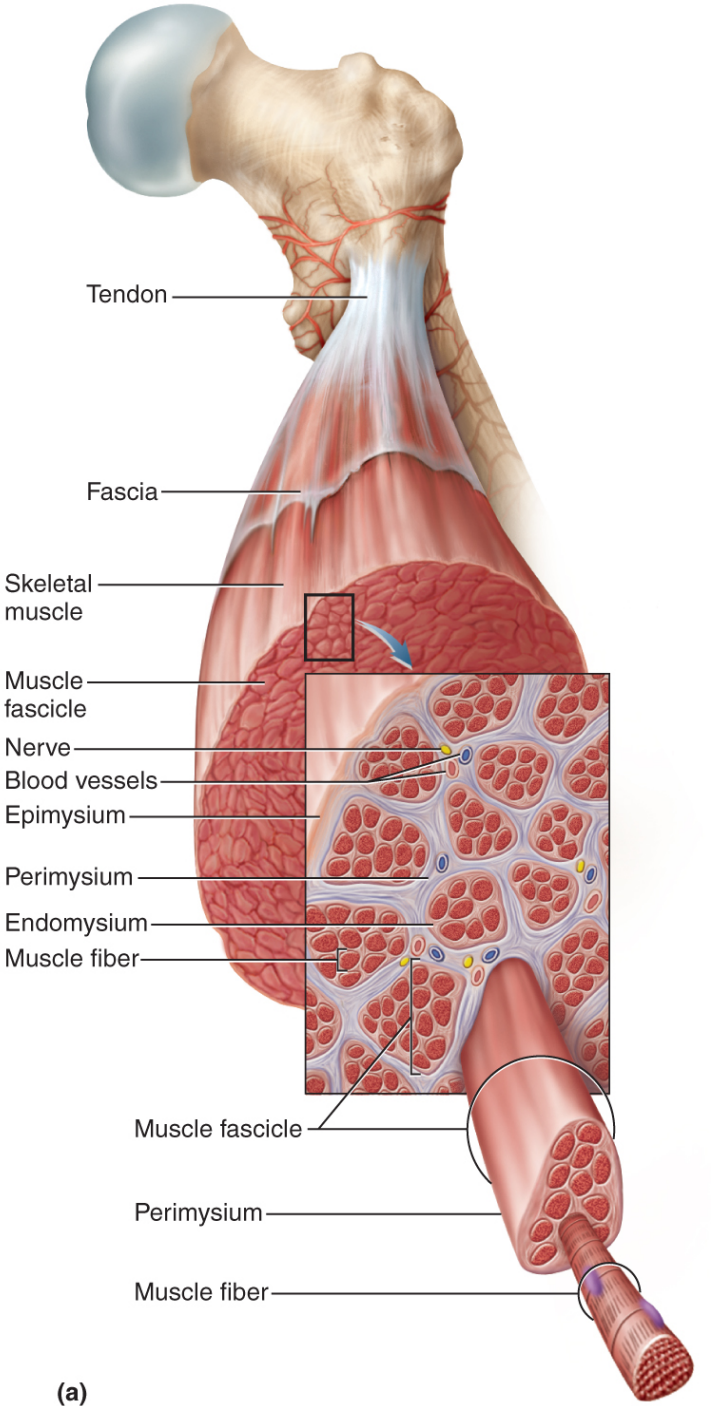
Organization of Muscles

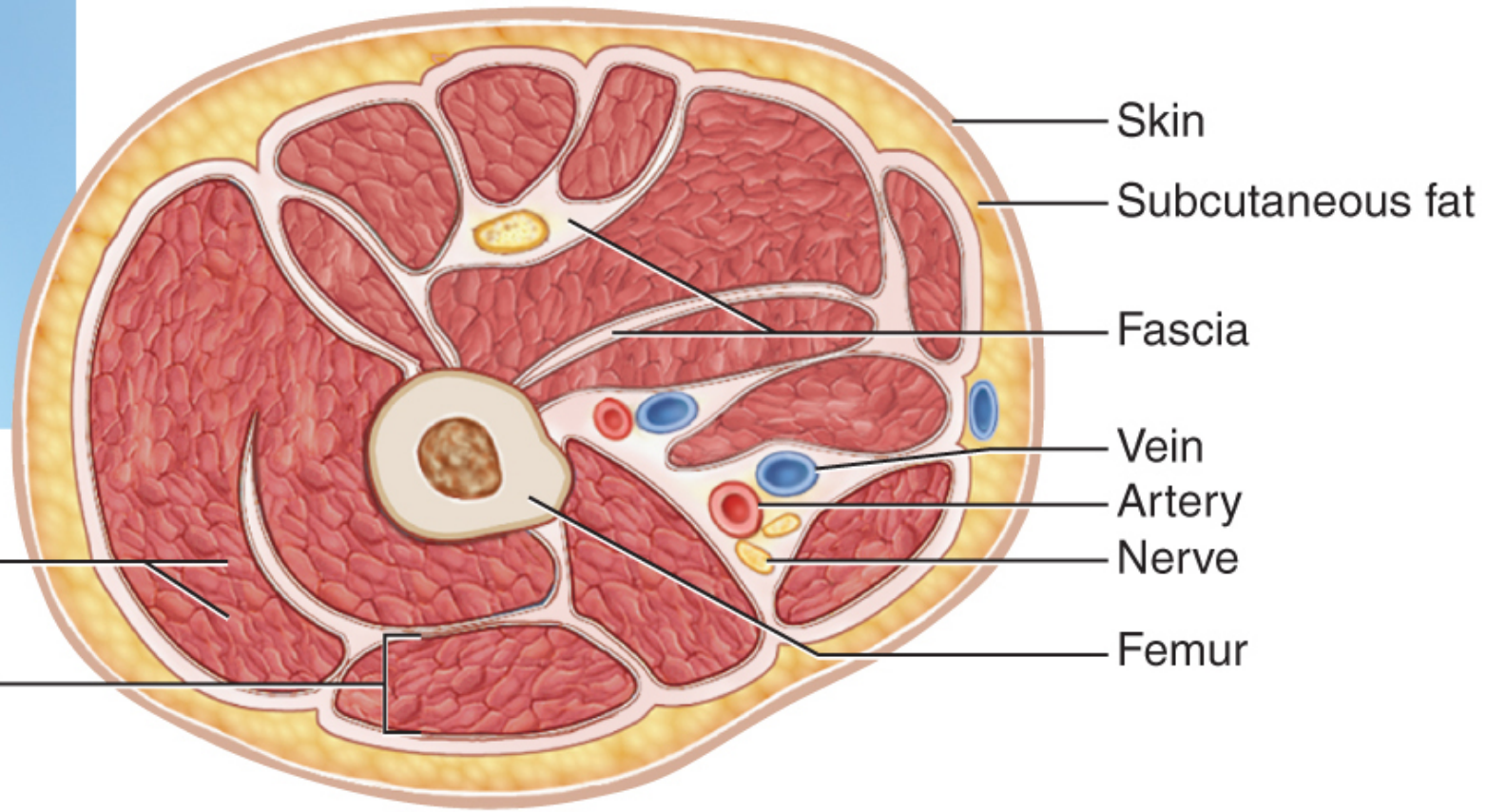
- three kinds of muscle tissue
  - **skeletal, cardiac, smooth**
- specialized for one major purpose
  - converting the chemical energy in ATP into the mechanical energy of motion

The Functions of Muscles

- **Movement**
- **Stability**
- **Control of openings and passageways**
  - **sphincters**
- **Heat production by skeletal muscles**
  - as much as 85% of our body heat



(a)



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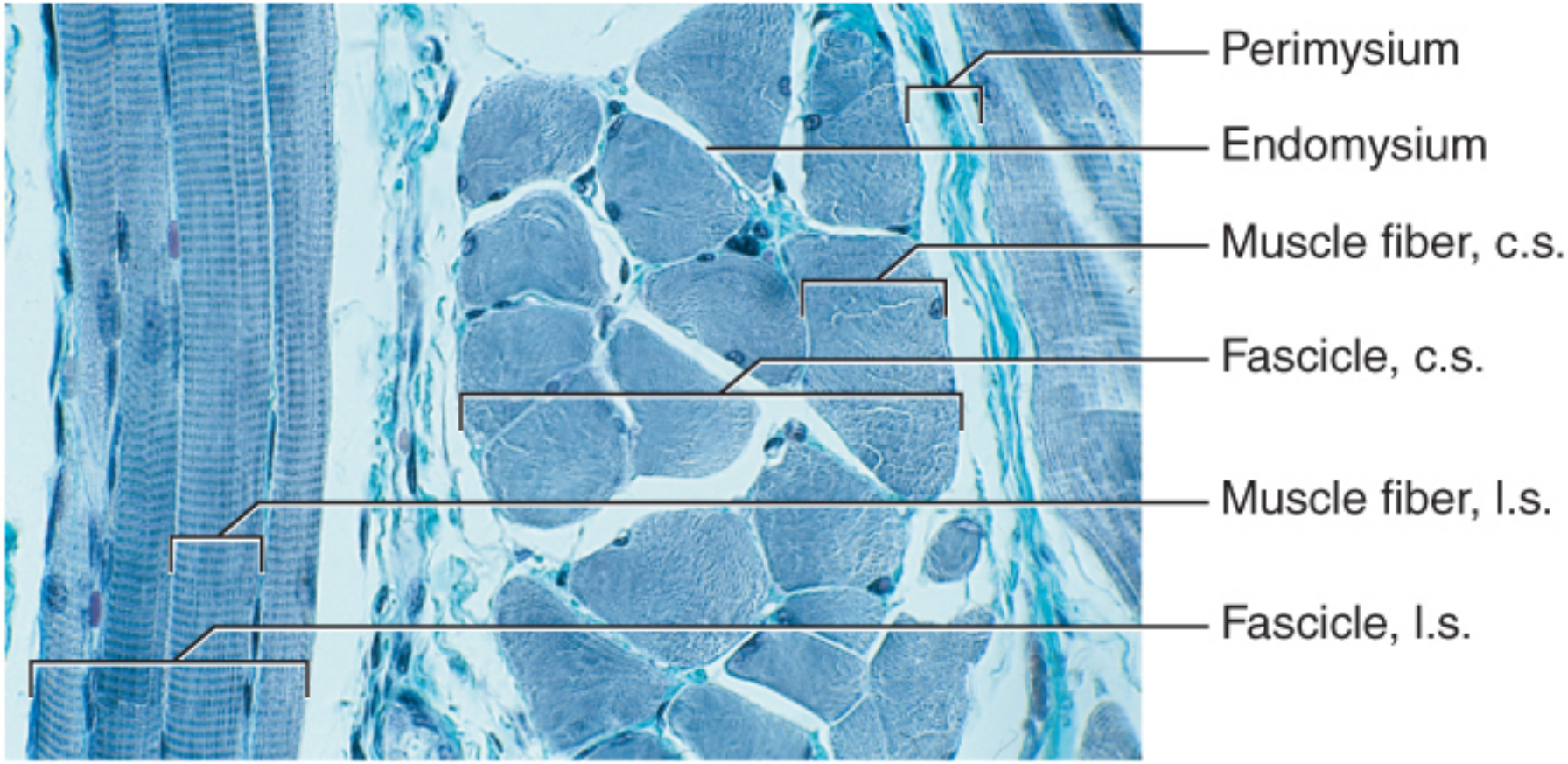


(c)

Victor Eroschenko

Connective Tissues of a Muscle

- **endomysium**
  - thin sleeve of loose connective tissue surrounding each **muscle fiber**
  - allows room for capillaries and nerve fibers to reach each muscle fiber
- **perimysium**
  - slightly thicker layer of connective tissue
  - **fascicles** – bundles of muscle fibers wrapped in perimysium
  - carry larger nerves and blood vessels, and stretch receptors
- **epimysium**
  - fibrous sheath surrounding the entire muscle
  - outer surface grades into the fascia
  - inner surface sends projections between fascicles to form perimysium
- **fascia**
  - sheet of connective tissue that separates neighboring muscles or muscle groups from each other and the subcutaneous tissue

Compartment Syndrome

- fasciae of arms and legs enclose muscle compartments very snugly
- if a blood vessel in a compartment is damaged, blood and tissue fluid accumulate in the compartment
- fasciae prevent compartment from expanding with increasing pressure
- **compartment syndrome** – mounting pressure on the muscles, nerves and blood vessel triggers a sequence of degenerative events
  - blood flow to compartment is obstructed by pressure
  - if **ischemia** (poor blood flow) persists for more than 2 – 4 hours, nerves begin to die
  - after 6 hours, muscles begin to die
- nerves can regenerate after pressure relieved, but muscle damage is permanent
- myoglobin in urine indicates compartment syndrome
- **treatment** – immobilization of limb and **fasciotomy** – incision to relieve compartment pressure

Fascicle Orientation of Muscles

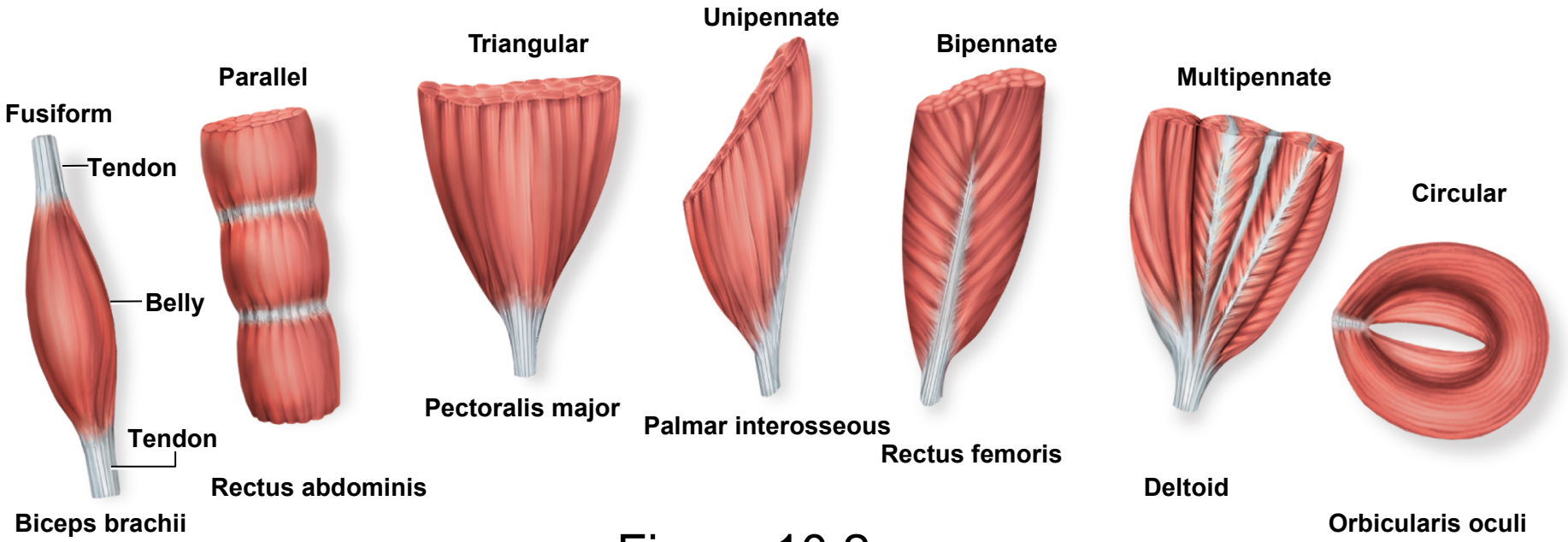


Figure 10.2

strength of a muscle and the direction of its pull are determined partly by the orientation of its fascicles.

Muscle Attachments

- **indirect attachment to bone**
  - **tendons**
    - the collagen fibers of the endo-, peri-, and epimysium continue into the tendon then into the periosteum and the matrix of bone
    - *biceps brachii, Achilles tendon*

- **direct (fleshy) attachment to bone**
  - little separation between muscle and bone
  - muscle seems to immerge directly from bone
  - margins of *brachialis*, lateral head of *triceps brachii*

- some skeletal muscles do not insert on bone, but in dermis of the skin – muscles of facial expression

Muscle Origins and Insertions

- **Origin**
  - bony attachment at stationary end of muscle
- **Belly**
  - thicker, middle region of muscle between origin and insertion
- **Insertion**
  - bony attachment to mobile end of muscle

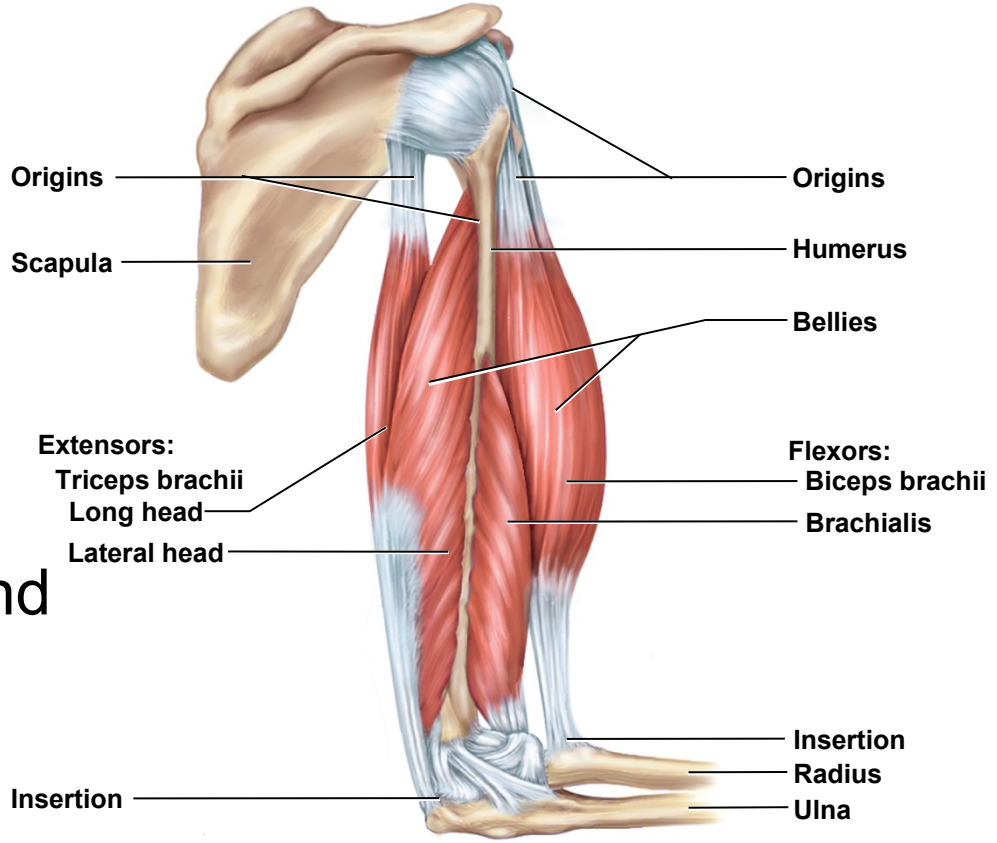


Figure 10.3

Functional Groups of Muscles

- **action –** the effects produced by a muscle
  - to produce or prevent movement
- **prime mover (agonist) -** muscle that produces most of force during a joint action
- **synergist -** muscle that aids the prime mover
  - stabilizes the nearby joint
  - modifies the direction of movement
- **antagonist -** opposes the prime mover
  - relaxes to give prime mover control over an action
  - preventing excessive movement and injury
  - **antagonistic pairs** – muscles that act on opposite sides of a joint
- **fixator -** muscle that prevents movement of bone

Muscle Actions Across Elbow

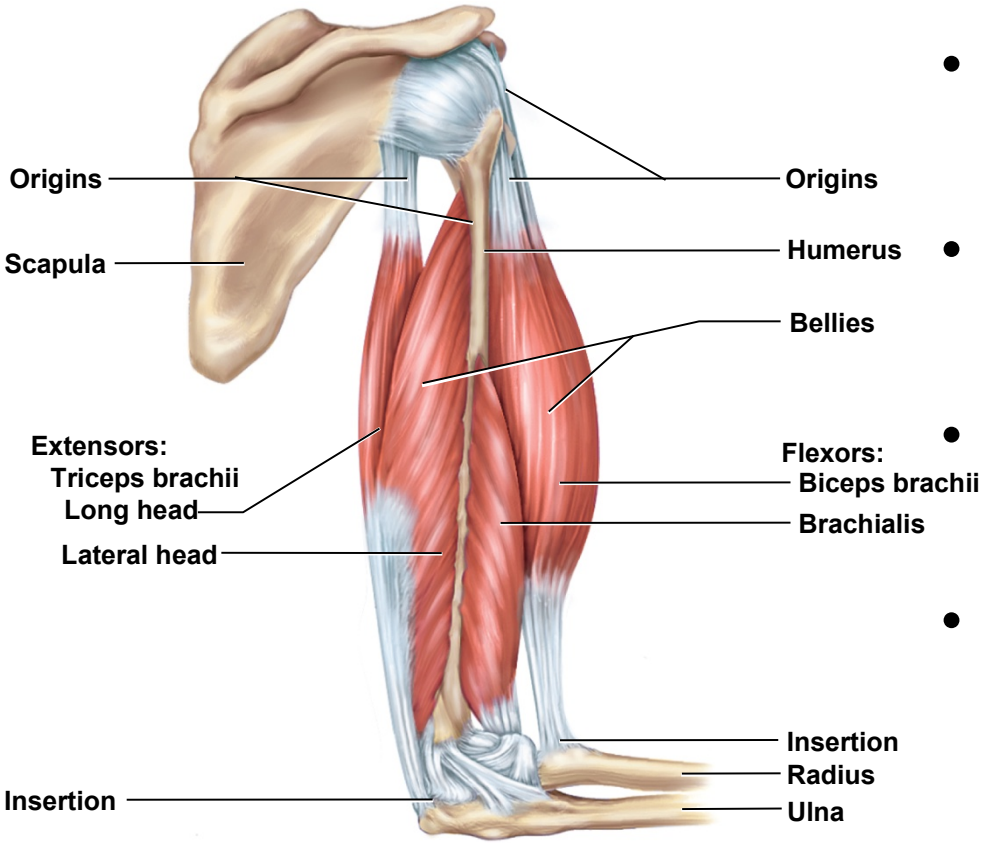
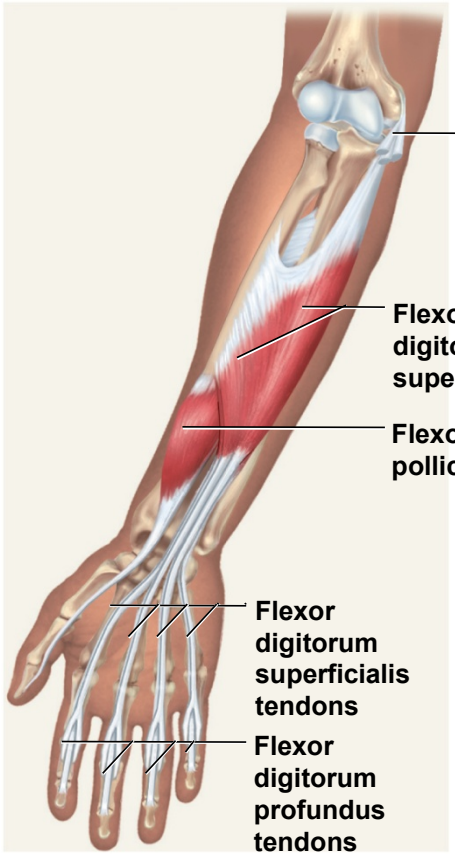


Figure 10.3

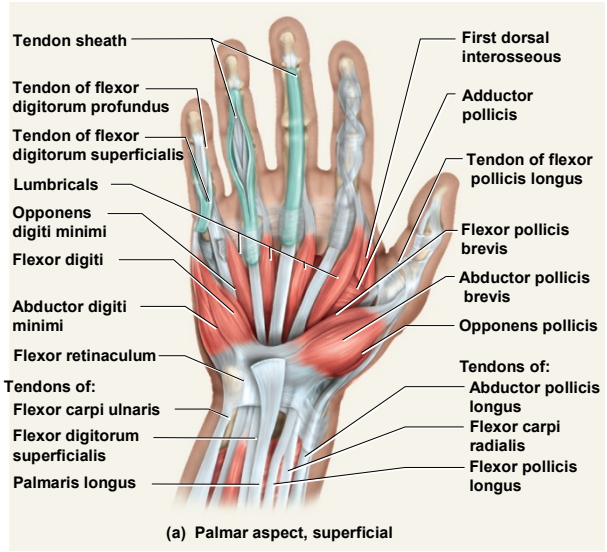
- **prime mover** - brachialis
- **synergist** - biceps brachii
- **antagonist** - triceps brachii
- **fixator** - muscle that holds scapula firmly in place
  - *rhomboids*

Intrinsic and Extrinsic Muscles



(b) Intermediate flexor

- **intrinsic muscles –** entirely contained within a region, such as the hand
  - both its origin and insertion there
- **extrinsic muscles –** act on a designated region, but has its origin elsewhere
  - fingers – extrinsic muscles in the forearm



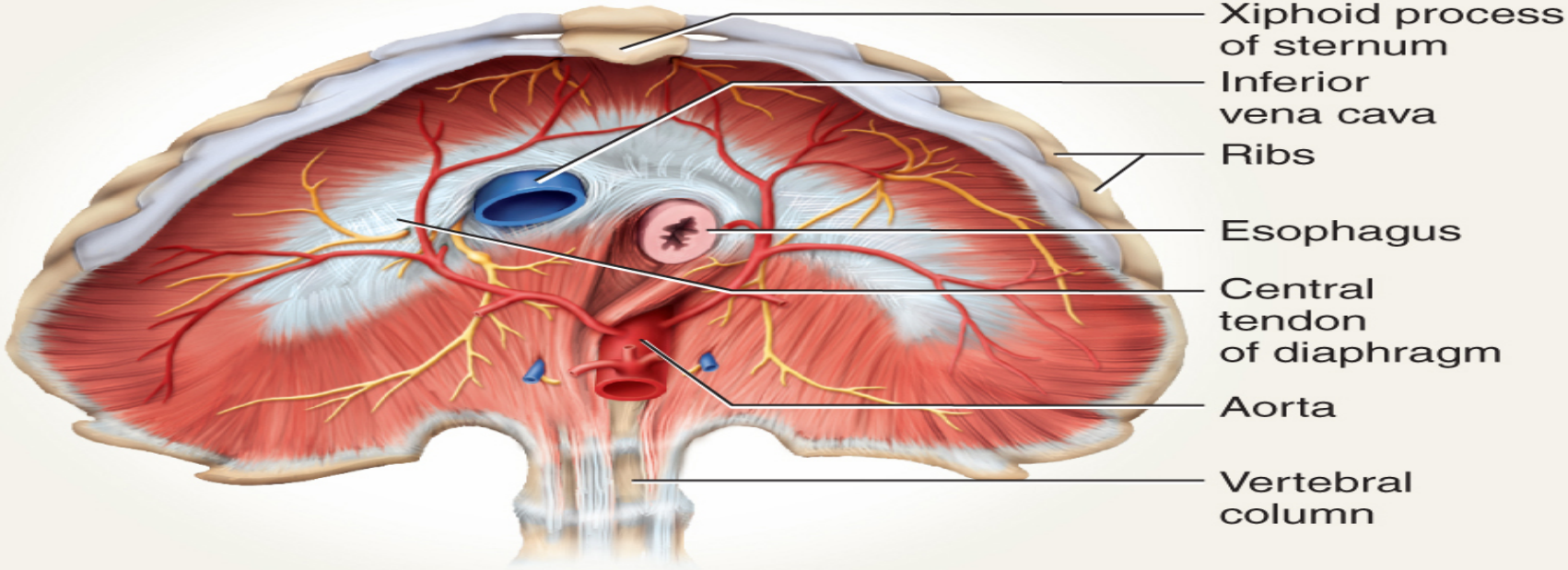
(a) Palmar aspect, superficial

Figure 10.32a

Figure 10.29b

Abdominopelvic Hernias

- **hernia** – any condition in which the viscera protrudes through a weak point in the muscular wall of the abdominopelvic cavity
- **inguinal hernia**
  - most common type of hernia (rare in women)
  - viscera enter inguinal canal or even the scrotum
- **hiatal hernia**
  - stomach protrudes through diaphragm into thorax
  - overweight people over 40
- **umbilical hernia**
  - viscera protrude through the navel



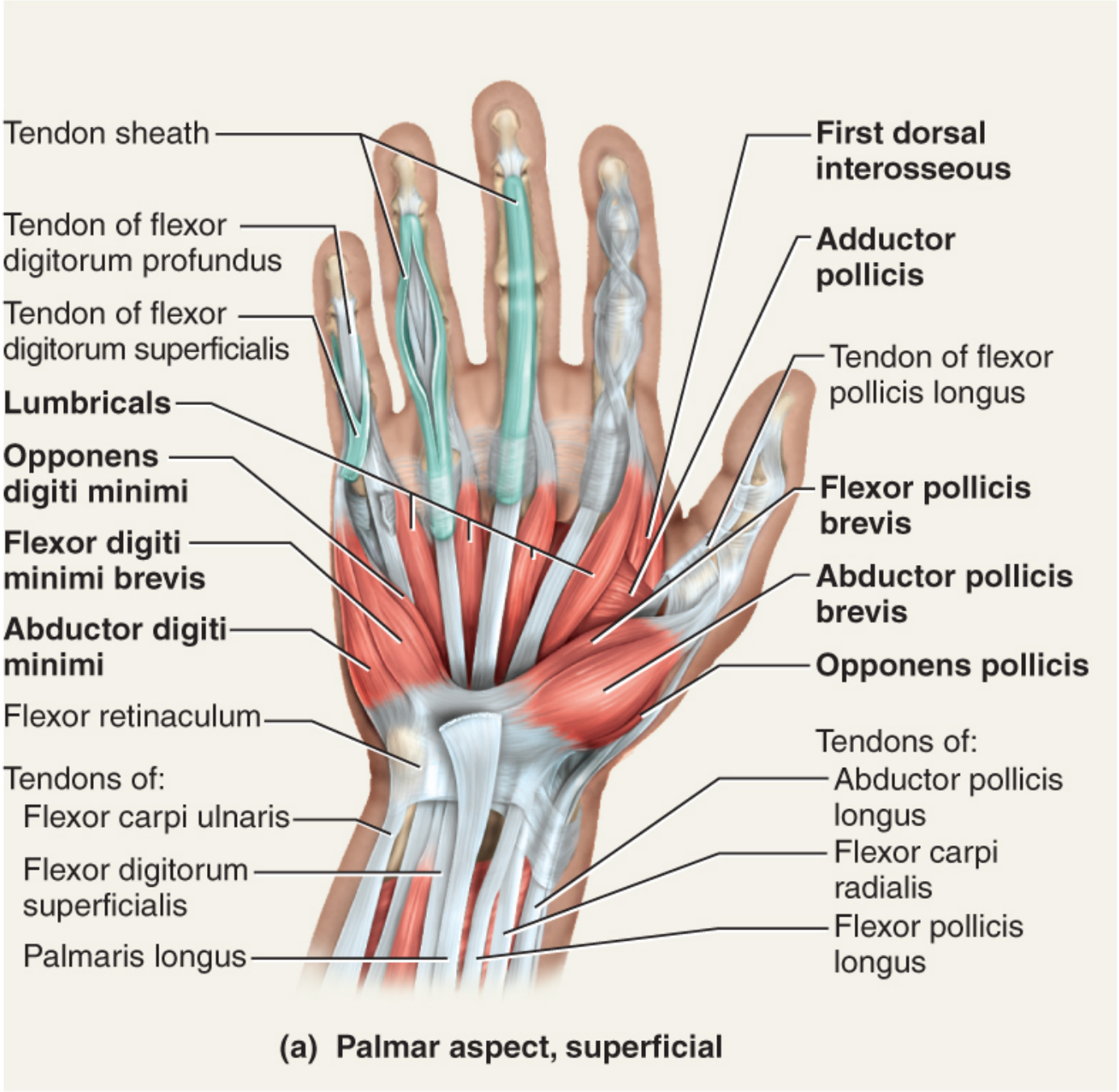
(b) Inferior view of diaphragm

Carpal Tunnel Syndrome

- **flexor retinaculum –** bracelet-like fibrous sheet that the flexor tendons of the extrinsic muscles that flex the wrist pass on their way to their insertions

- **carpal tunnel** – tight space between the flexor retinaculum and the carpal bones
  - flexor tendons passing through the tunnel are enclosed in **tendon sheaths**
    - enable tendons to slide back and forth quite easily

- **carpal tunnel syndrome** - prolonged, repetitive motions of wrist and fingers can cause tissues in the carpal tunnel to become inflamed, swollen, or fibrotic
  - puts pressure on the **median nerve** of the wrist that passes through the carpal tunnel along with the flexor tendons
  - tingling and muscular weakness in the palm and medial side of the hand
  - pain may radiate to arm and shoulder
  - **treatment** – anti-inflammatory drugs, immobilization of the wrist, and sometimes surgery to remove part or all of flexor retinaculum



(a) Palmar aspect, superficial