Joint Injections and Aspiration

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AMERICAN ACADEMY OF FAMILY PHYSICIANS
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Learning Objectives

1. Evaluate whether joint injections and aspirations are for diagnostic information, pain relief, mobility improvement, or inflammation reduction.
2. Compare musculoskeletal injections by joint site, steroid agent and dosage, and identify potential side effects that may occur.
3. Counsel patients on potential risks and side effects from corticosteroid joint injections.
4. Assess the benefits of adding musculoskeletal injections to practice.

Outline

- Indications
  - Tendonitis, bursitis, tenosynovitis
  - Neuritis, carpal tunnel, neuroma
  - Arthritis, including osteoarthritis, rheumatoid arthritis, crystal arthropathies (gout, pseudogout) and other arthropathies (including psoriatic arthritis, reactive arthritis)
- Contraindications
- Risks and complications
- What to inject
- How to inject
- Injection techniques for common indications

Why Perform a Soft Tissue or Joint Injection?

- Diagnostic
  - Arthrocentesis
  - Anesthetic localization
- Therapeutic
  - Relieve pain
  - Decrease inflammation
  - Stimulate healing?

Contraindications

- Absolute
  - Allergy
  - Infection
  - Severe bleeding diathesis
  - Fracture (except in case of hematoma block)
  - Prosthesis

Contraindications

- Relative
  - Diabetes – elevated glucose
  - Large ecchymoses
  - Anticoagulation – low risk
  - Large tendons
  - Immunosuppression
  - No previous conservative treatment

Risks and Complications

- Immediate injection site pain – common
- Pain from post-injection corticosteroid flare, 2-5%
- Bleeding, 2.5-15%
- Infection 1 in 17,000-60,000 (usually *Staphylococcus aureus*)
- Steroid atrophy, 1-2% – particular at hands, elbow and other superficial structures
- Tendon weakening / rupture?
- Steroid arthropathy – basic science in rats, no clear human data

Other Complications and Side Effects

- Systemic reactions
  - Facial flushing
  - Impaired glucose control
  - Syncope
- Local trauma
  - Neurovascular damage
  - Trauma to articular cartilage
  - Needle fracture / Retained needle
  - Pneumothorax

Injection Frequency

- No EBM guidelines
- General Recommendations
  - Limit injections to large joints to 3-4 times per year; no more than 10 times overall.
  - Small joints should be injected no more than 3 times per year and 4 times overall.
  - Steroid injections should be spaced at least 4 weeks apart; hyaluronan series 6 months apart.

Equipment

- Gloves
- Needles
- Antiseptic
  - Povidone-iodine (Betadine), chlorhexidine or alcohol
- Syringes
- Collection tubes (if aspirating)
- Gauze and bandages

Needle and Syringe

- Small joint / trigger point : 1 cc
- Medium joint: 3 cc
- Large joint : 5-10 cc
- Aspiration: 20-60 cc

Needle and Syringe

- Use appropriate gauge
  - 18 gauge for aspiration
  - 27 gauge for skin anesthesia and fingers
- Use needle long enough
  - 5/8 inch – finger
  - 1 inch – elbow
  - 1 1/2 inch – Shoulder, knee
  - 3 inch spinal – Hip trochanter

What to Inject?

- Anesthetic
- Corticosteroids
- Viscosupplementation (hyaluronic acids)
- Prolotherapy / sclerosing solutions (dextrose, etc)
- Other: platelet rich plasma (PRP) / autologous blood

Anesthetic Choice

- Rule of thumb: Use more, not less, anesthetic
- Injectable anesthetic 1% or 2% lidocaine (Xylocaine) (1-3 hours), 0.25% or 0.5% bupivacaine (Marcaine) (3-6 hours)
- Use higher concentrations in smaller joints
- Topical anesthetic: ethyl chloride or other skin refrigerants

Anesthesia

- Anesthetics work by causing a reversible block to impulse conduction along nerve fibers
- As dose increases, progressive inhibition of nerve function

Corticosteroids

- Mechanism of action: complex and largely unknown, however:
  - Reduction of cytokines and inflammatory mediators
  - Decrease polymorphonuclear (PMN) migration
  - Nerve pain modulation?
- Treats pain, doesn’t heal tissue

Corticosteroids

- More soluble (nonfluorinated) → shorter duration
  - ? Better for soft tissue
  - ? Less skin atrophy
- Less soluble → longer duration
  - ? Better for joints

Steroid Selection

- Short-acting (not fluorinated):
  - Hydrocortisone
  - Cortisone
- Medium-acting
  - Prednisolone – Not fluorinated
  - Methylprednisolone (Depo-Medrol) – Not fluorinated
  - Triamcinolone
    - Hexacetonide (Aristospan)
    - Diacetate
    - Acetonide (Kenalog)

Steroid Selection

- Long-acting (fluorinated)
  - Betamethasone acetate/phosphate (Celestone)
  - Dexamethasone (Decadron)

Corticosteroids

Corticosteroid	Relative Potency (cortisone = 1)	Solubility	Preparations
Triamcinolone acetate (Kenalog)	5	Less	10 mg/mL 40 mg/mL
Methylprednisolone acetate (Depo-Medrol)	5	Less	40 mg/mL
Betamethasone acetate (Celestone Soluspan)	25	More	4 mg/mL 6 mg/mL
Dexamethasone acetate	20-30	More	4 mg/mL

Hyaluronate derivatives: MOA

- Slight anti-inflammatory effect
- Gone from IA space within few days
- Stimulates chondrocytes to produce HA
- Increases viscosity of synovial fluid
- Decreases pain, increases function
- Contraindications
  - Standard injection contraindications
  - Avian-derived (Synvisc, Hyalgan, Orthovisc, etc): CAUTION if allergy to feathers, eggs, avian protein

Hyaluronic Acid Derivatives

- FDA-indicated only for treatment of knee OA but works in GH and Hip
  - Avian Hylan G-F20 polymers (Synvisc, Synvisc-One):
    - Heavy weight preparation
    - One-time injection or 3 weekly injections
  - Avian Sodium Hyaluronate (Hyalgan, Supartz)
    - 3-5 weekly injections
  - Bacterial fermentation products (Euflexxa, Orthovisc)
    - 3 weekly injections

Preparation Protocol

- Appropriate diagnosis
- Know the anatomy
- Obtain informed consent (verbal vs signed)
- Wash hands
- Prepare equipment
- Prepare site
- Inject

Injection Types

- Joint/Bursa
  - Injection: Diagnostic or therapeutic
  - Arthrocentesis
- Soft Tissue
  - Tendon
  - Trigger / tender point
  - Nerve, e.g. carpal tunnel

Injection Techniques

- Sterile
  - Site, gloves, needle, syringe all sterile (requires an assistant or a sterile tray)
- Semi-sterile
  - Site, one glove, needle sterile
- Clean
  - Site (should be marked), needle sterile

Injection Techniques

- One Needle – One Syringe
  - One needle stick. Anesthetic and corticosteroid mixed
- One Needle – Two Syringe
  - One needle stick. Anesthetic injected first, needle left and syringe changed at the hub with sterile clamp

Injection Techniques

- Two Needle – Two Syringe
  - Two separate needle sticks, anesthetic and steroid injected separately
- Why?
  - Steroid precipitation when mixed with multidose vial parabens preservative. Theoretically would reduce efficacy but not established by any study.
  - Anesthetization, aspiration and injection

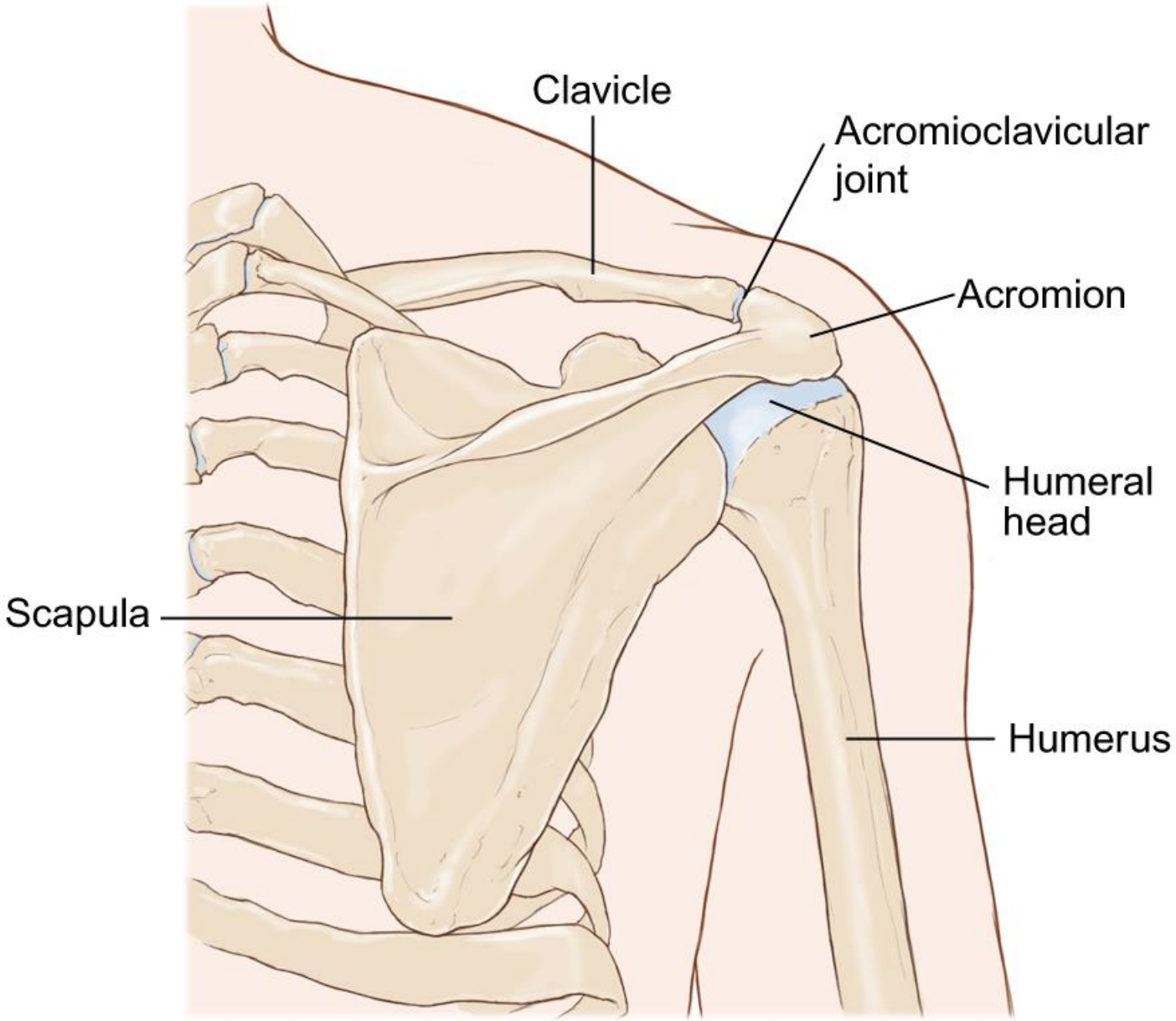
Mixing

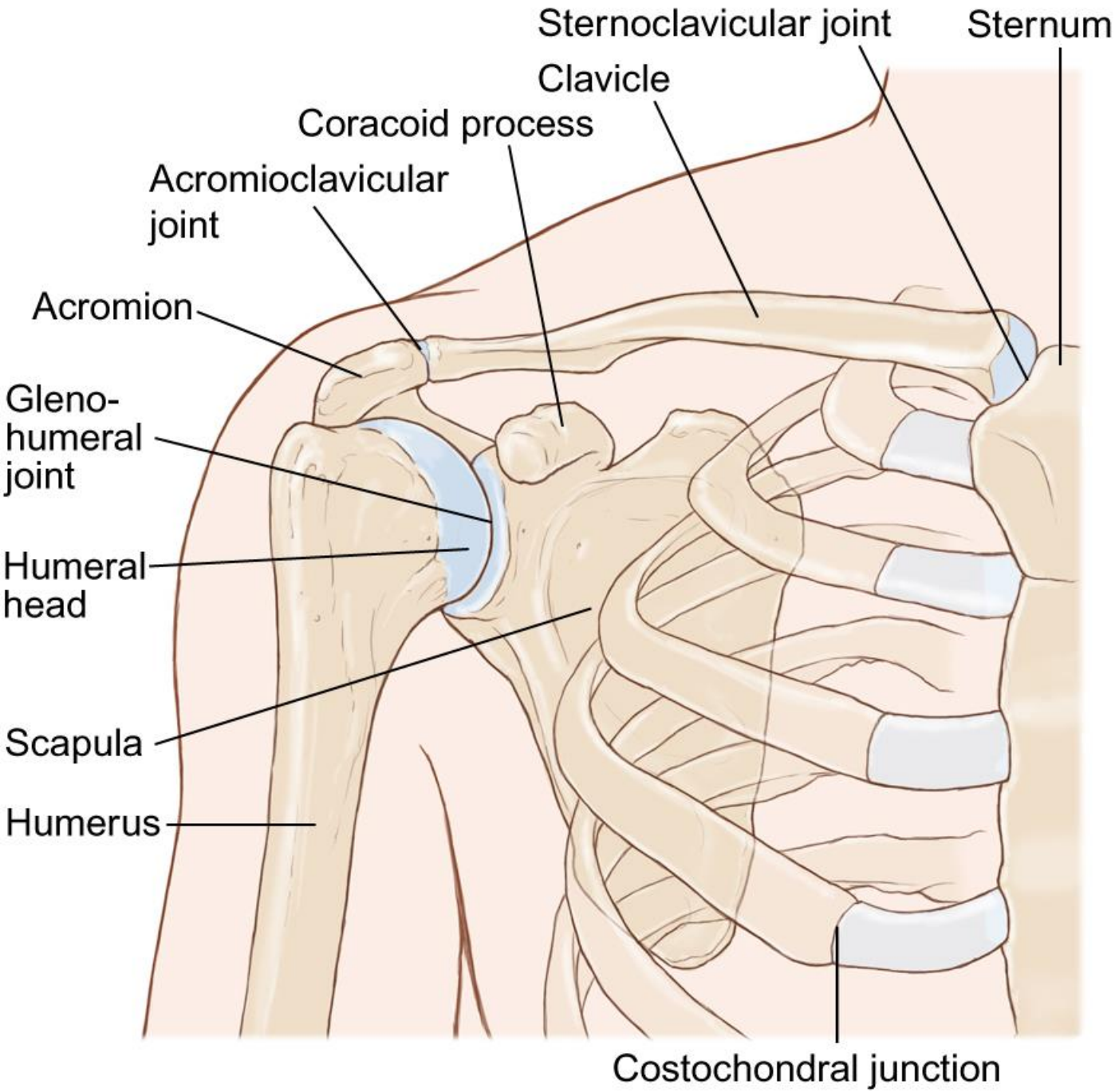
- First, draw the anesthetic into the syringe
- Second, draw the corticosteroid into the syringe
- Prior to injection, mix the agents, and then expel the air prior to injection
- Do not mix anything with hyaluronans

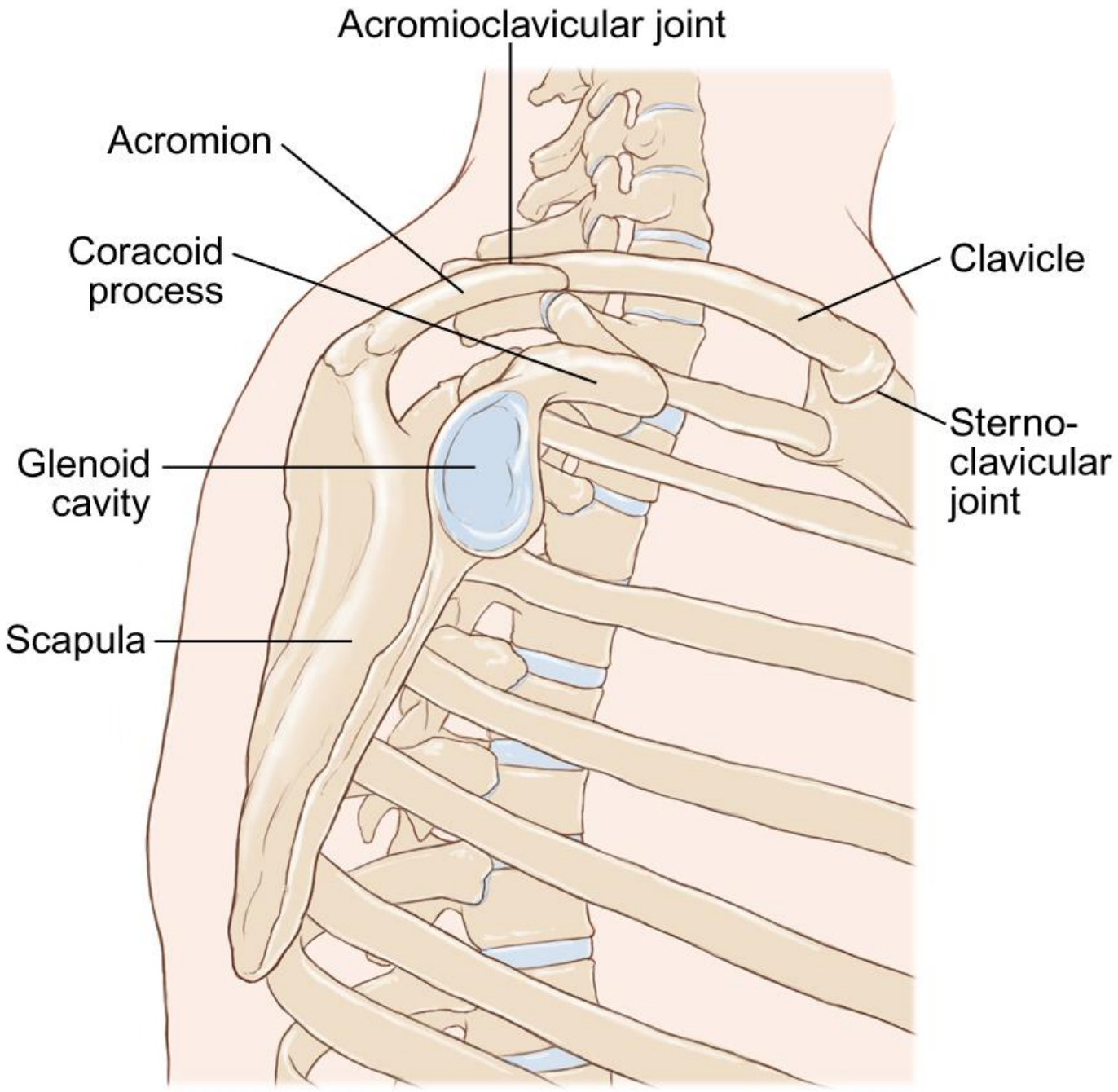
Thank you

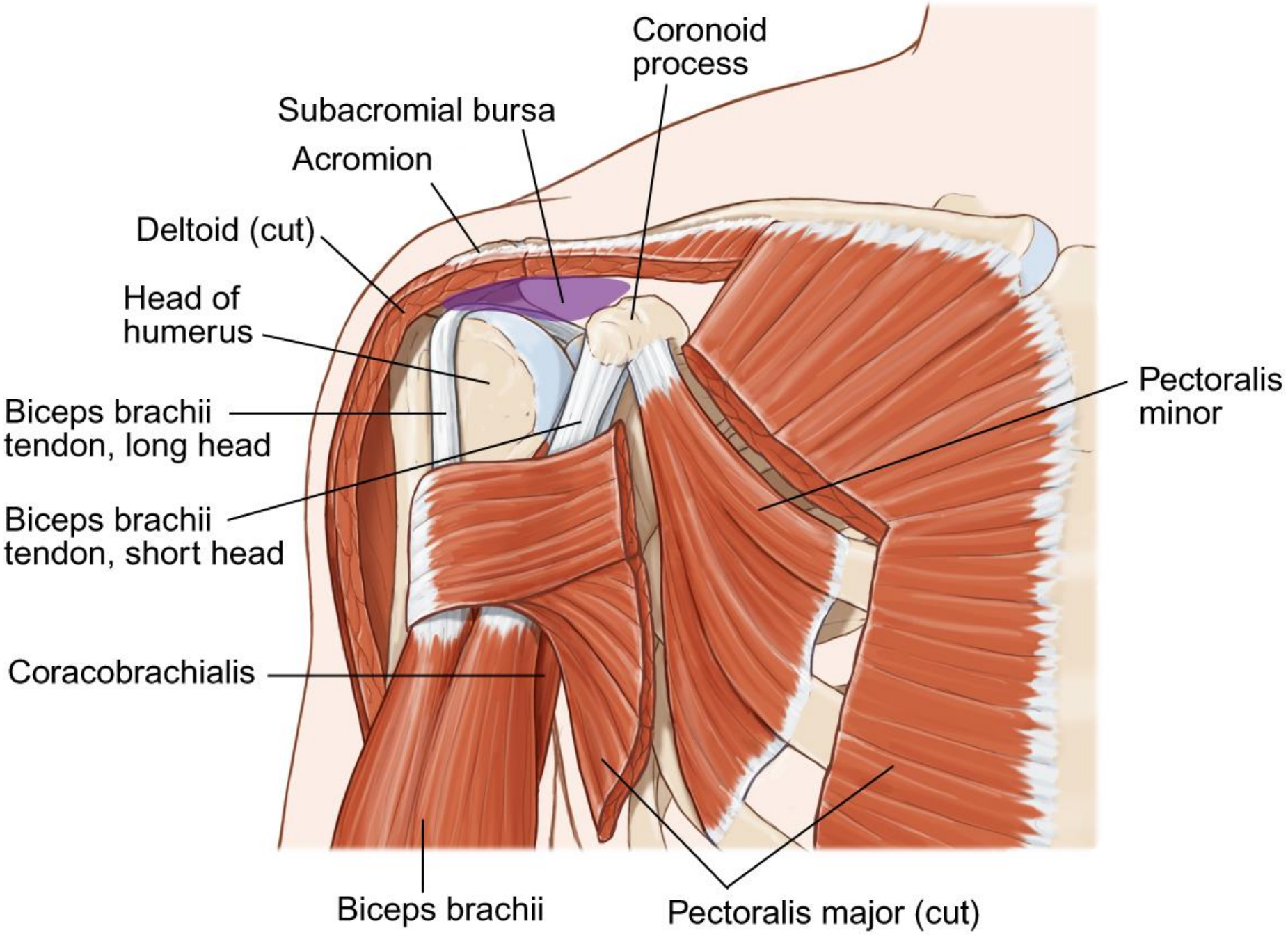
Thank you for joining me today for this self-study workshop.

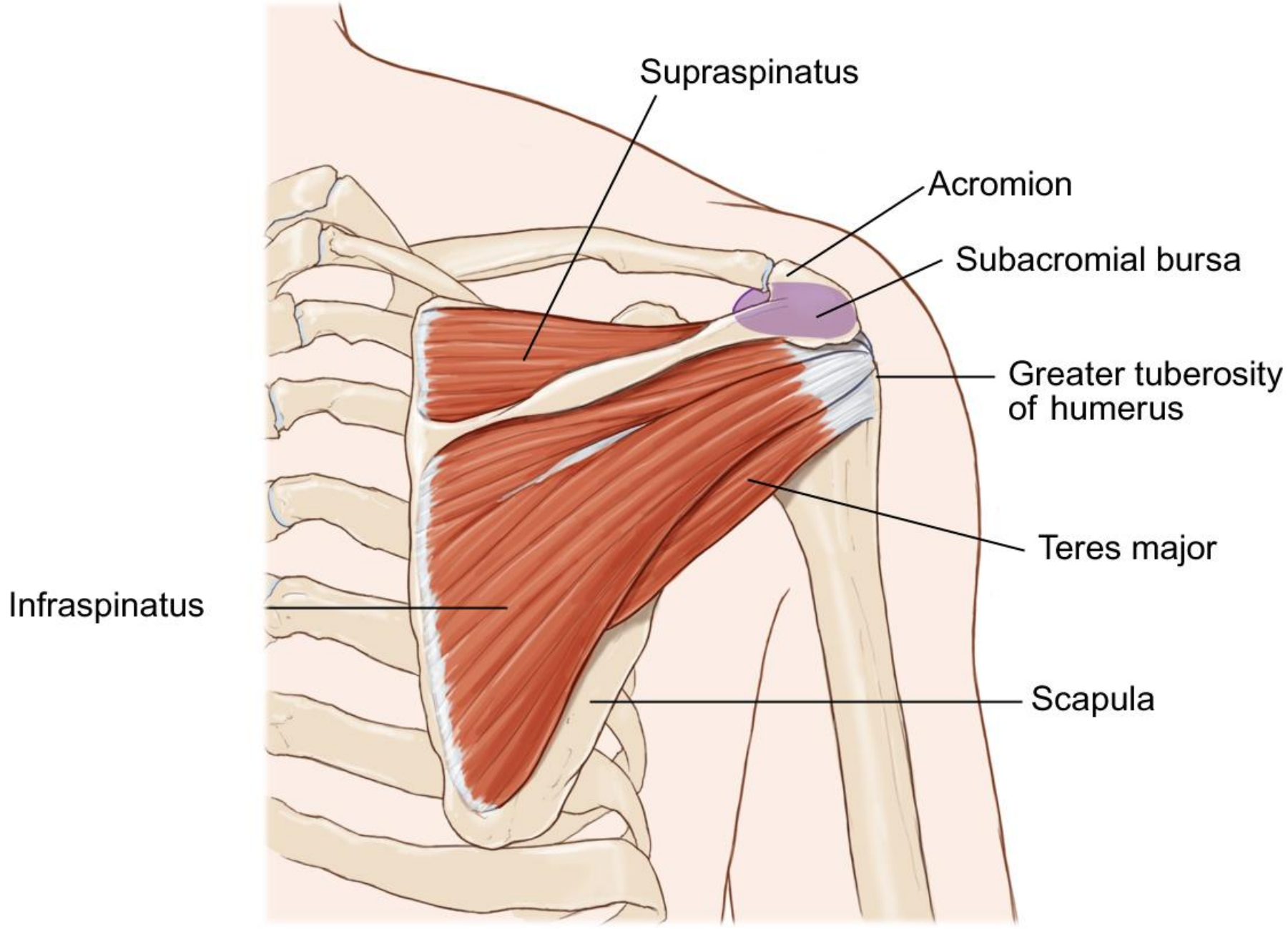
When you have completed the self-study, please click on the link on the table-of-contents to complete the post-assessment.

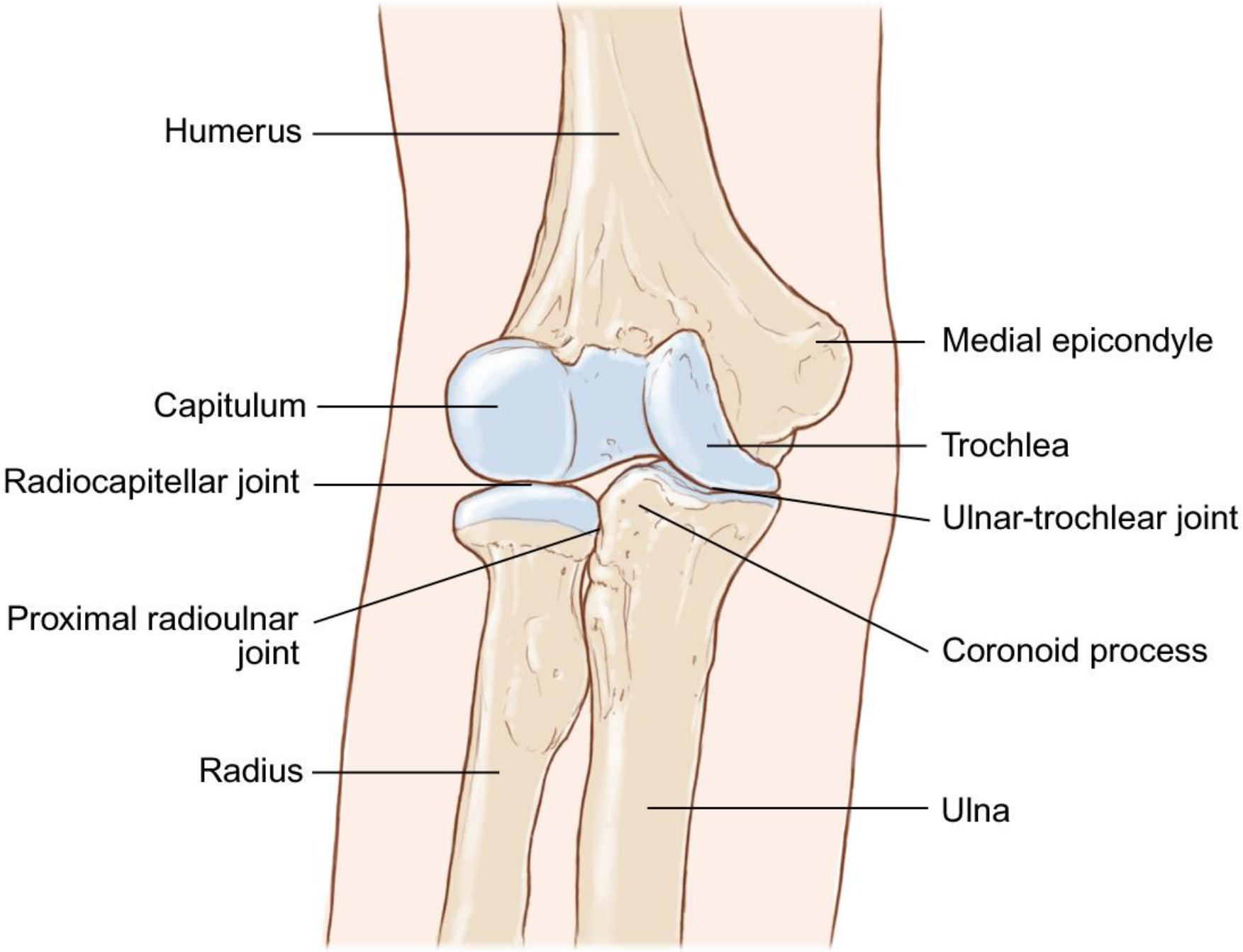

Clavicle
Acromioclavicular joint
Acromion
Humeral head
Scapula
Humerus

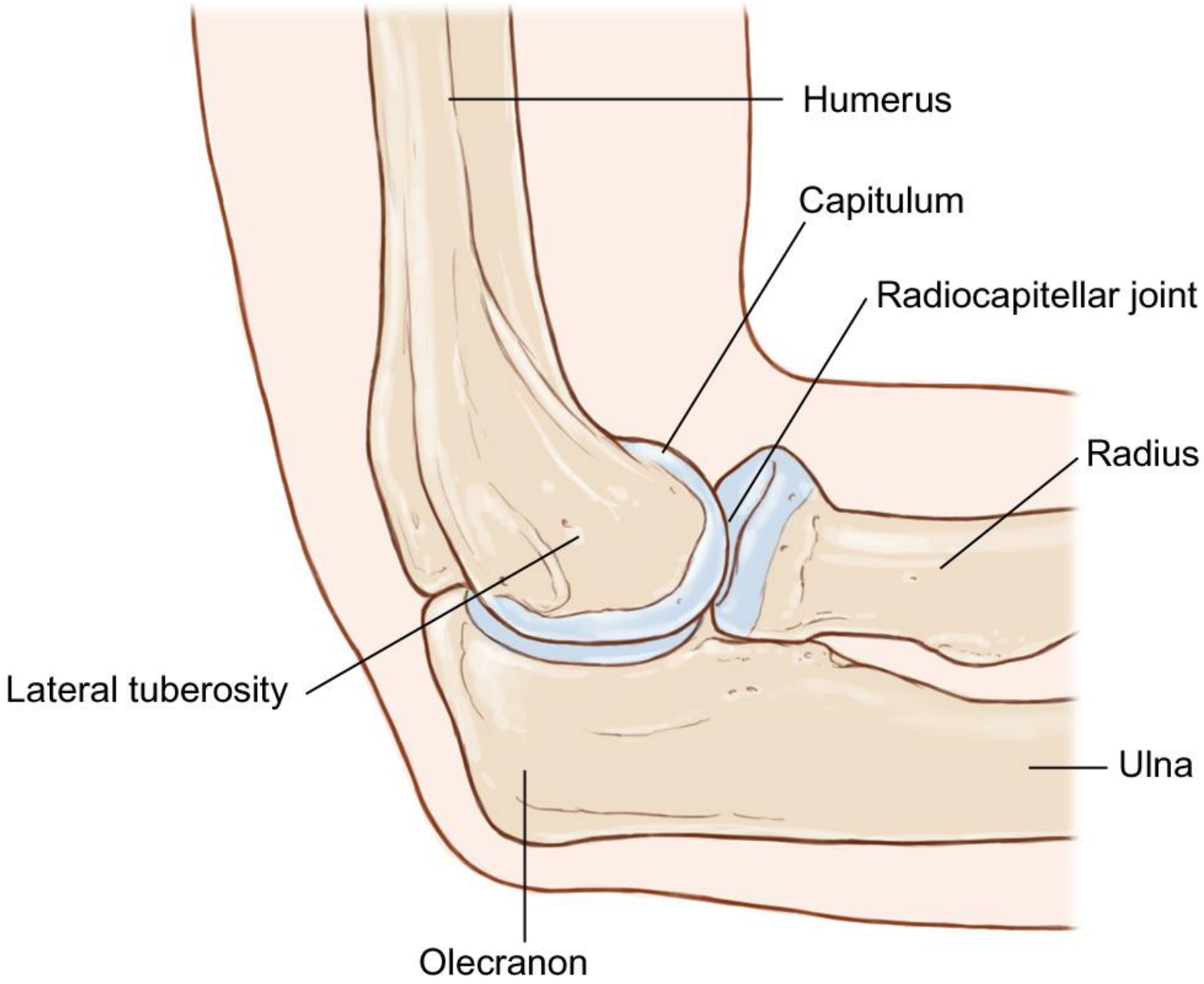

Sternoclavicular joint
Sternum
Clavicle
Coracoid process
Acromioclavicular joint
Acromion
Gleno-humeral joint
Humeral head
Scapula
Humerus
Costochondral junction

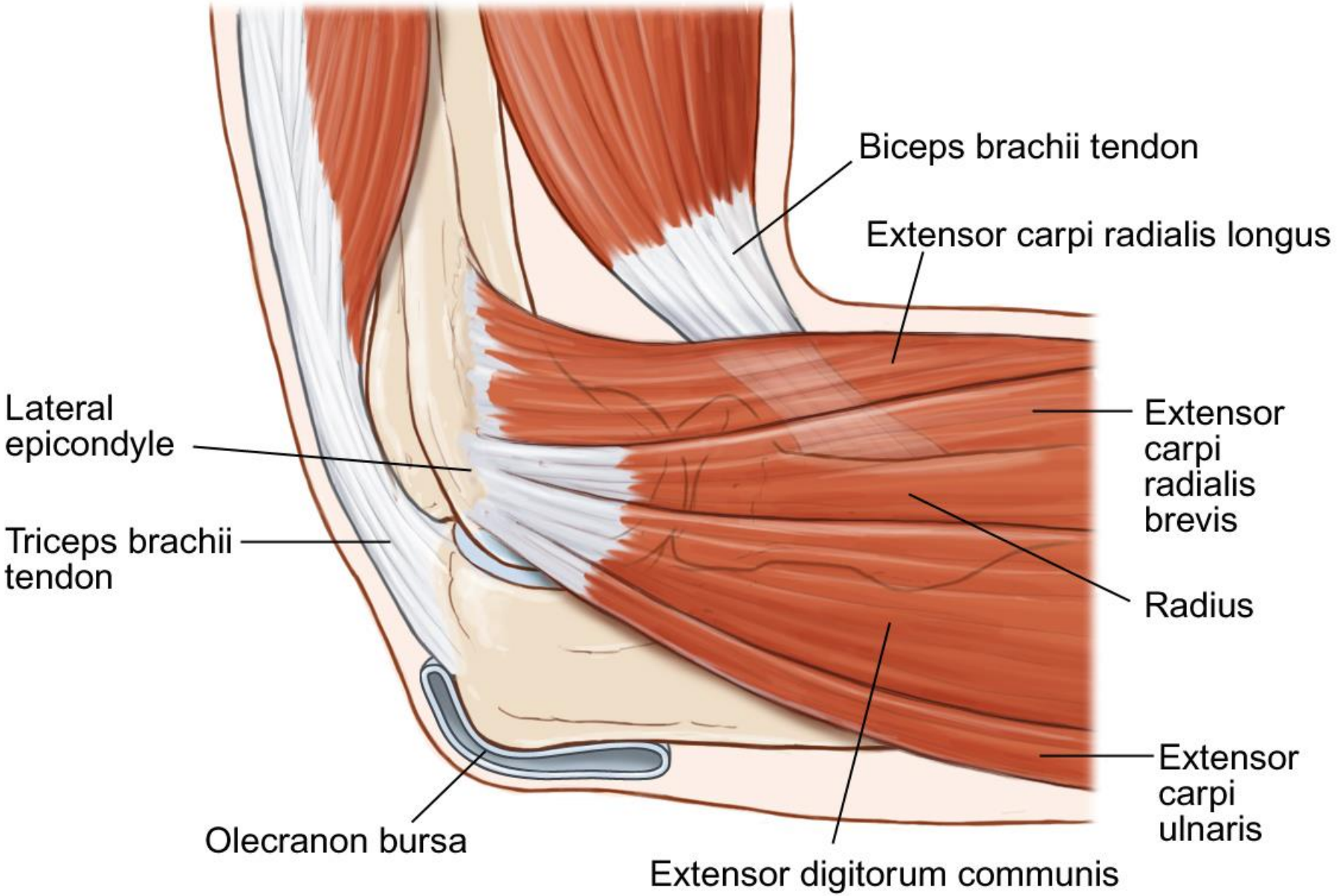

Acromioclavicular joint
Acromion
Coracoid process
Clavicle
Sterno-clavicular joint
Glenoid cavity
Scapula

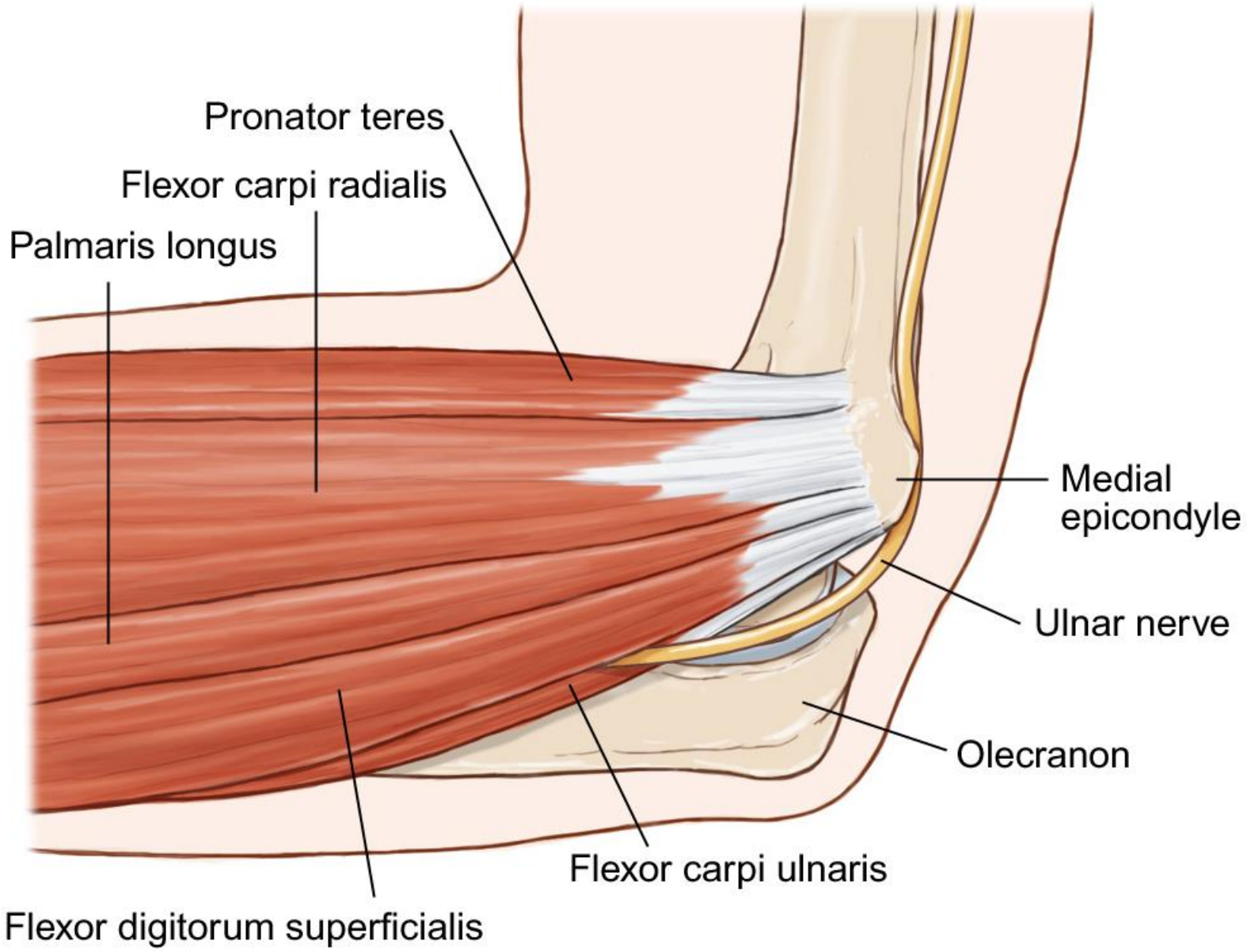

Coronoid process
Subacromial bursa
Acromion
Deltoid (cut)
Head of humerus
Biceps brachii tendon, long head
Biceps brachii tendon, short head
Coracobrachialis
Biceps brachii
Pectoralis minor
Pectoralis major (cut)

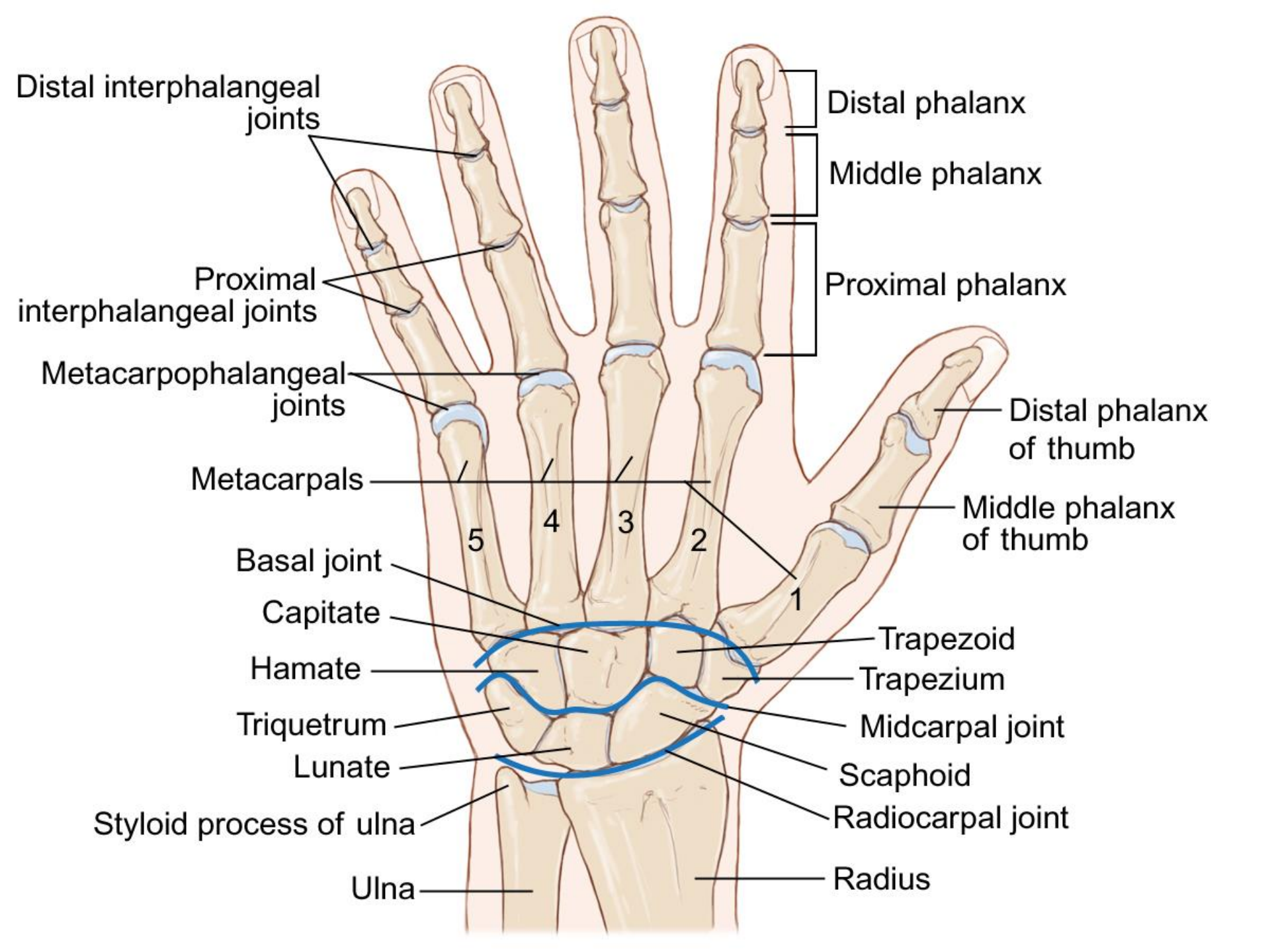

Supraspinatus
Acromion
Subacromial bursa
Greater tuberosity of humerus
Teres major
Infraspinatus
Scapula

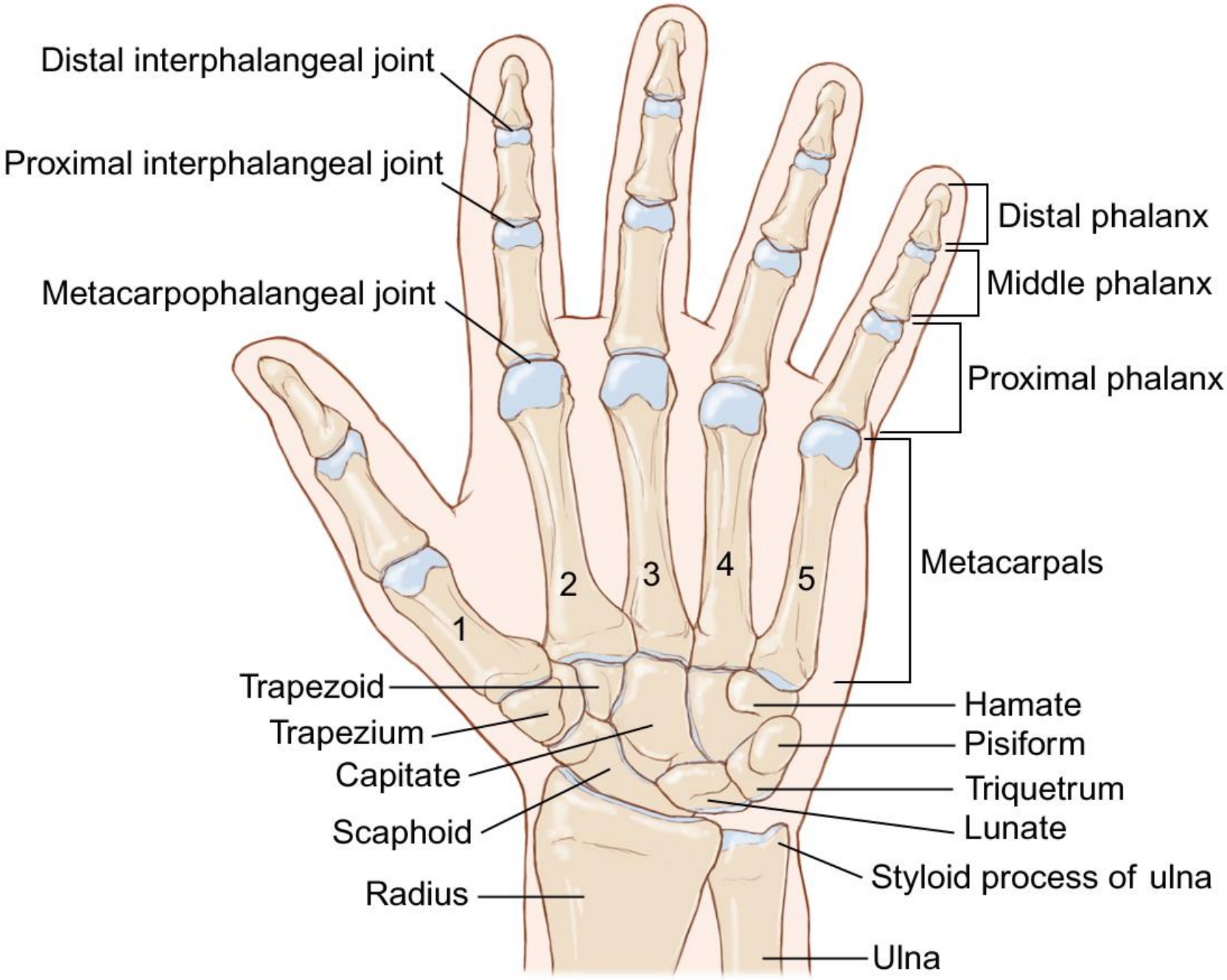

Humerus
Medial epicondyle
Capitulum
Trochlea
Radiocapitellar joint
Ulnar-trochlear joint
Proximal radioulnar joint
Coronoid process
Radius
Ulna

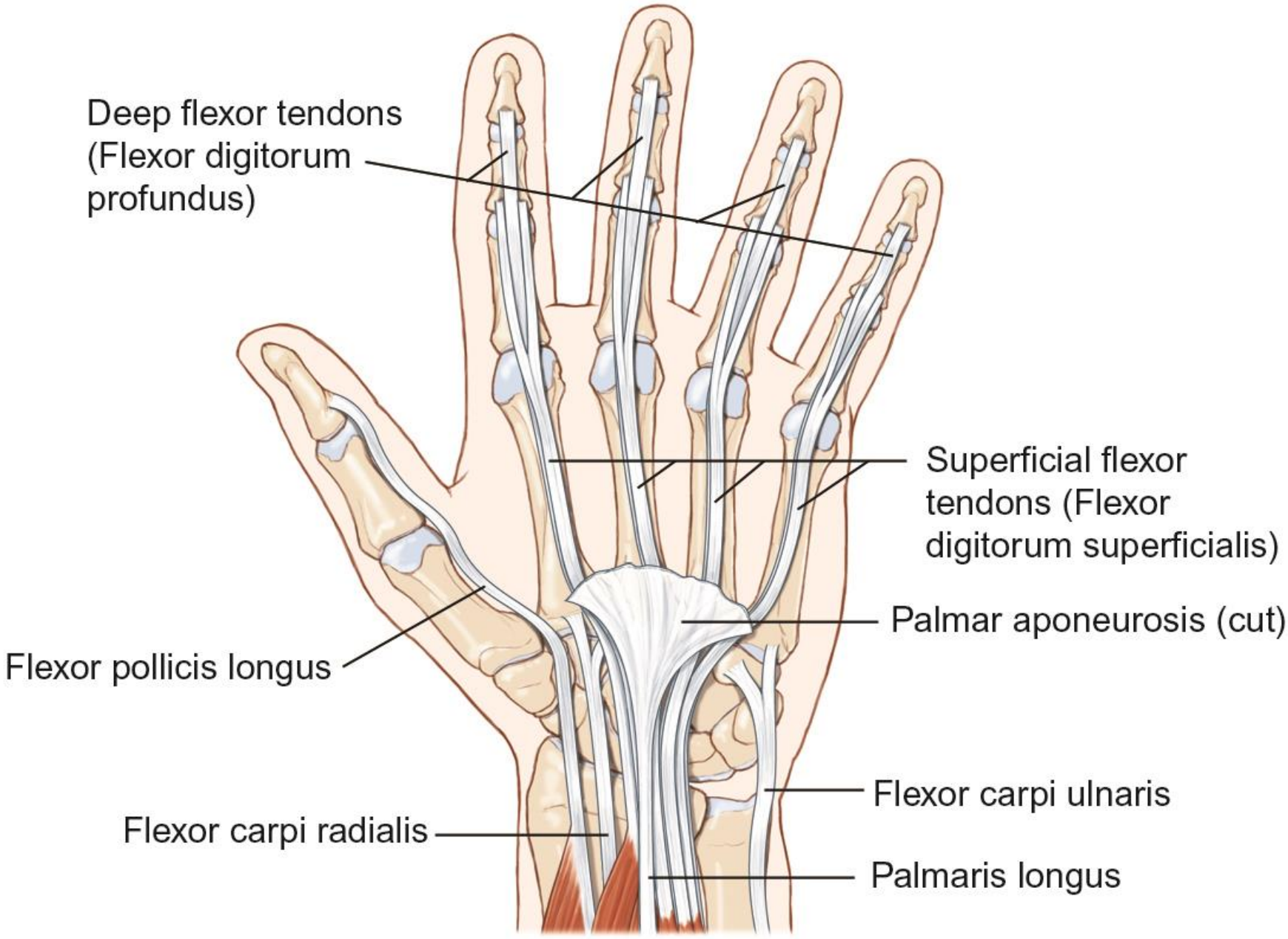

Humerus
Capitulum
Radiocapitellar joint
Radius
Lateral tuberosity
Ulna
Olecranon

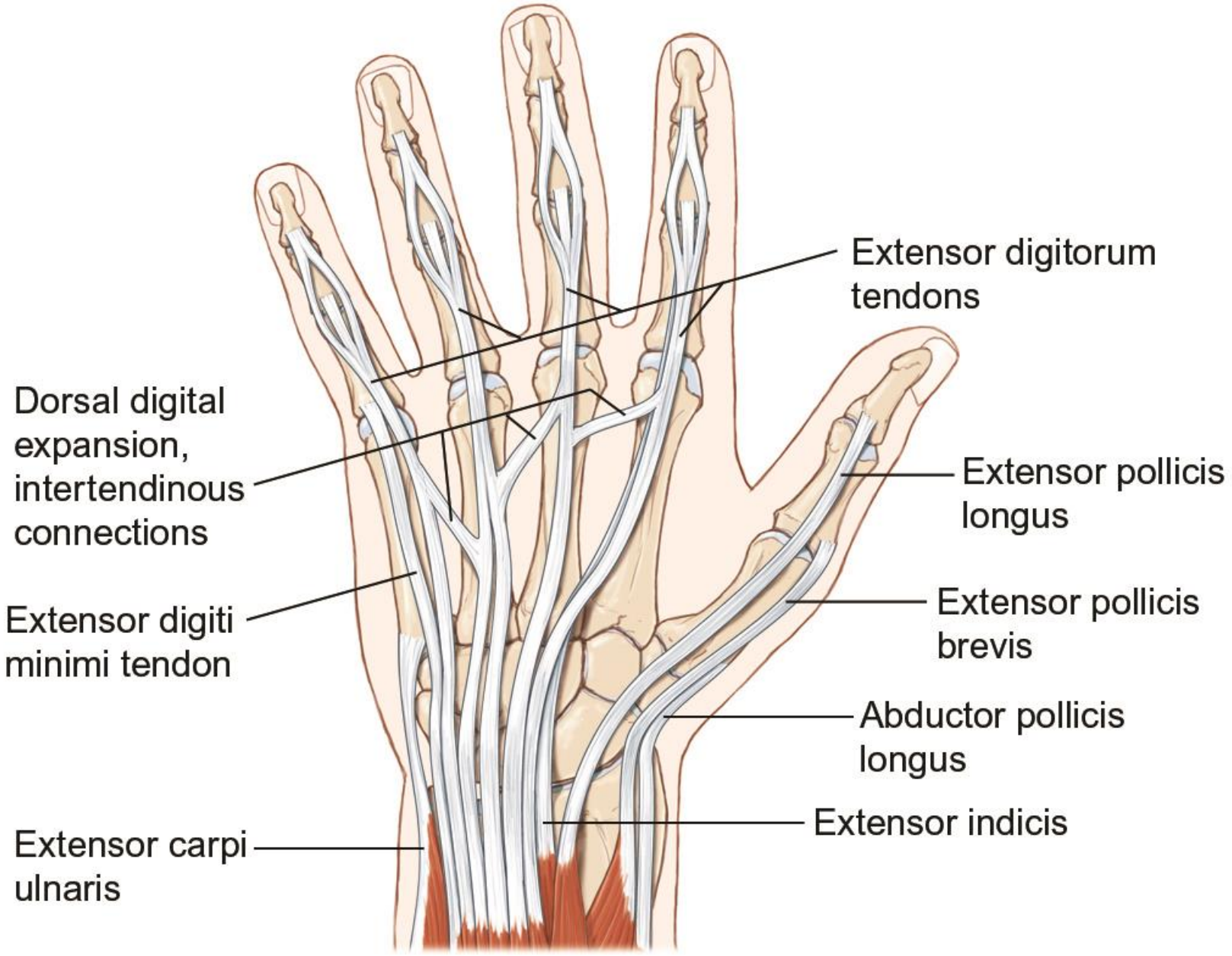

Biceps brachii tendon
Extensor carpi radialis longus
Lateral epicondyle
Extensor carpi radialis brevis
Triceps brachii tendon
Radius
Extensor carpi ulnaris
Olecranon bursa
Extensor digitorum communis

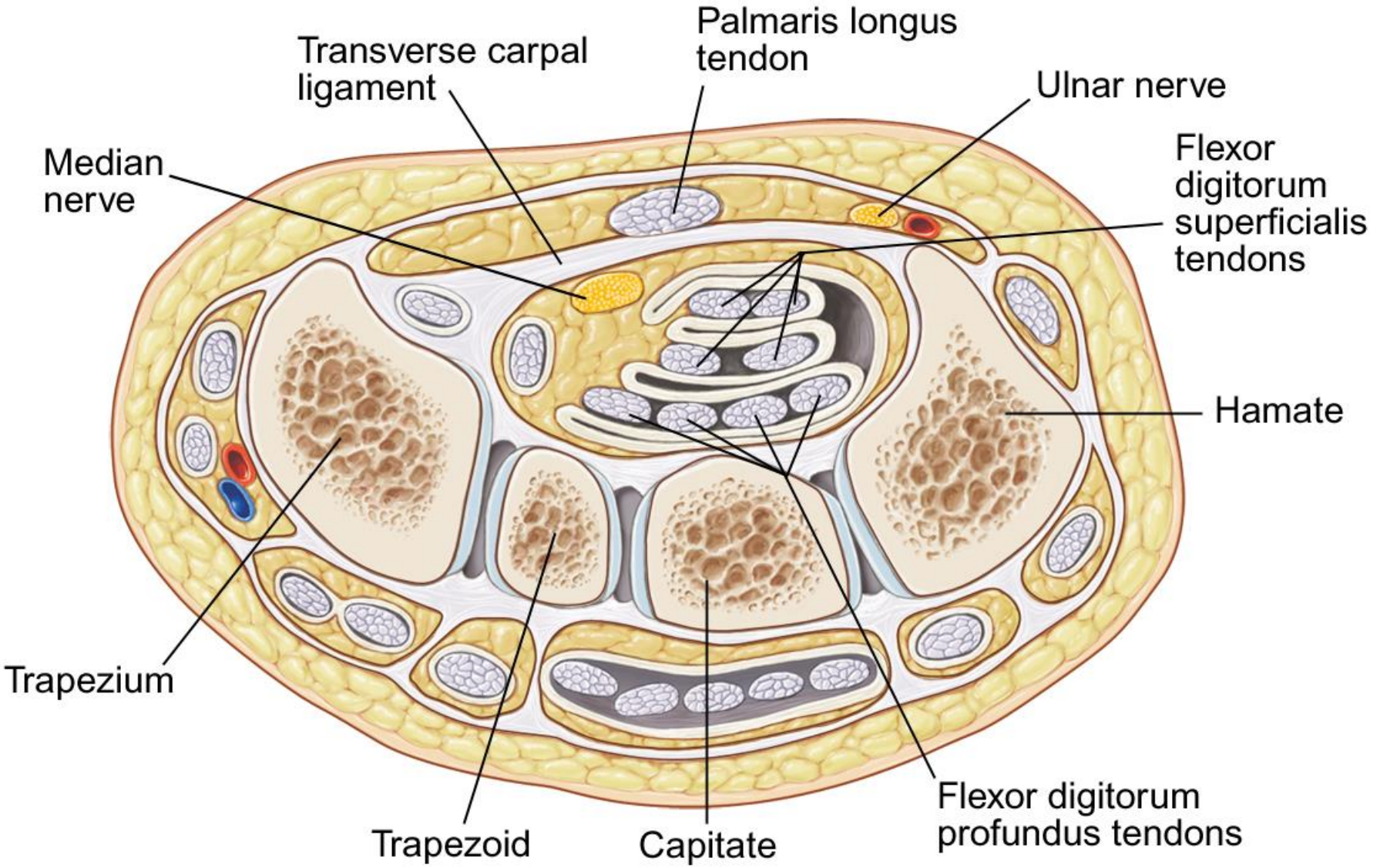

Pronator teres
Flexor carpi radialis
Palmaris longus
Medial epicondyle
Ulnar nerve
Olecranon
Flexor carpi ulnaris
Flexor digitorum superficialis

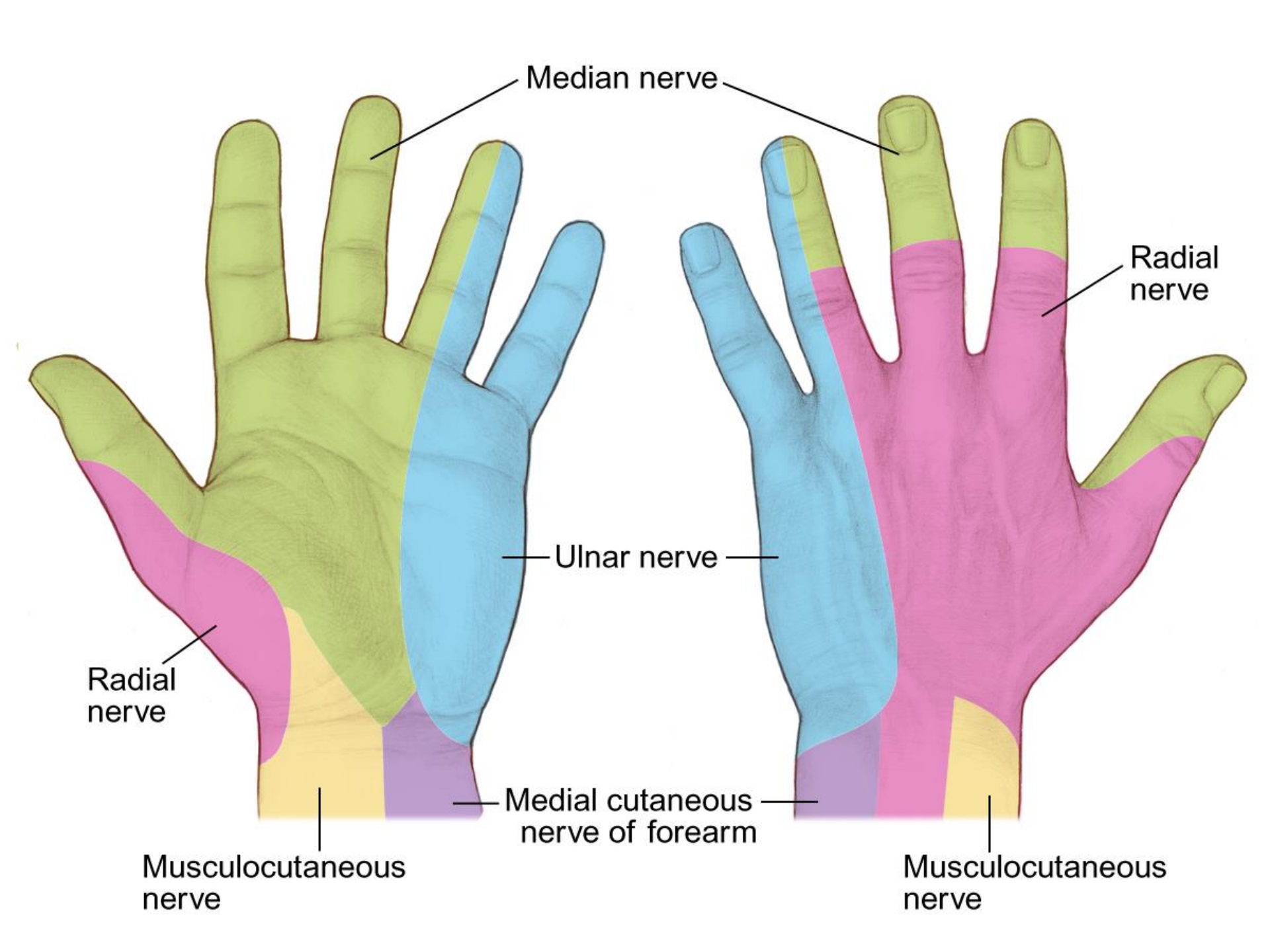

Distal interphalangeal joints
Proximal interphalangeal joints
Metacarpophalangeal joints
Metacarpals
Basal joint
Capitate
Hamate
Triquetrum
Lunate
Styloid process of ulna
Ulna
Distal phalanx
Middle phalanx
Proximal phalanx
Distal phalanx of thumb
Middle phalanx of thumb
5
4
3
2
1
Trapezoid
Trapezium
Midcarpal joint
Scaphoid
Radiocarpal joint
Radius

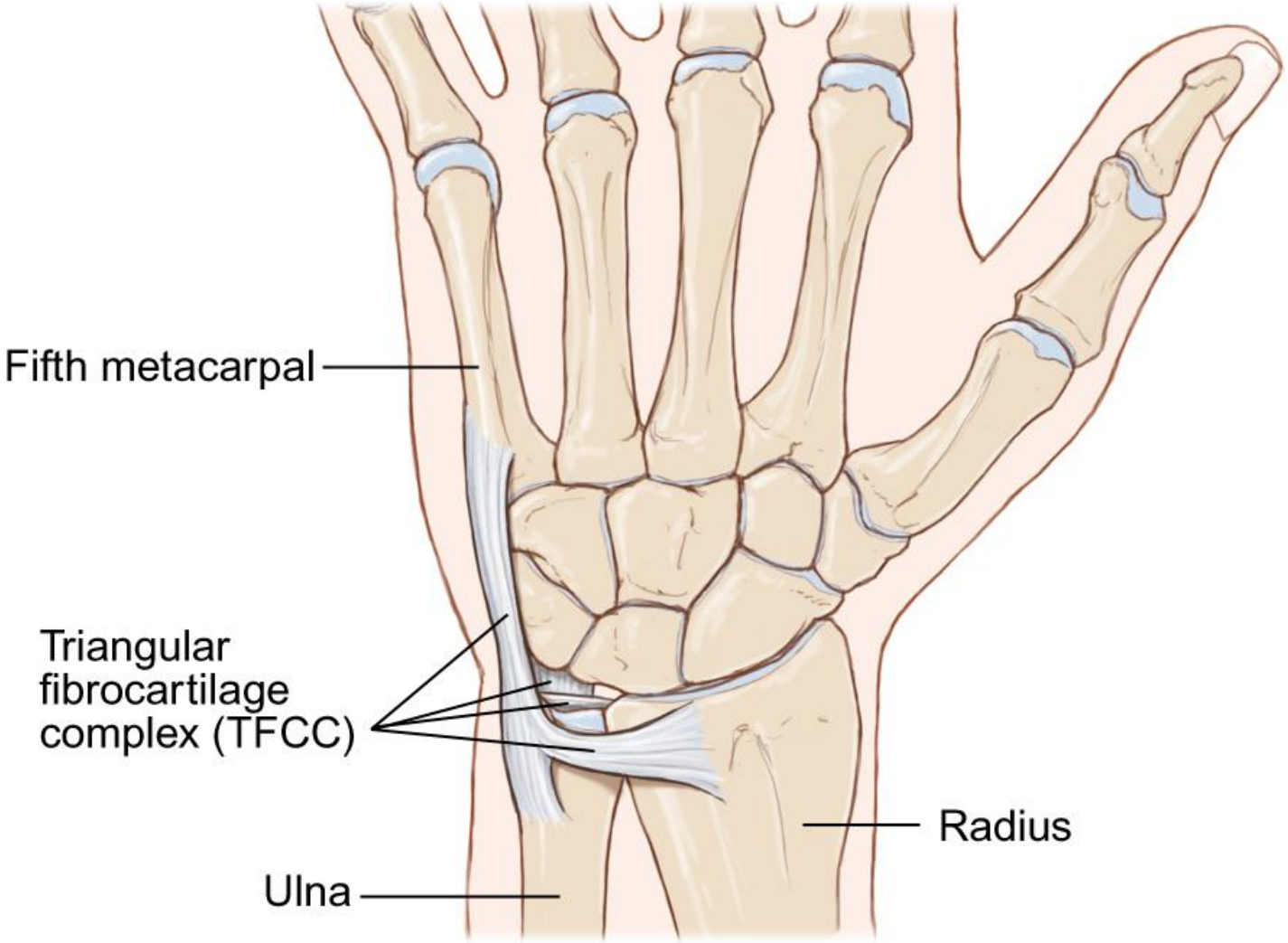

Distal interphalangeal joint
Proximal interphalangeal joint
Metacarpophalangeal joint
Distal phalanx
Middle phalanx
Proximal phalanx
Metacarpals
1
2
3
4
5
Trapezoid
Trapezium
Capitate
Scaphoid
Radius
Hamate
Pisiform
Triquetrum
Lunate
Styloid process of ulna
Ulna

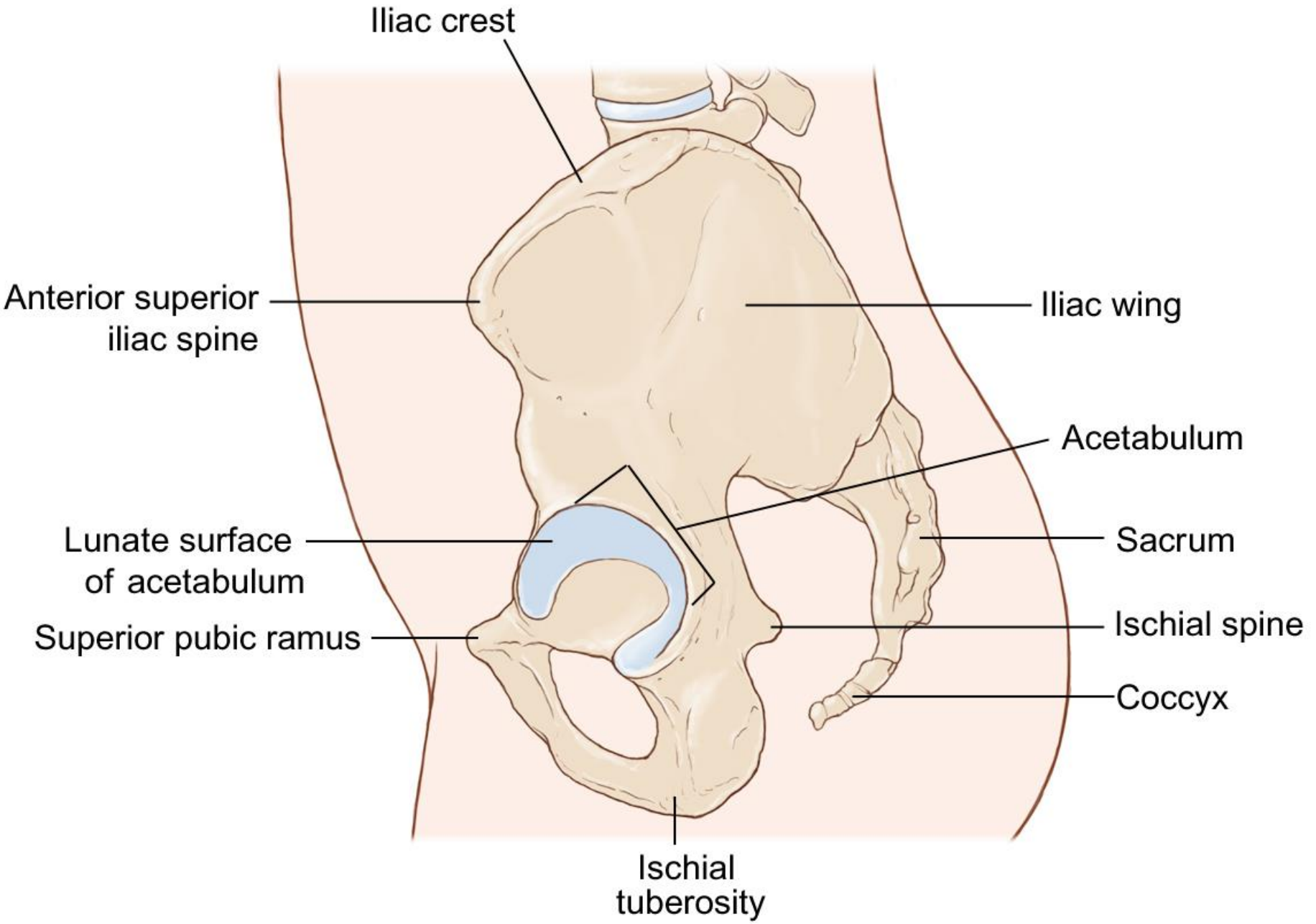

Deep flexor tendons (Flexor digitorum profundus)
Superficial flexor tendons (Flexor digitorum superficialis)
Palmar aponeurosis (cut)
Flexor pollicis longus
Flexor carpi ulnaris
Flexor carpi radialis
Palmaris longus

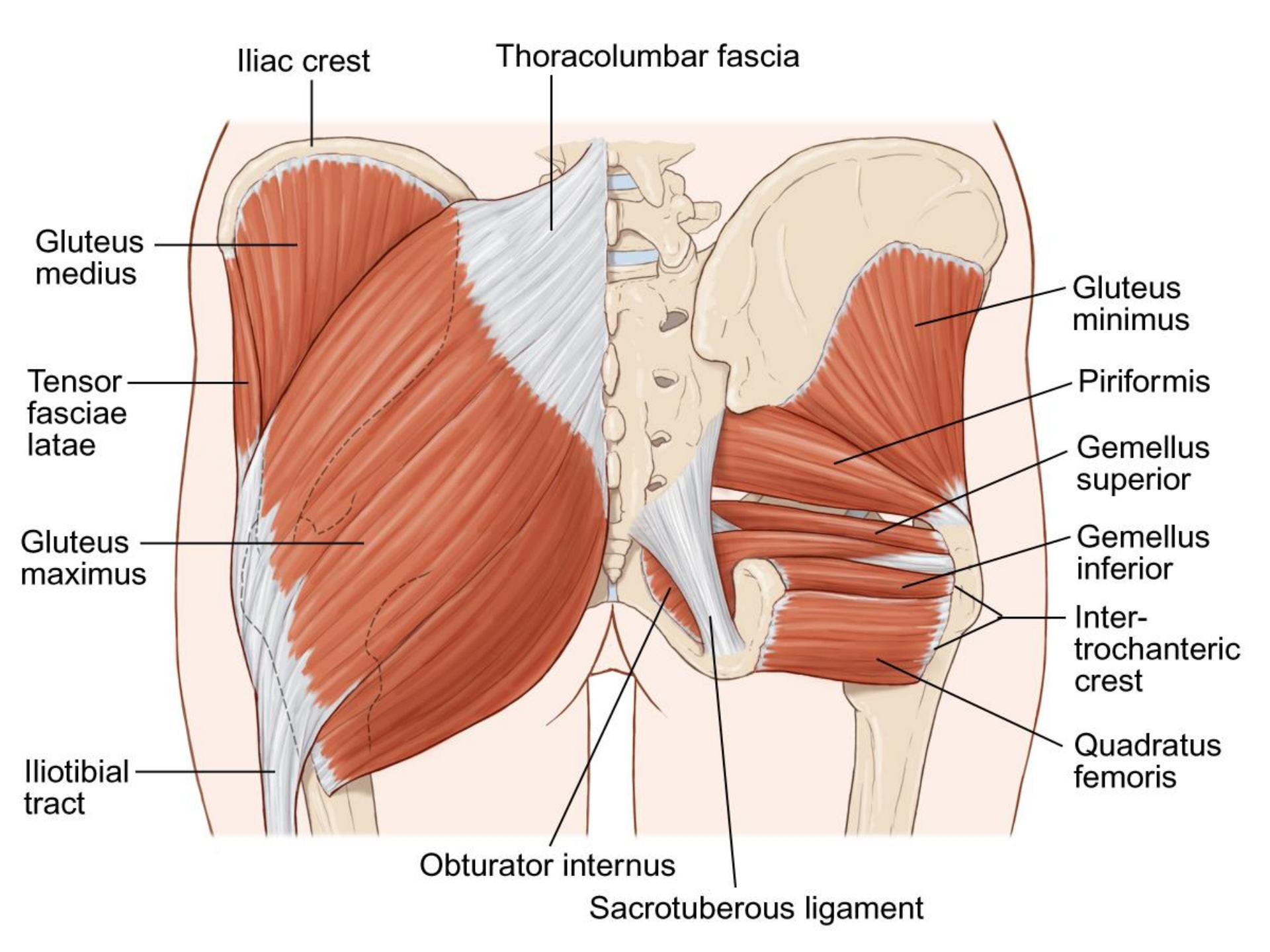

Extensor digitorum tendons
Dorsal digital expansion, intertendinous connections
Extensor pollicis longus
Extensor digiti minimi tendon
Extensor pollicis brevis
Abductor pollicis longus
Extensor indicis
Extensor carpi ulnaris

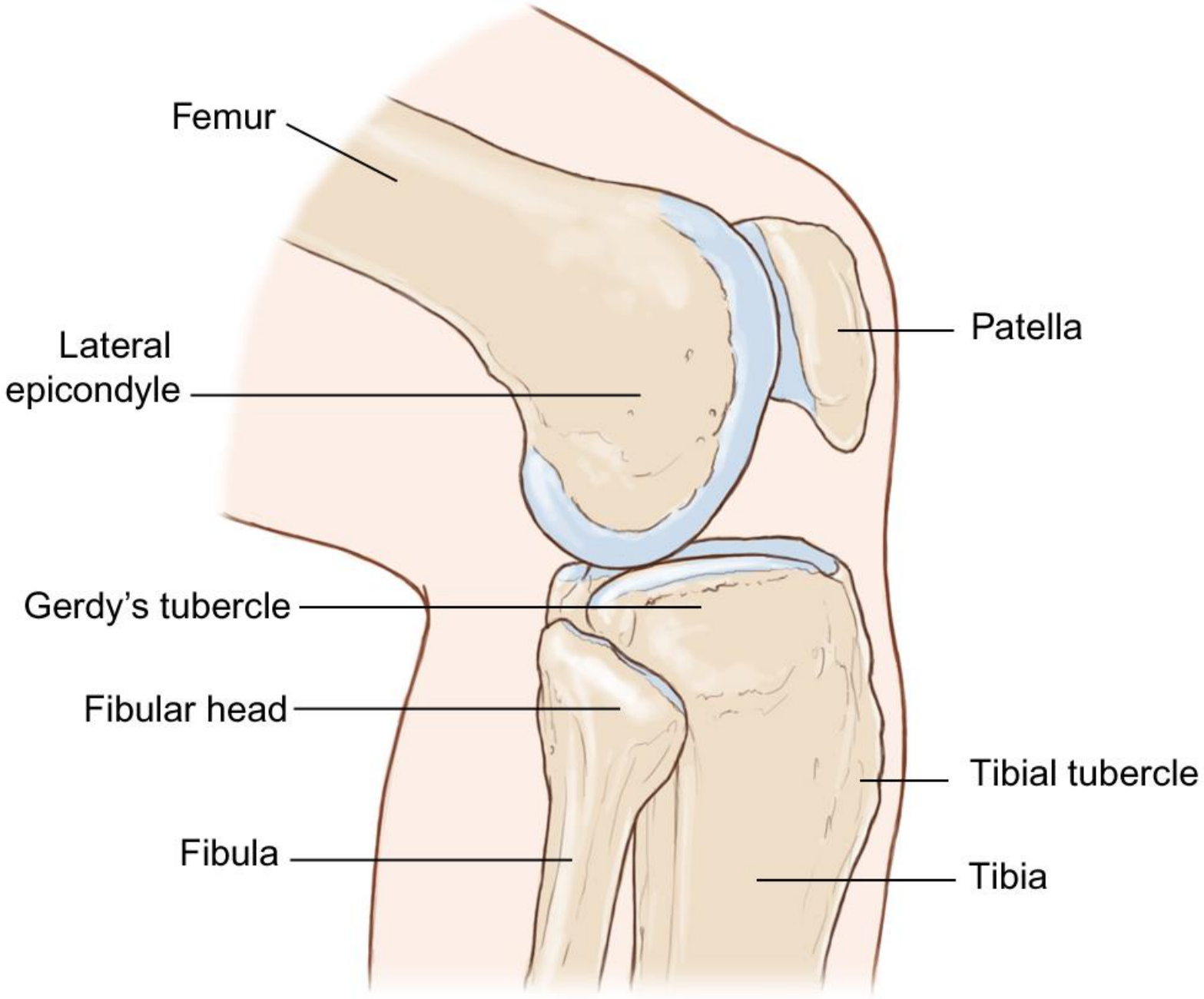

Transverse carpal ligament
Palmaris longus tendon
Ulnar nerve
Median nerve
Flexor digitorum superficialis tendons
Hamate
Trapezium
Trapezoid
Capitate
Flexor digitorum profundus tendons

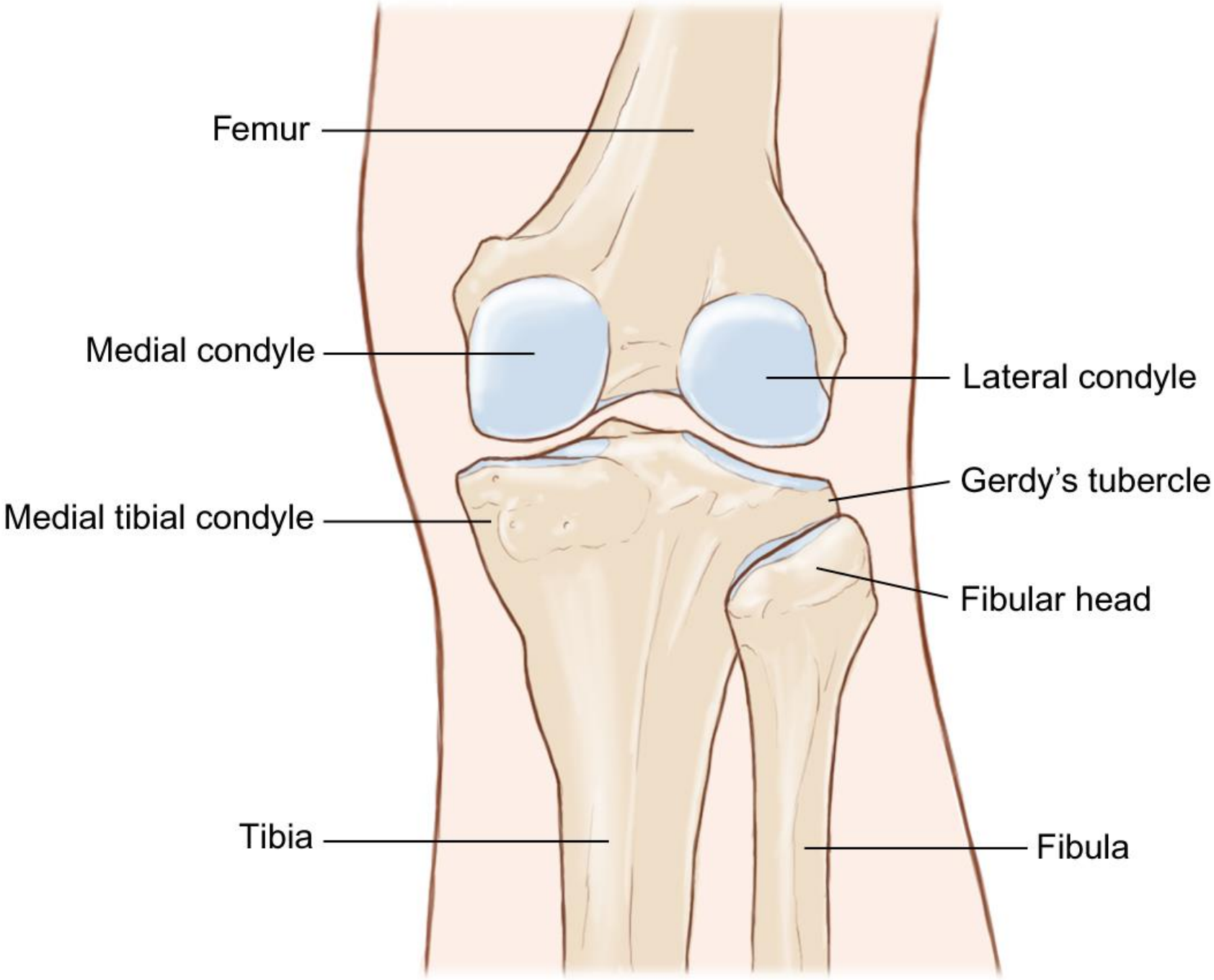

Median nerve
Radial nerve
Ulnar nerve
Radial nerve
Medial cutaneous nerve of forearm
Musculocutaneous nerve
Musculocutaneous nerve

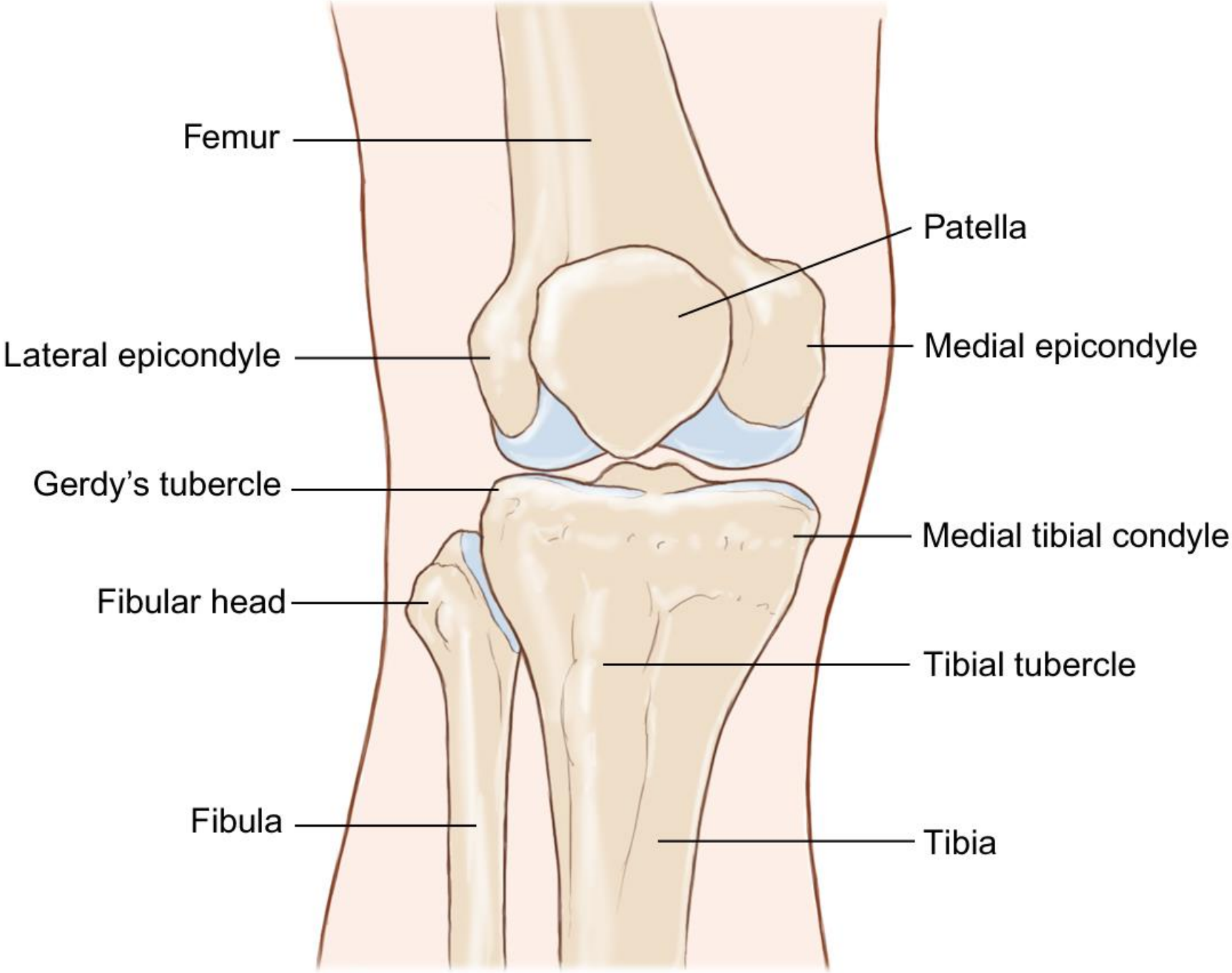

Fifth metacarpal
Triangular fibrocartilage complex (TFCC)
Radius
Ulna

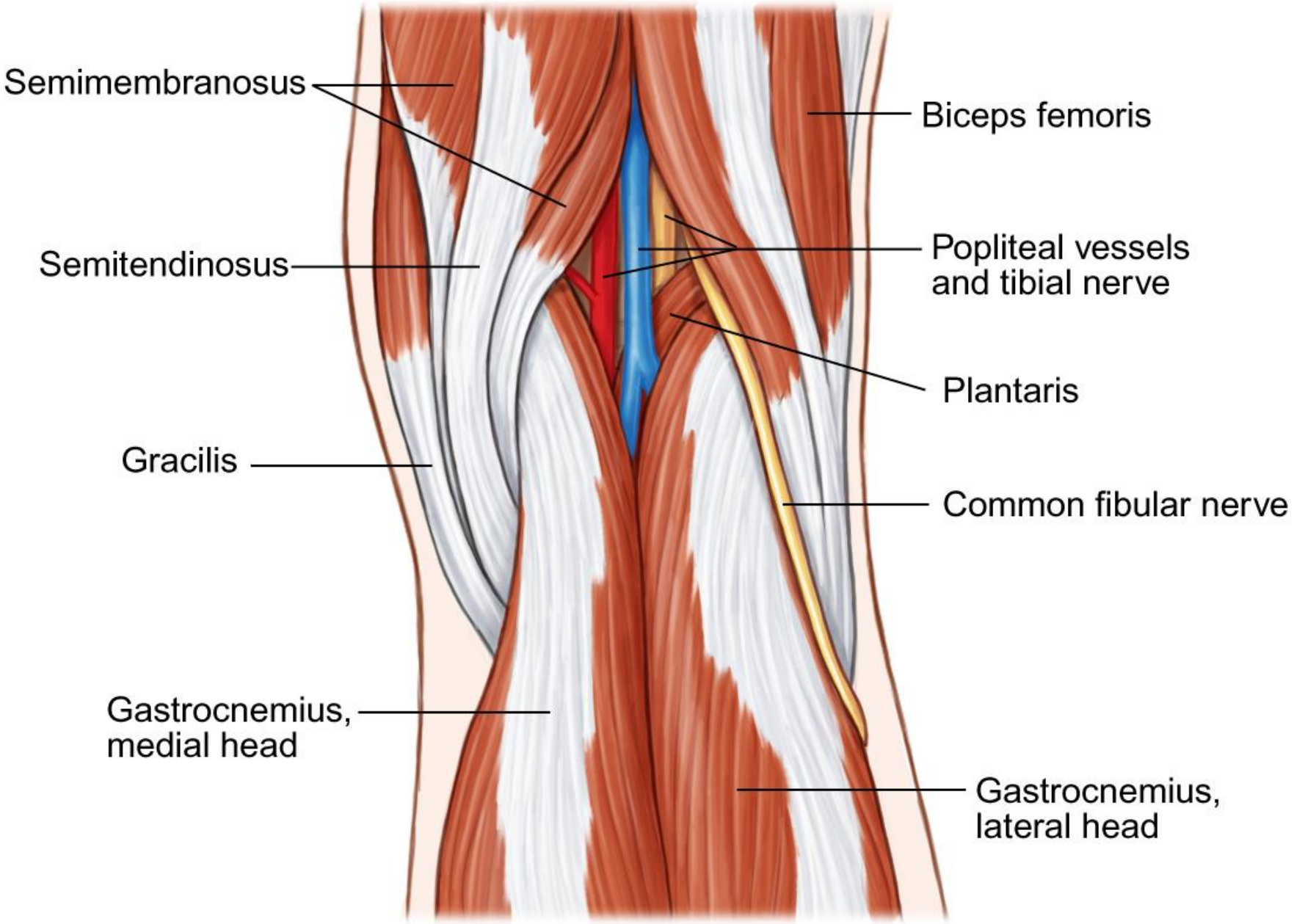

Iliac crest
Anterior superior iliac spine
Iliac wing
Acetabulum
Lunate surface of acetabulum
Sacrum
Superior pubic ramus
Ischial spine
Coccyx
Ischial tuberosity

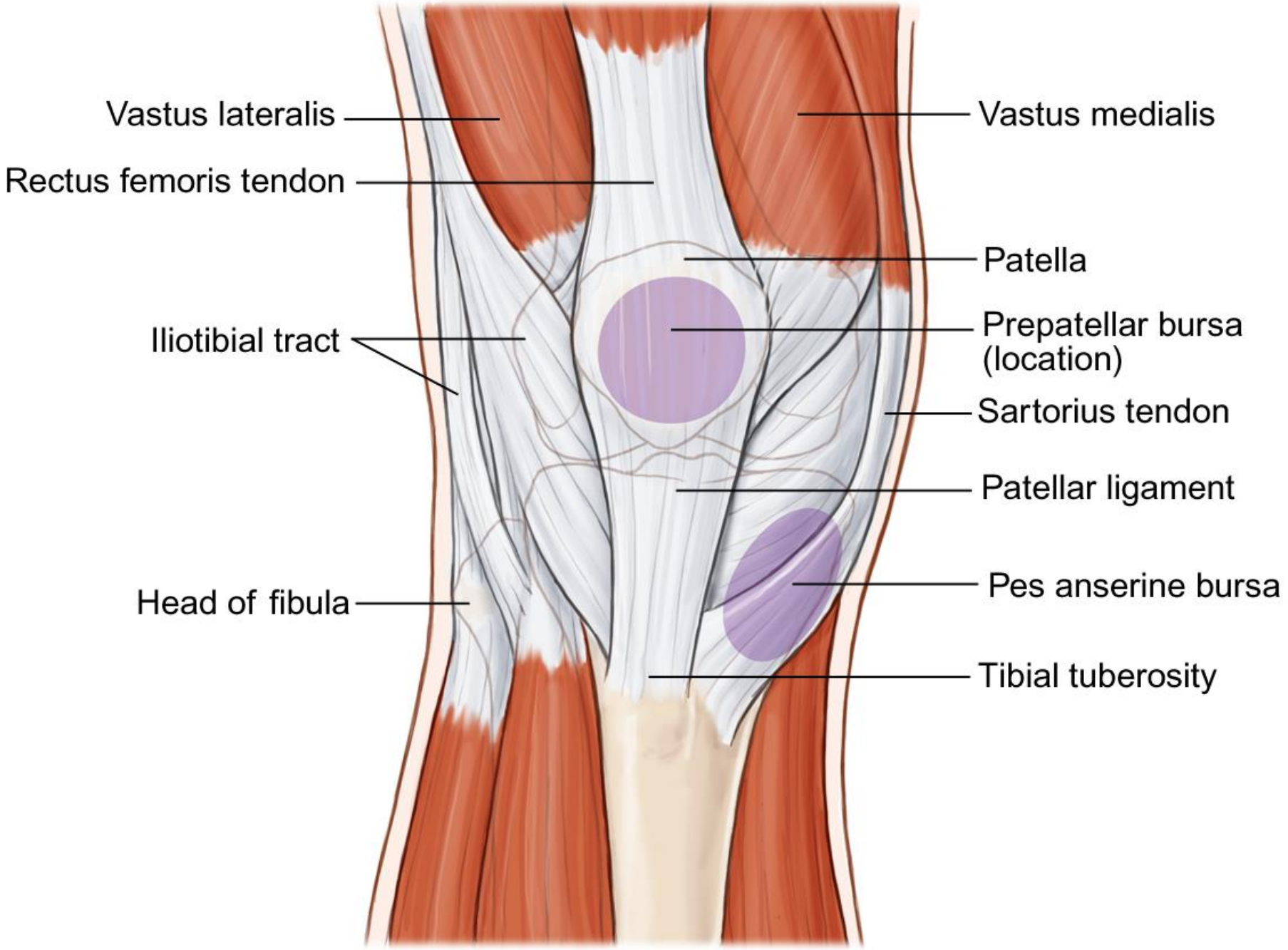

Iliac crest
Thoracolumbar fascia
Gluteus medius
Tensor fasciae latae
Gluteus maximus
Iliotibial tract
Gluteus minimus
Piriformis
Gemellus superior
Gemellus inferior
Inter-trochanteric crest
Quadratus femoris
Obturator internus
Sacrotuberous ligament

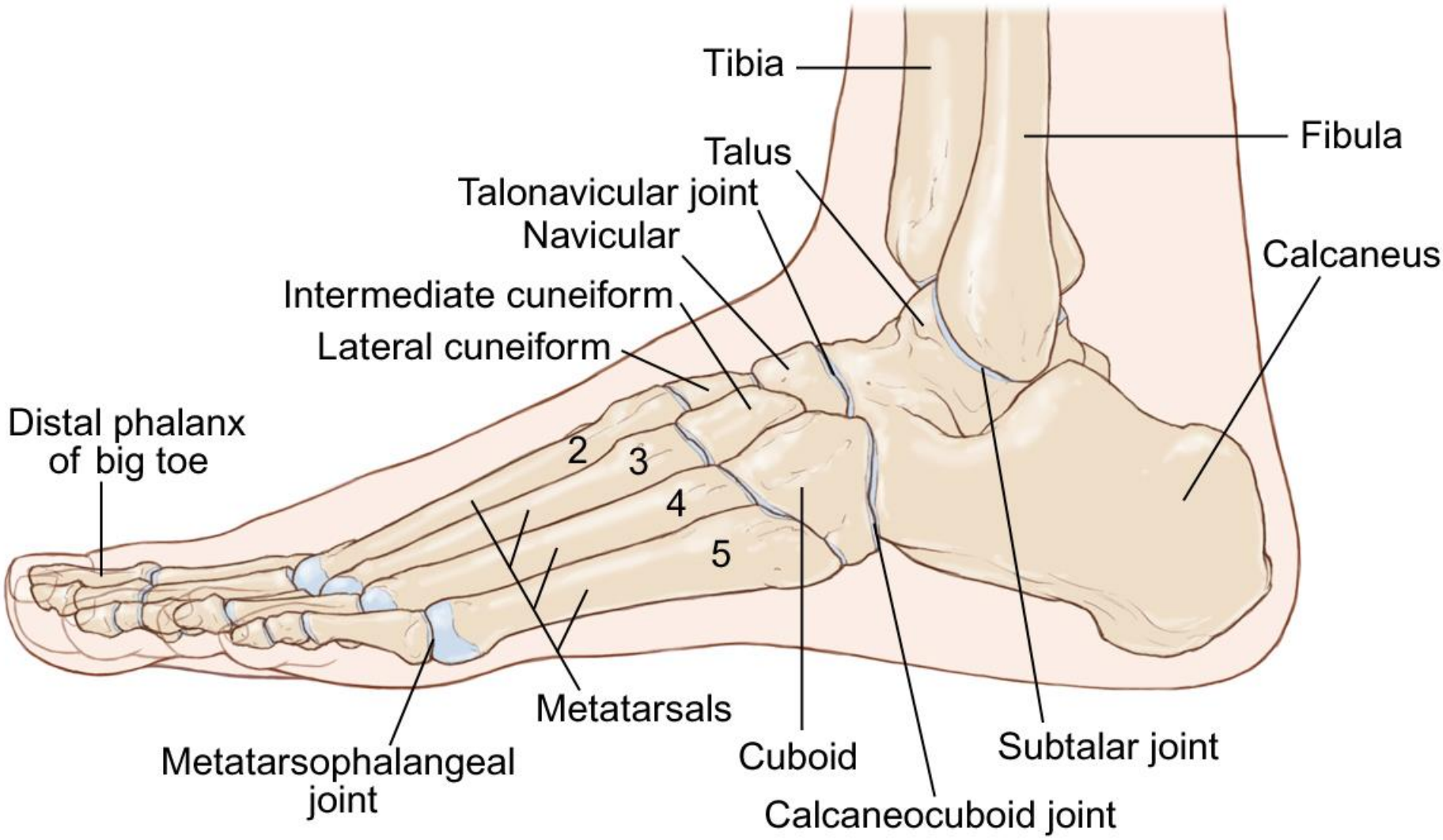

Femur
Patella
Lateral epicondyle
Gerdy's tubercle
Fibular head
Tibial tubercle
Fibula
Tibia

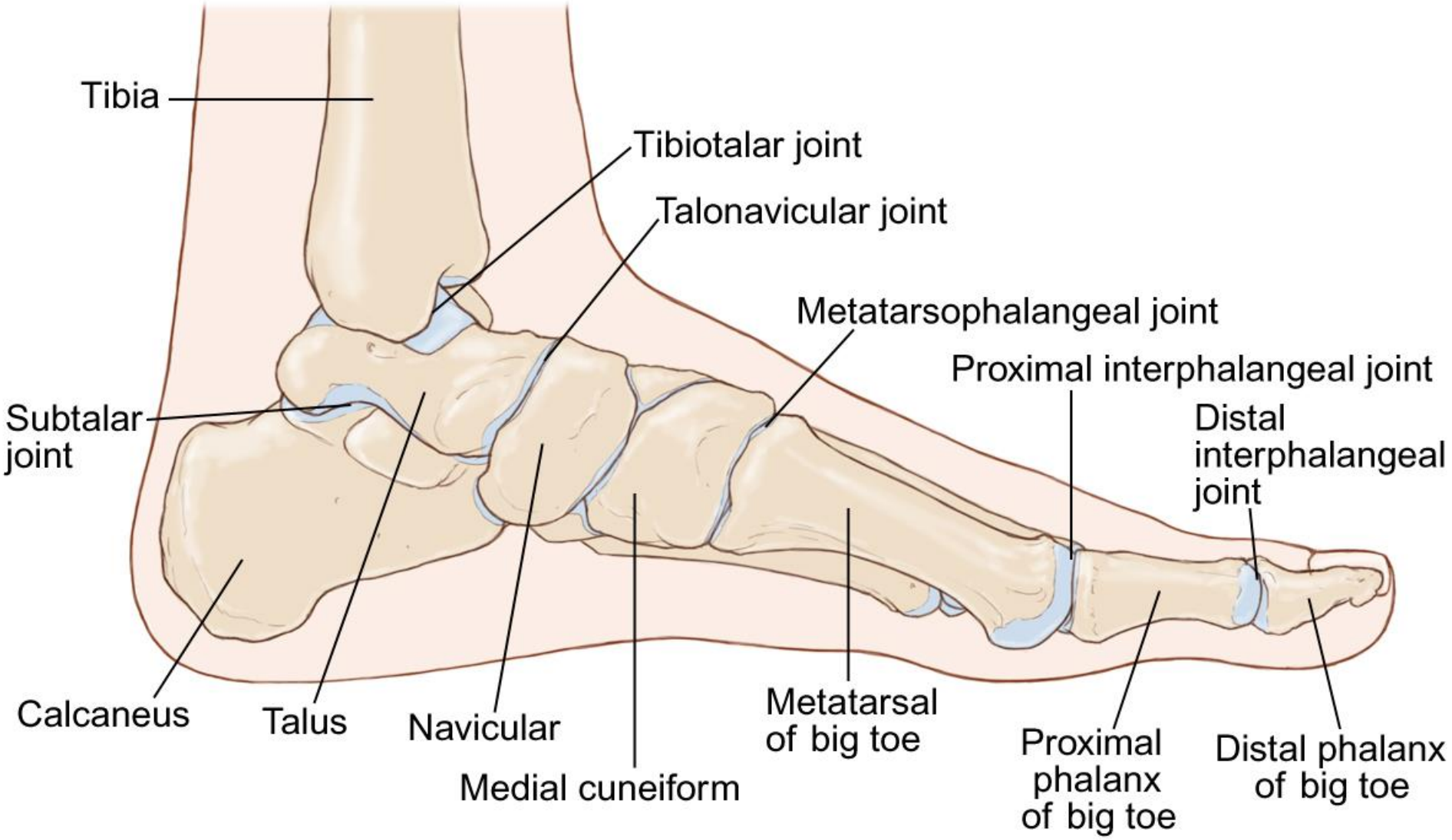

Femur
Medial condyle
Lateral condyle
Gerdy's tubercle
Medial tibial condyle
Fibular head
Tibia
Fibula

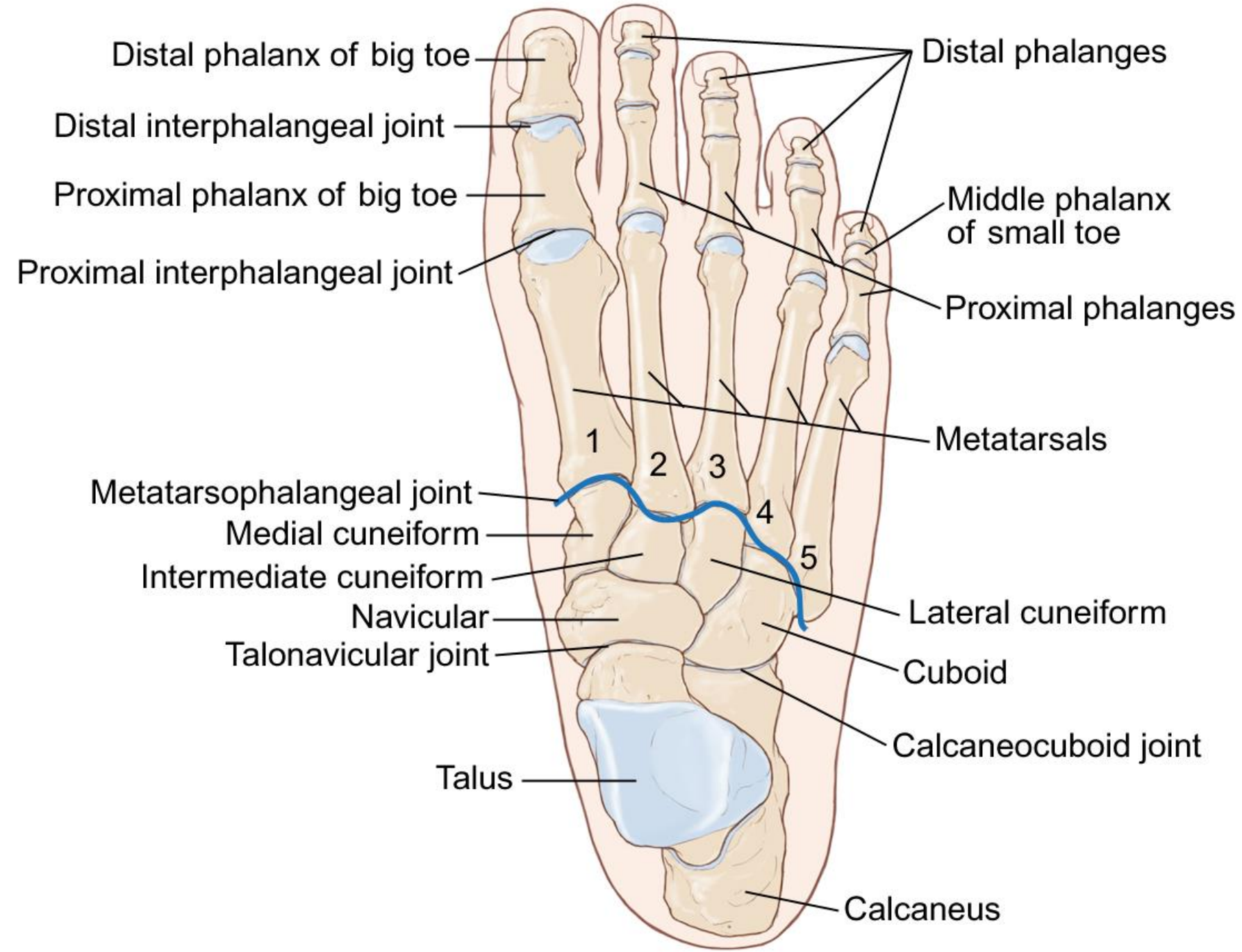

Femur
Patella
Lateral epicondyle
Medial epicondyle
Gerdy's tubercle
Medial tibial condyle
Fibular head
Tibial tubercle
Fibula
Tibia

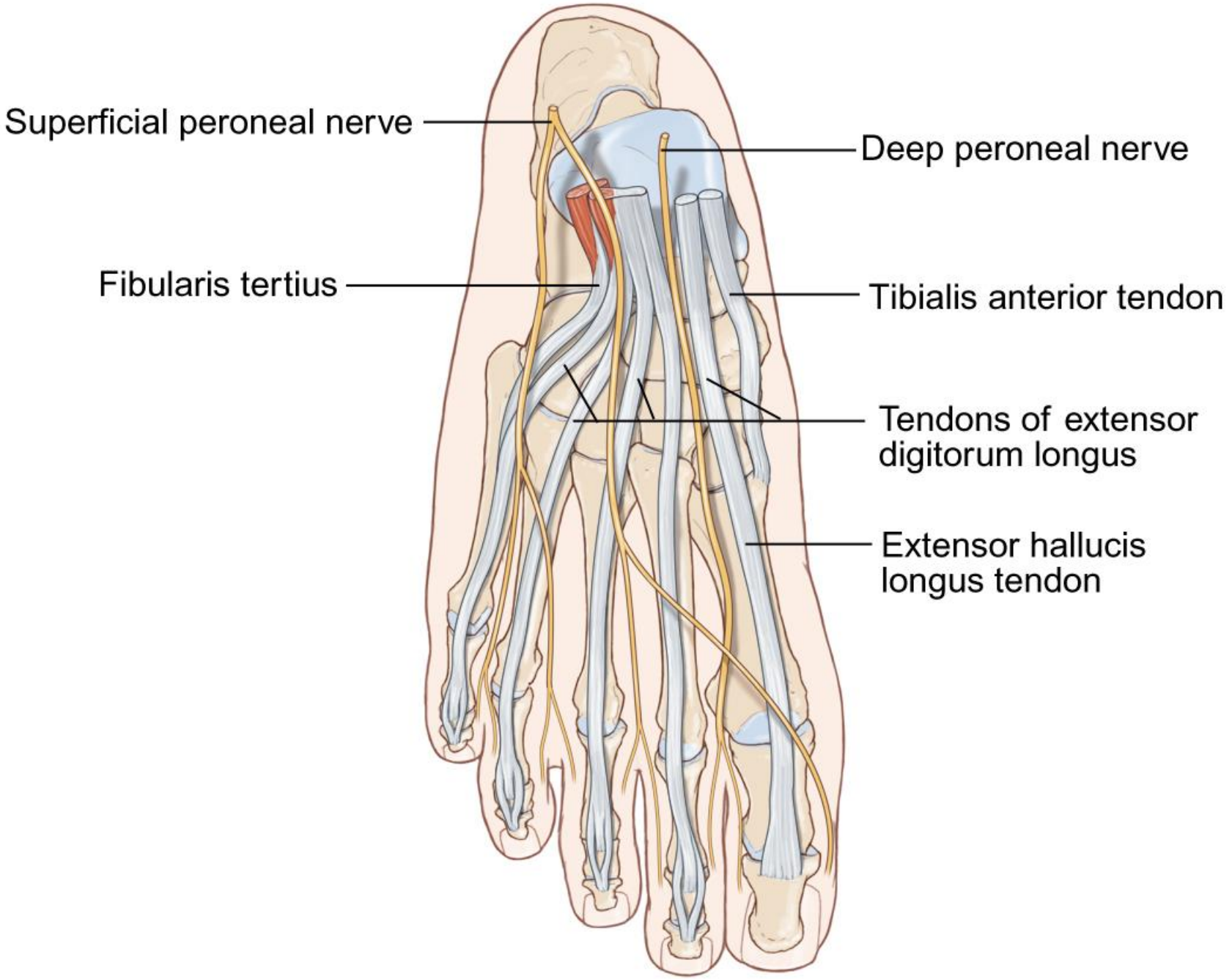

Semimembranosus
Semitendinosus
Gracilis
Gastrocnemius, medial head
Biceps femoris
Popliteal vessels and tibial nerve
Plantaris
Common fibular nerve
Gastrocnemius, lateral head

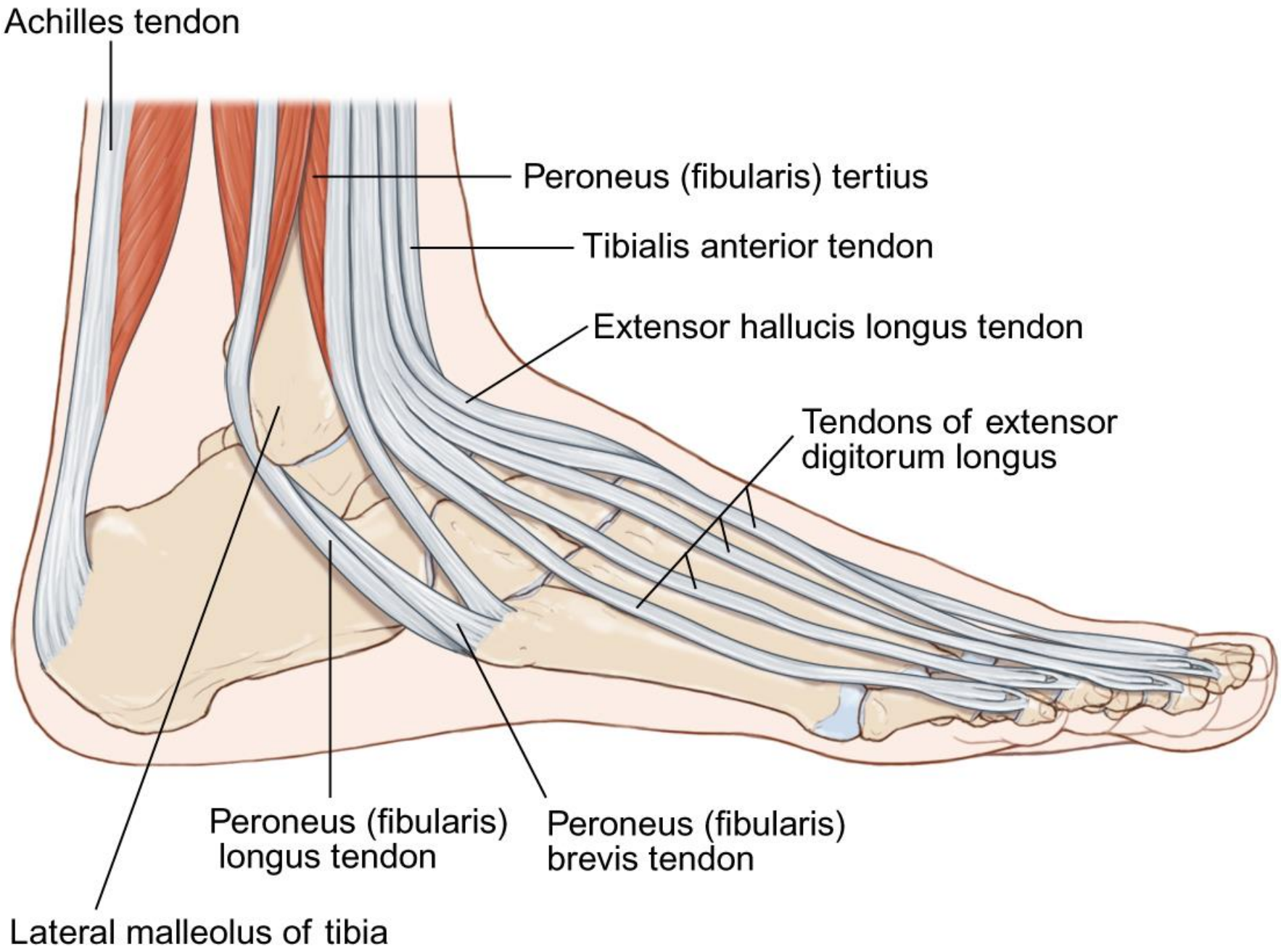

Vastus lateralis
Rectus femoris tendon
Iliotibial tract
Head of fibula
Vastus medialis
Patella
Prepatellar bursa (location)
Sartorius tendon
Patellar ligament
Pes anserine bursa
Tibial tuberosity

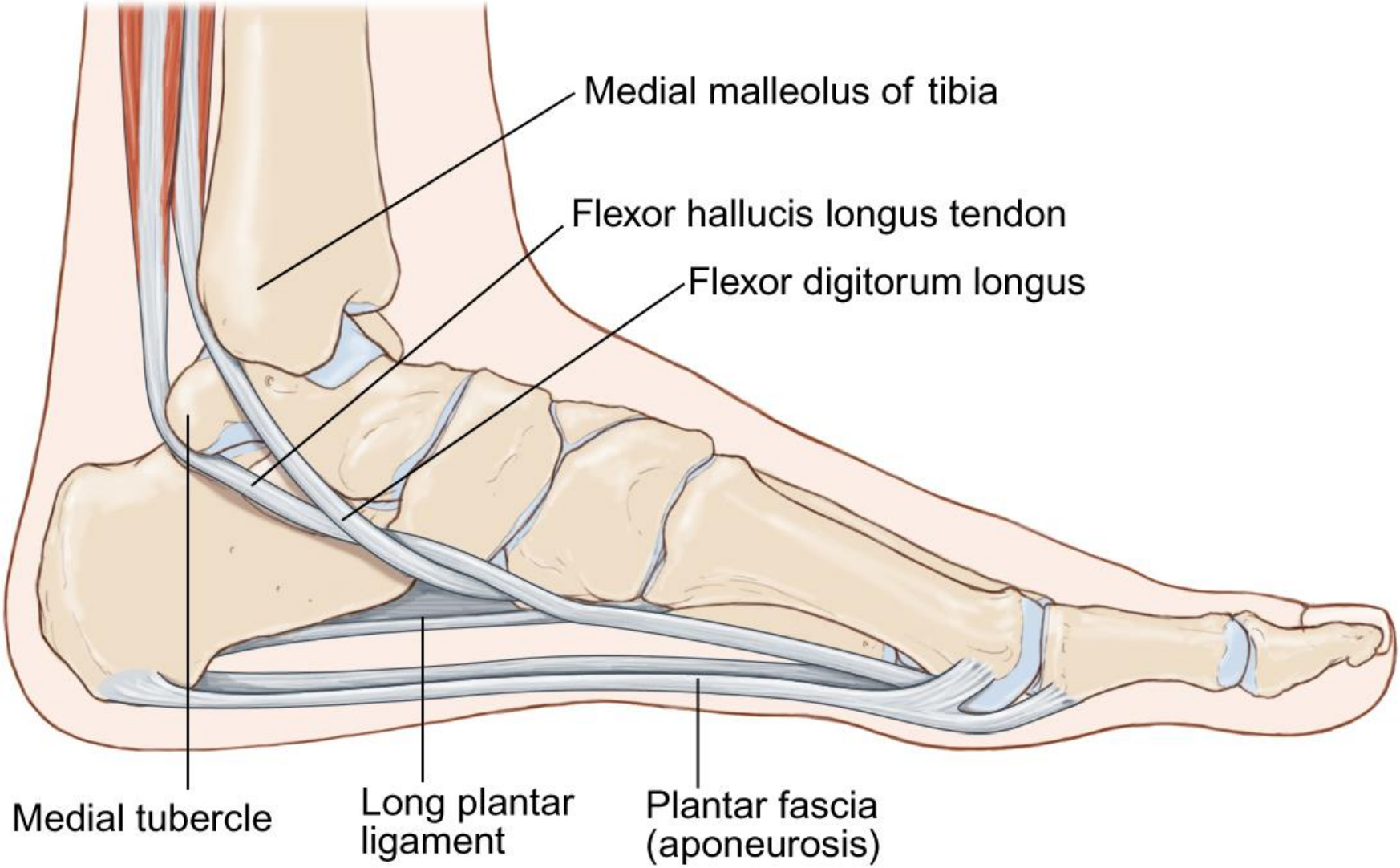

Tibia
Fibula
Talus
Talonavicular joint
Navicular
Calcaneus
Intermediate cuneiform
Lateral cuneiform
Distal phalanx
of big toe
2
3
4
5
Metatarsals
Metatarsophalangeal
joint
Cuboid
Subtalar joint
Calcaneocuboid joint


Tibia
Tibiotalar joint
Talonavicular joint
Metatarsophalangeal joint
Proximal interphalangeal joint
Distal interphalangeal joint
Subtalar joint
Calcaneus
Talus
Navicular
Medial cuneiform
Metatarsal of big toe
Proximal phalanx of big toe
Distal phalanx of big toe


Distal phalanx of big toe
Distal interphalangeal joint
Proximal phalanx of big toe
Proximal interphalangeal joint
Distal phalanges
Middle phalanx of small toe
Proximal phalanges
Metatarsals
1
2
3
4
5
Metatarsophalangeal joint
Medial cuneiform
Intermediate cuneiform
Navicular
Talonavicular joint
Lateral cuneiform
Cuboid
Calcaneocuboid joint
Talus
Calcaneus


Superficial peroneal nerve
Deep peroneal nerve
Fibularis tertius
Tibialis anterior tendon
Tendons of extensor digitorum longus
Extensor hallucis longus tendon


Achilles tendon
Peroneus (fibularis) tertius
Tibialis anterior tendon
Extensor hallucis longus tendon
Tendons of extensor digitorum longus
Peroneus (fibularis) longus tendon
Peroneus (fibularis) brevis tendon
Lateral malleolus of tibia


Medial malleolus of tibia
Flexor hallucis longus tendon
Flexor digitorum longus
Medial tubercle
Long plantar ligament
Plantar fascia (aponeurosis)