injury to tendons attaching to lateral epicondyle of humerus (e.g., wrist extensors, extensor digitorum)
- Extensor carpi radialis brevis most often affected
- Pain and tenderness over lateral epicondyle; pain with resisted wrist extension and radial deviation (e.g., Cozen's test); pain with gripping activities
- Often painful with stretch to wrist extensors (e.g., Mill's test)

Extensor Digitorum

- Extension of digits 2-5; extends the wrist
- **Extensor digiti minimi** - muscular slip from the ulnar aspect of the extensor digitorum that inserts on the proximal phalanx of the 5th digit
- Innervated by the **radial nerve** (posterior interosseous branch)



Muscles of the Dorsal (Posterior) Forearm Deep Layer

- Supinator
- Abductor pollicis longus
- Extensor pollicis longus & brevis
- Extensor indicis

Supinator

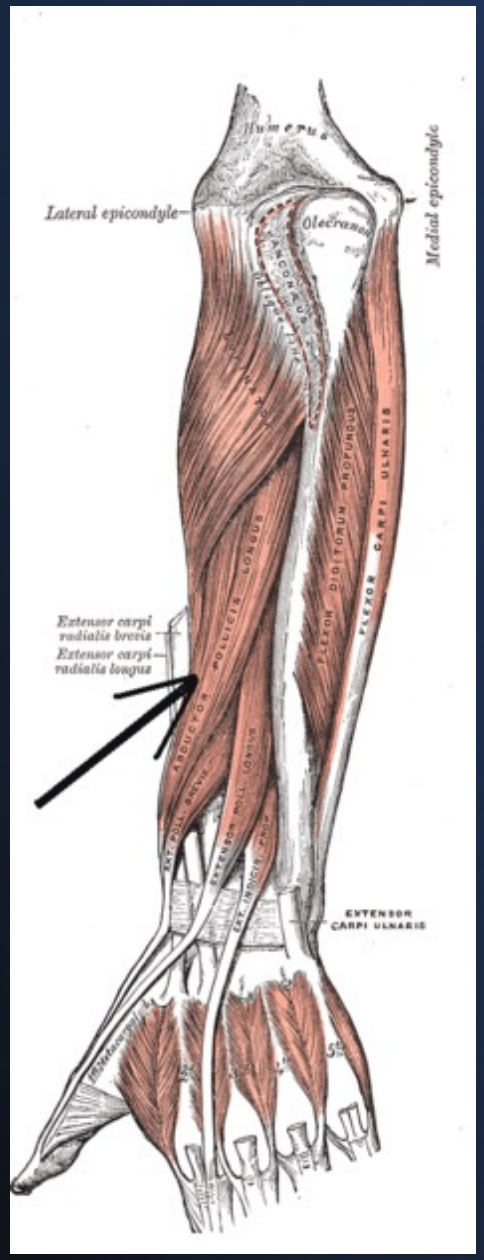
- Prime supinator of the forearm (in any elbow position)
- Two heads (from the humerus and the ulna)
- Innervation: **Radial nerve** (becomes posterior interosseous nerve as it exits the supinator)

Clinical Relevance
Supinator syndrome

- Also known as posterior interosseous nerve syndrome (PINS)
- Lateral elbow pain that radiates into the distal forearm; pain aggravated by resisted supination
- Tenderness 3-4 cm distal to the lateral epicondyle (where radial nerve crosses the radial head and penetrates the supinator muscle)
- PIN palsy: inability to extend the MCP joints of the thumb and fingers

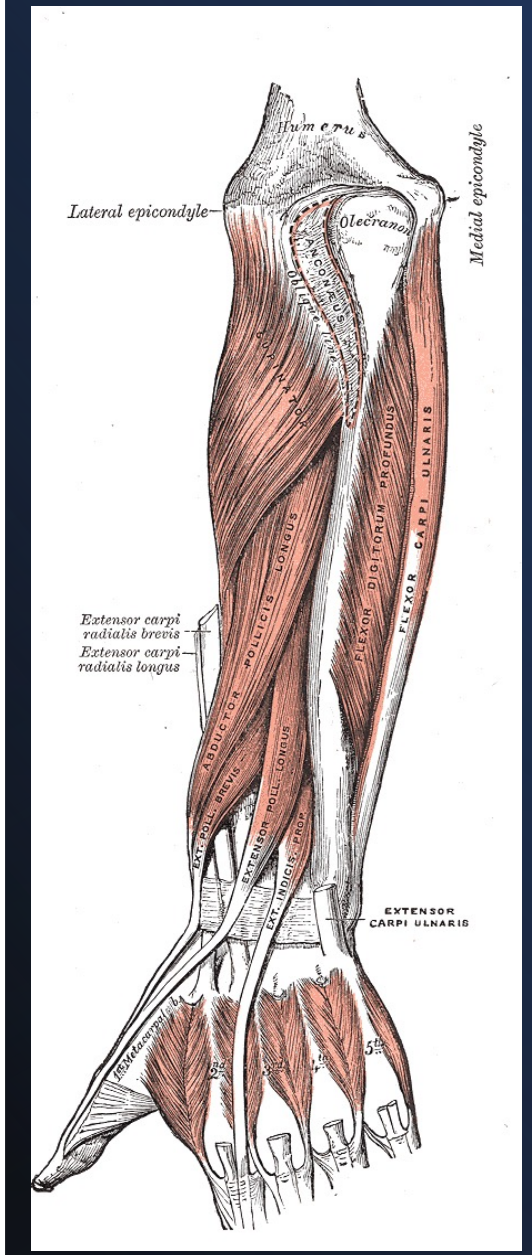
Abductor pollicis longus

- Abducts the thumb
- Able to assist with wrist abduction (radial deviation)
- Innervation: **Radial nerve** (posterior interosseous branch)



Extensor pollicis brevis

- Extends the thumb (at the proximal phalanx)
- Part of the lateral border of the anatomical snuff box (along with abductor pollicis longus)
- Innervation: **Radial nerve** (posterior interosseous branch)



Clinical Relevance
De Quervain's tenosynovitis

Tendons of abductor pollicis longus and extensor pollicis brevis share a common sheath at the dorsum of the wrist along the lateral snuff box

Forceful or repetitive movements of the thumb and wrist can increase friction

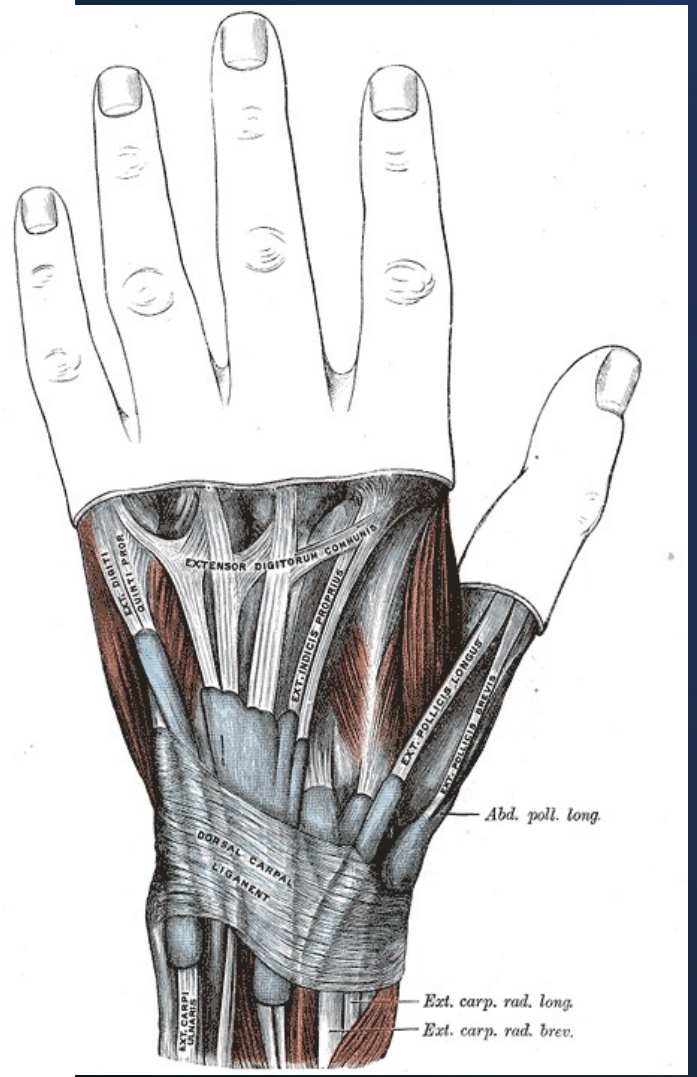
Pain in the radial aspect of the wrist at the base of the thumb that can radiate to the proximal forearm

Commonly assessed with the Finkelstein test

Extensor pollicis longus

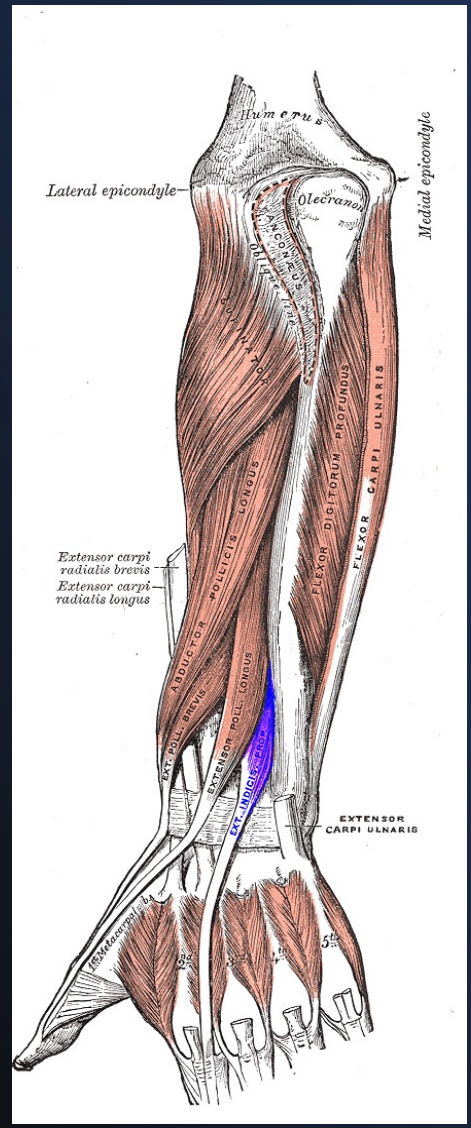
- Extends the thumb (at the distal phalanx)
- Forms the medial border of the anatomical snuff box
- Innervation: **Radial nerve** (posterior interosseous branch)

- **Clinical relevance:** Drummer's tendonitis; MMT differentiation of EPL vs. EPB



Extensor indicis

- Extends the index finger
- Runs parallel to EPL
- Like EDM at the little finger, runs along the extensor digitorum, but at the index finger
- Innervation: Radial nerve (posterior interosseous branch)



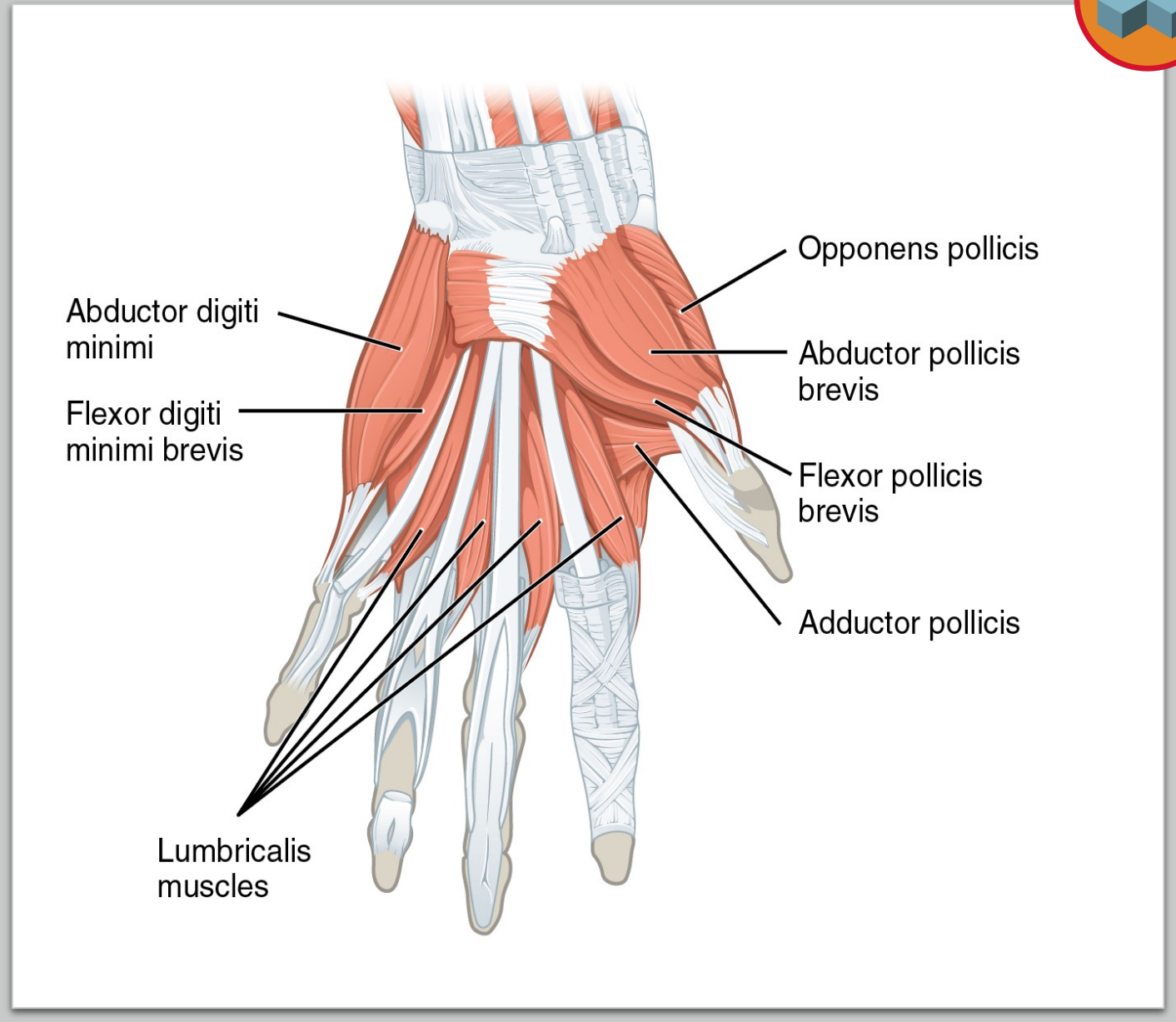
Intrinsic Muscles of the Hand

- **Thenar muscles**
- **Hypothenar muscles**
- **Interossei muscles**
- **Lumbrical muscles**

Thenar muscles

- **O**pponens pollicis
- **A**bductor pollicis brevis
- **F**lexor pollicis brevis

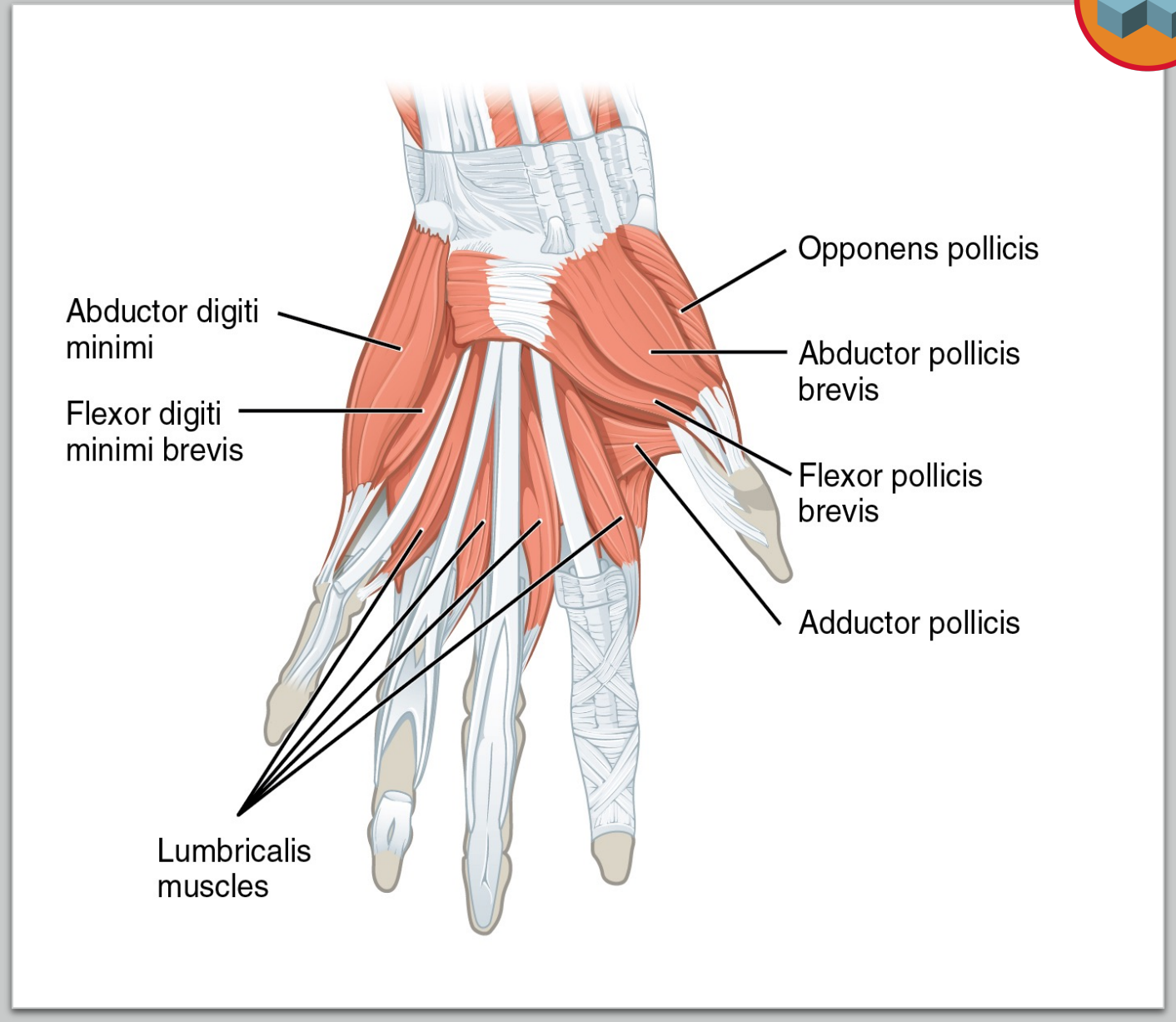
- **Innervation:** Median nerve



Hypothenar muscles

- **O**pponens digiti minimi
- **A**bductor digiti minimi
- **F**lexor digiti minimi brevis

- **Innervation:** Ulnar nerve



Clinical Relevance
Thenar muscles

Helps to control fine motor movements of the thumb (e.g., grip, pinch)

Atrophy of thenar muscles associated with later stage carpal tunnel syndrome (compression of median nerve)

Thenar atrophy may be early sign of Amyotrophic Lateral Sclerosis (ALS)

Clinical Relevance
Hypothenar muscles

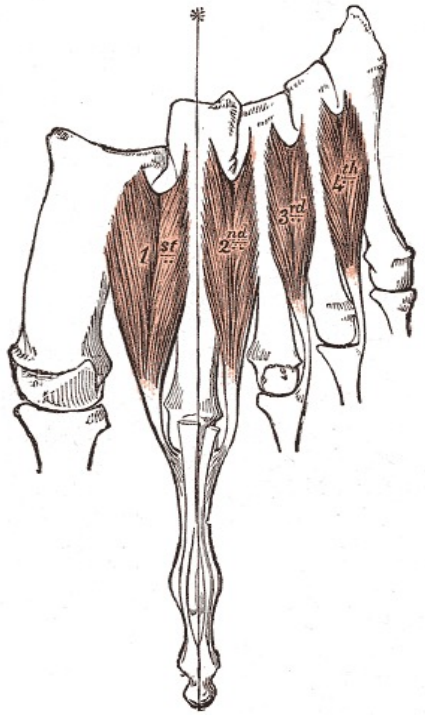
Hypothenar atrophy associated with ulnar nerve lesion

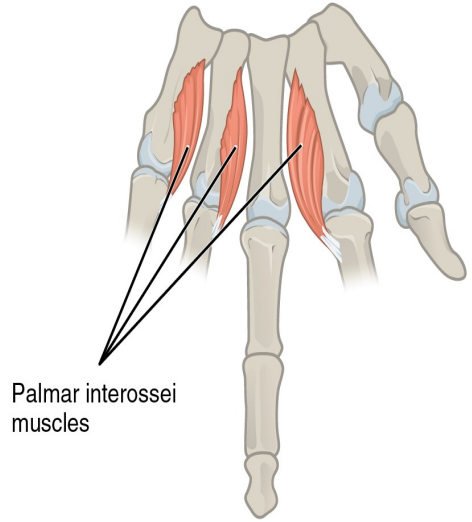
Guyon canal syndrome or ulnar tunnel syndrome (ulnar nerve entrapment between pisiform and hook of hamate)

Hypothenar hammer syndrome (vascular occlusion of the ulnar artery)

Interossei Muscles of the Hand

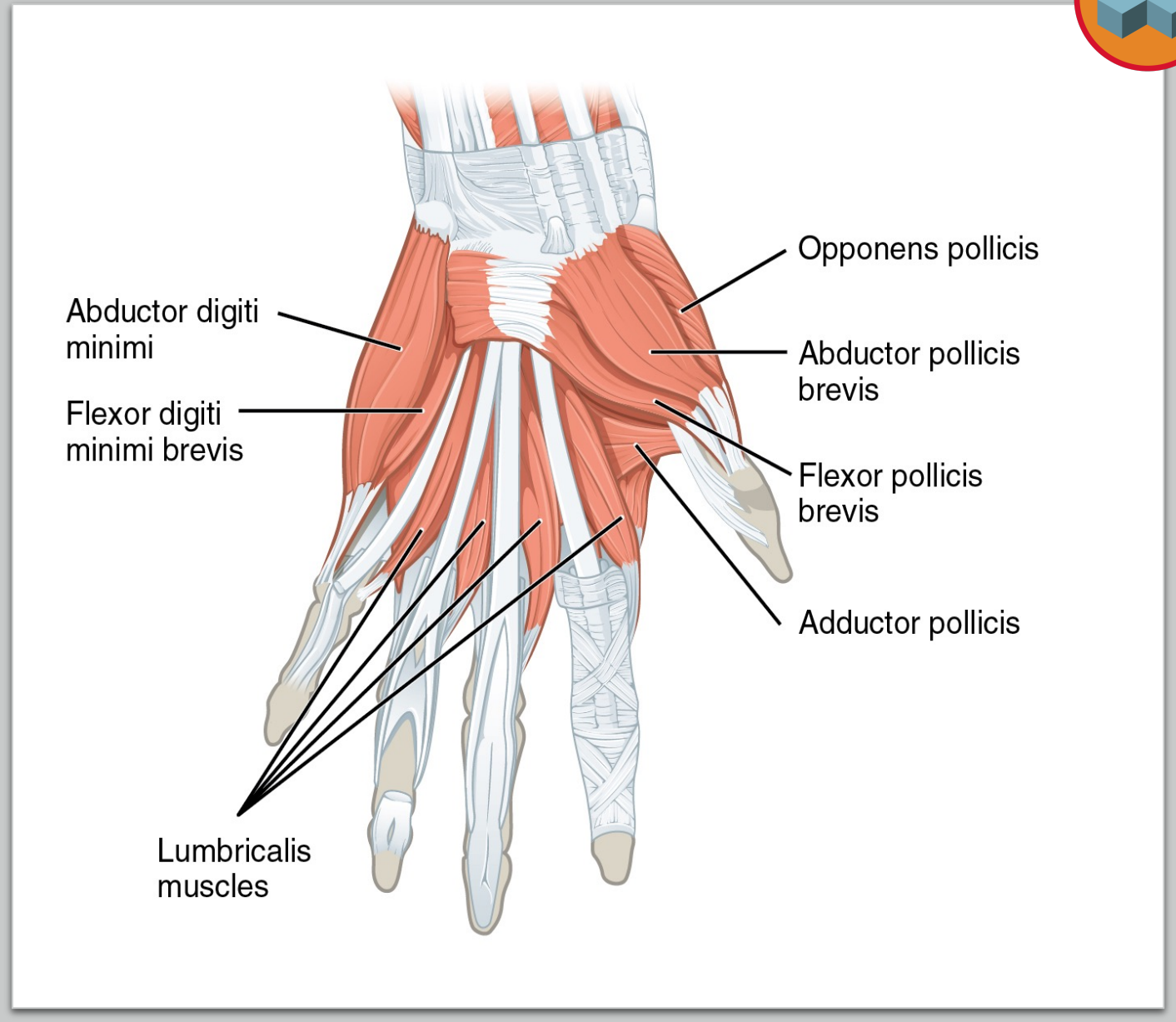
- **Dorsal interossei (DABs)**
- **Palmar interossei (PADs)**
- **Innervation: Ulnar nerve**





Adductor pollicis

- Adducts the thumb
- **Innervation: Ulnar nerve**
- Thinking of it as a thumb web space muscle (like the interossei are between the fingers) helps – **All are innervated by same deep branch of the ulnar nerve**



Clinical Relevance
Interossei and Adductor Pollicis

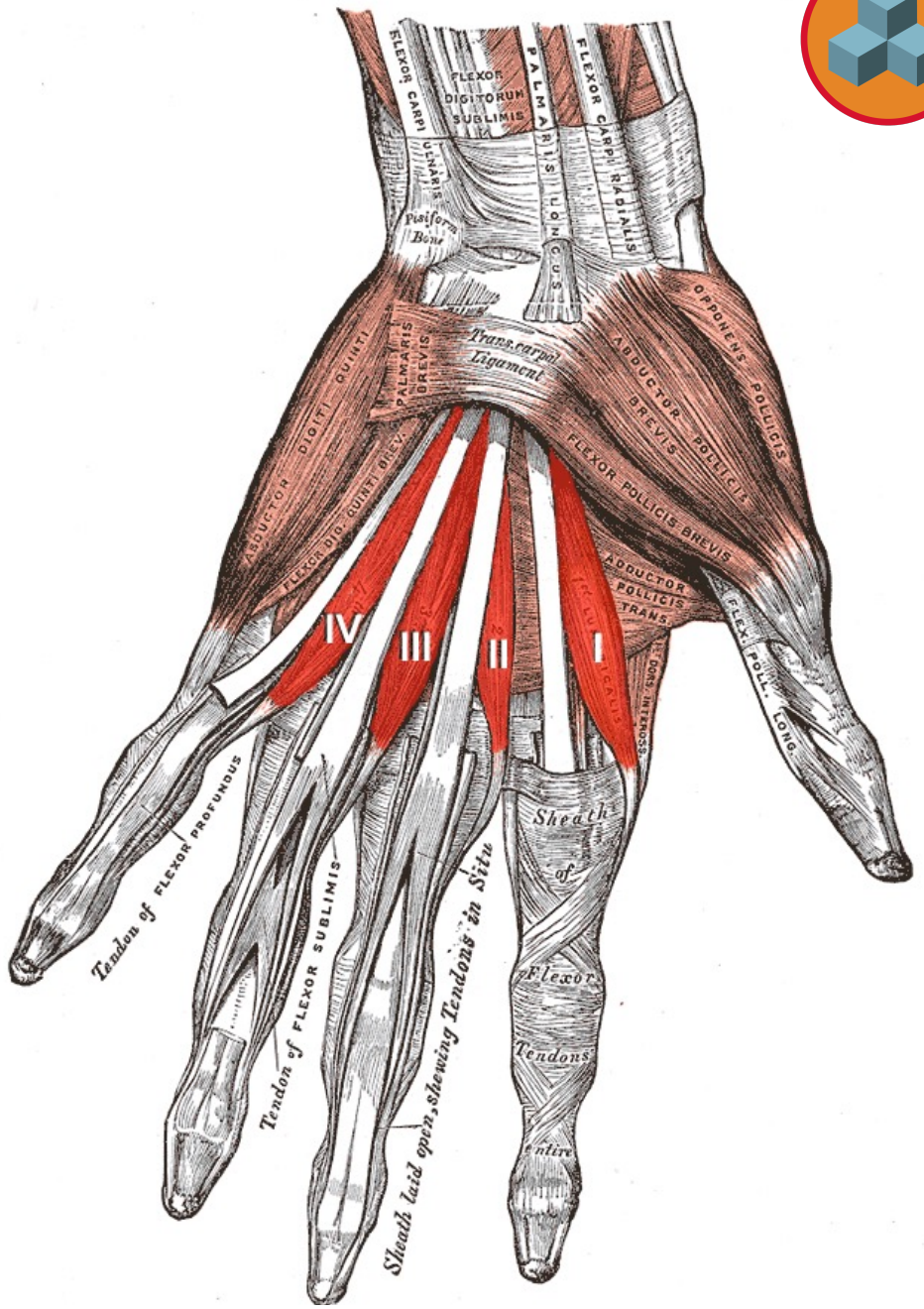
Differentiation with MMT (dorsal vs palmar interossei)

Froment’s sign used to test adductor pollicis function

Wasting of the interossei, the adductor pollicis, and the hypothenar eminence indicates ulnar nerve lesion

Lumbricals

- Flex the MCPs; extend the IP joints
- **Unique muscles with no bony attachment:** Originate from the flexor digitorum profundus (FDP) tendons and insert into the extensor mechanism
- **Innervation:** Similar to FDP (2nd-3rd fingers median nerve; 4th-5th ulnar nerve)
- Place your hand in a lumbrical grip position to make it easy to remember actions



Clinical Relevance
Lumbricals

Lumbrical strain often occurs in climbers; pain typically felt in the palm in line with the injured finger

Lumbrical grip is often a very functional position for splinting

Bunnel-Littler test (for limitation of passive PIP flexion of a finger): Helps determine source of restriction as intrinsic hand muscle (e.g., lumbrical) vs. joint capsule

Conclusion

- Increase your confidence with the muscles of the distal upper extremity
- Palpate the muscles during activation (saying them out loud while doing so increases retention)
- Think about line of pull and clinical relevance (the “why”) to improve your retention

Questions?

Email: hollydaniel26@gmail.com

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info@scorebuilders.com

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