

Anatomy of the Muscular System

An Overview of the Major Skeletal Muscles

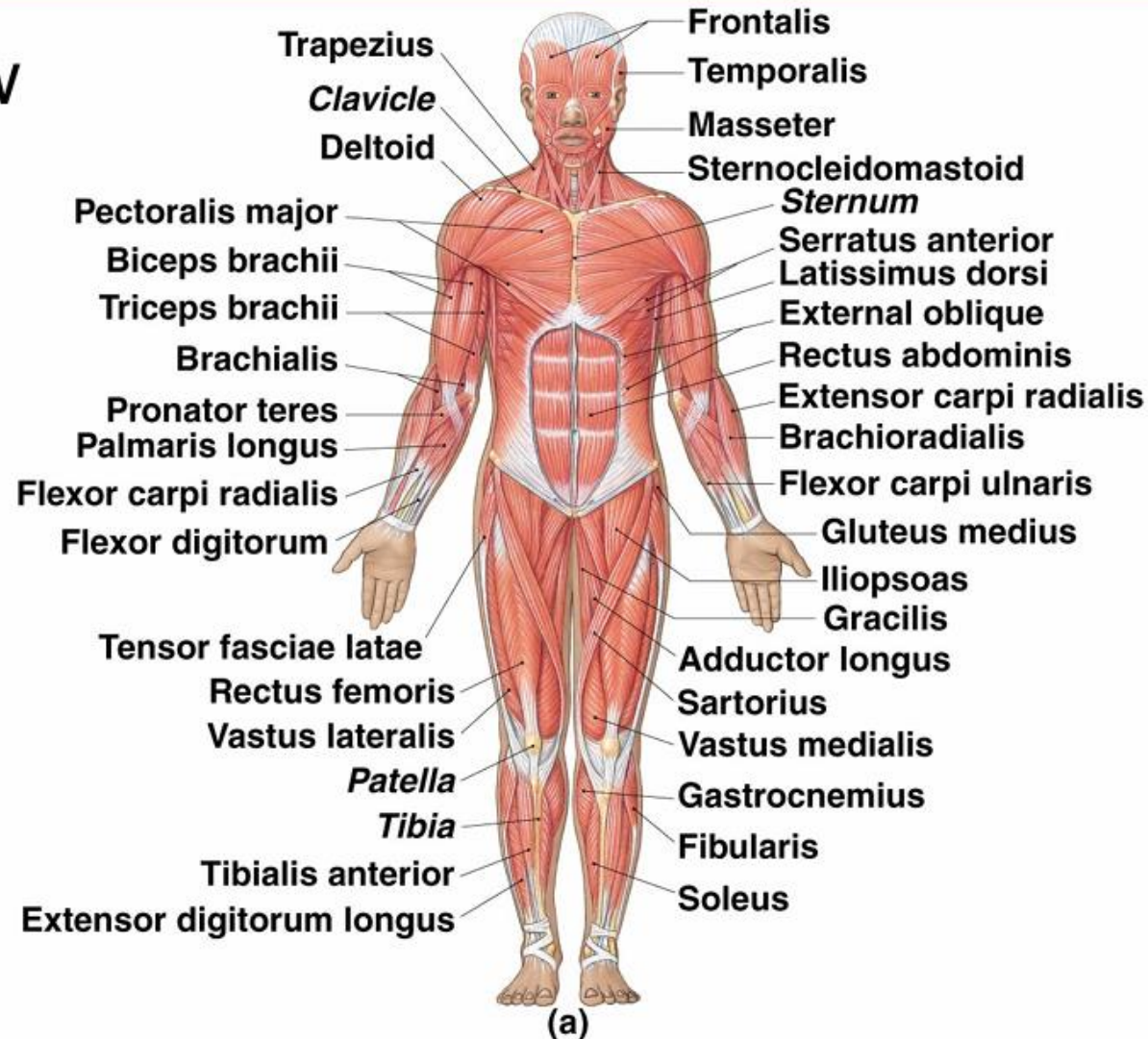


Figure 7.11(a)

Anatomy of the Muscular System

An Overview of the Major Skeletal Muscles

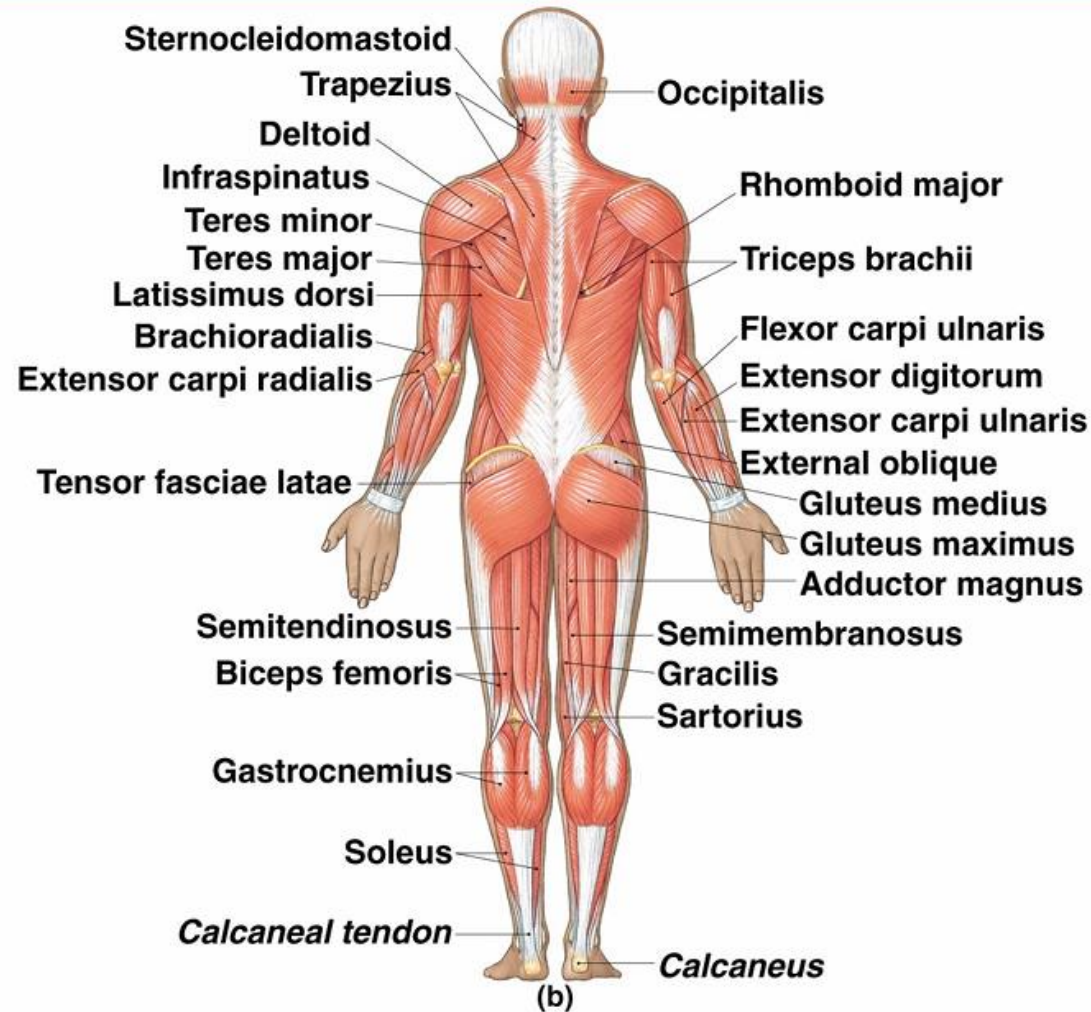


Figure 7-11(b)

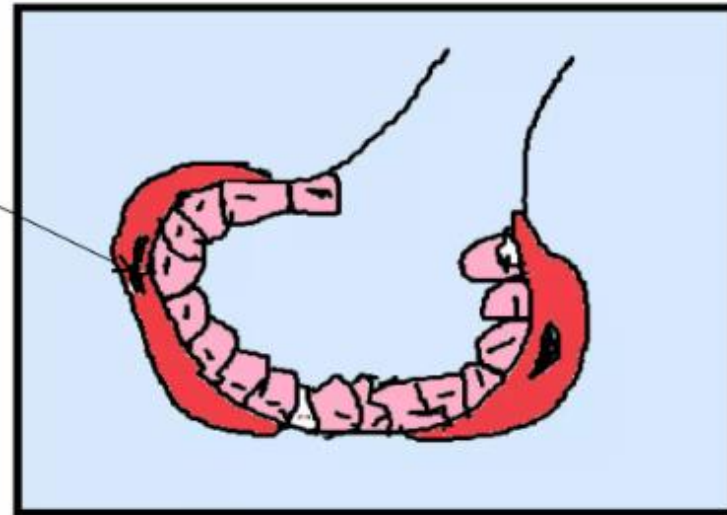
Definition

- Muscle is a contractile tissue which brings about movements.
- Muscles can be regarded as motors of the body.

- Other contractile cells:

Myofibroblasts- seen in regenerating connective tissue.

Myoepitheliocytes- associated with glands.



Characteristics of Muscle Tissue

Excitability- receive and respond to stimuli

Contractility- ability to shorten and thicken

Extensibility- ability to stretch

Elasticity- ability to return to its original shape after contraction or extension

Muscle Function

Stabilizing joints

Maintaining posture

Producing movement

Moving substances within the body

Stabilizing body position and regulating organ volume

Producing heat– muscle contraction generates 85% of the body's heat

Types of muscles

There are three types of muscles :

1. Skeletal muscles
2. Smooth muscles
3. Cardiac muscles

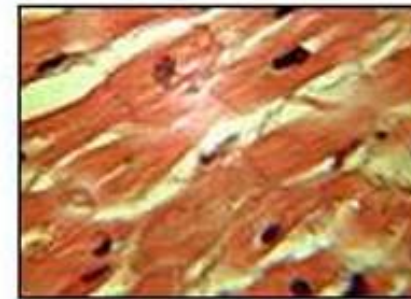
	Skeletal Muscle	Smooth Muscle	Cardiac Muscle
Location	Attached to bone	On hollow organs, glands and blood vessels	Heart
Function	Move the whole body	Compression of tubes & ducts	Heart contraction to propel blood
Nucleus	Multiple, peripheral	Single, central	Central & single
Control	voluntary	involuntary	involuntary
Striations	yes	no	yes
Cell Shape	Cylindrical	Spindle-shaped	Branched



Skeletal muscle



Smooth muscle



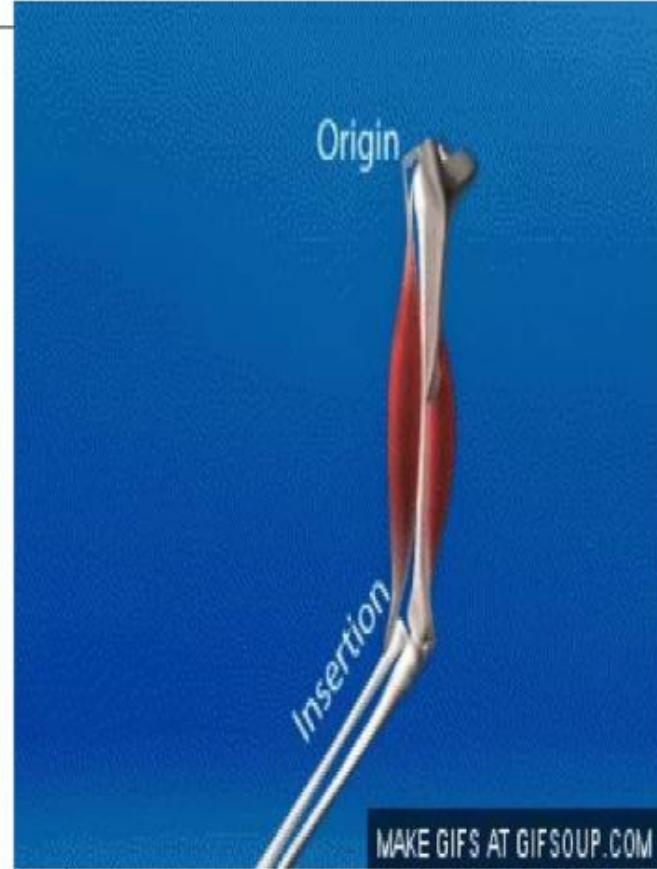
Cardiac muscle

Parts of a skeletal muscle

A. TWO ENDS

1. **Origin** is one end of the muscle which remains fixed during its contraction.
2. **Insertion** is the other end which moves during its contraction.

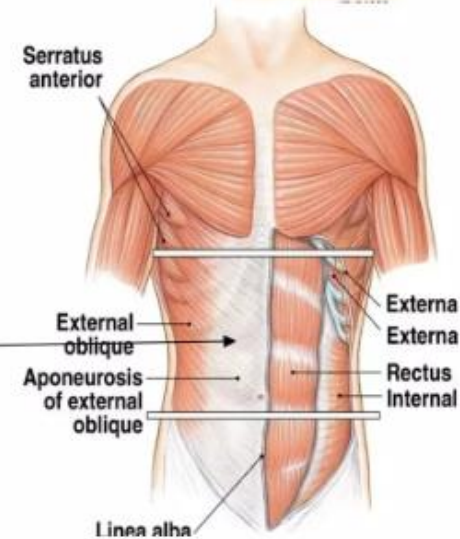
In the limb muscles, origin is usually proximal to insertion.



B. Two parts

1. **Fleshy part** is contractile, and is called the '**belly**'.

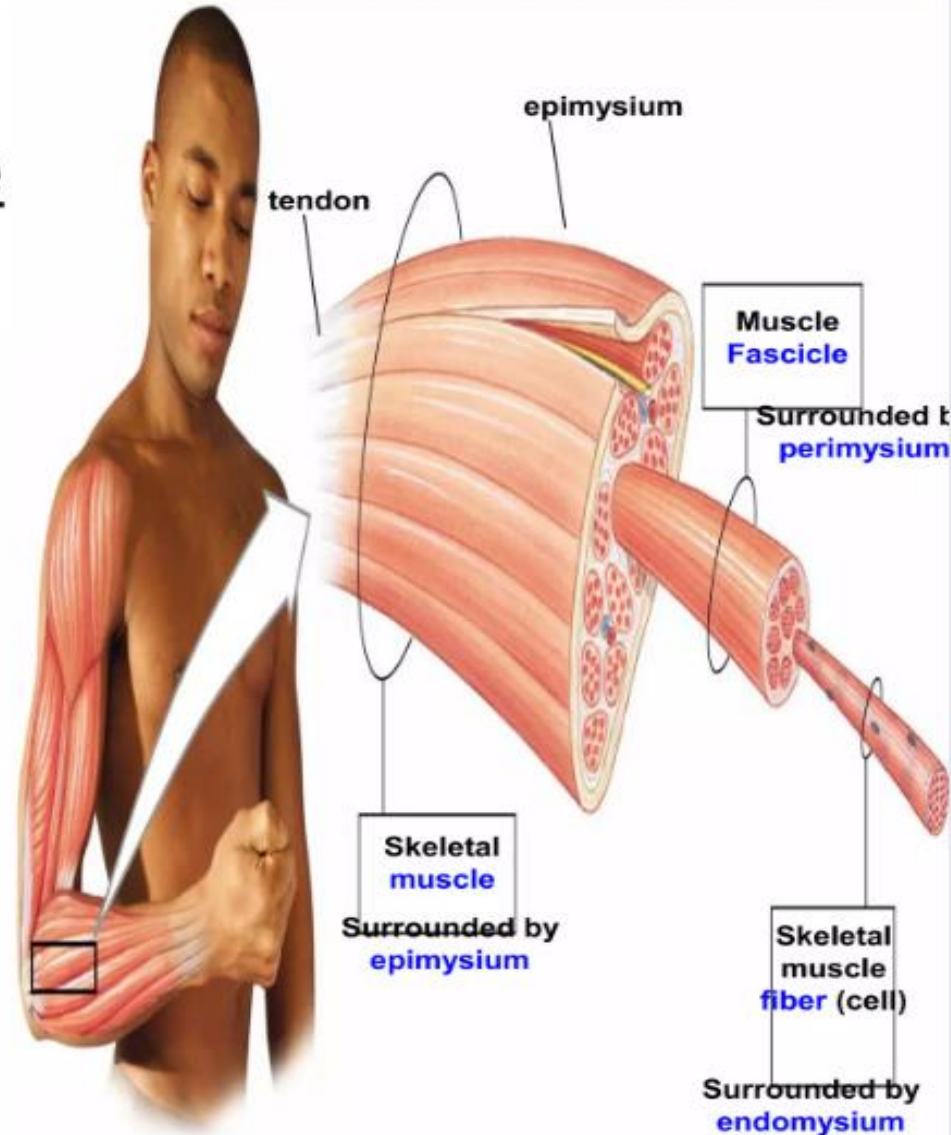
2. **Fibrous part** is non-contractile and inelastic. When cord-like or rope-like, it is called '**tendon**'; when flattened it is called '**aponeurosis**'.



Structure of striated muscle

A. CONTRACTILE TISSUE

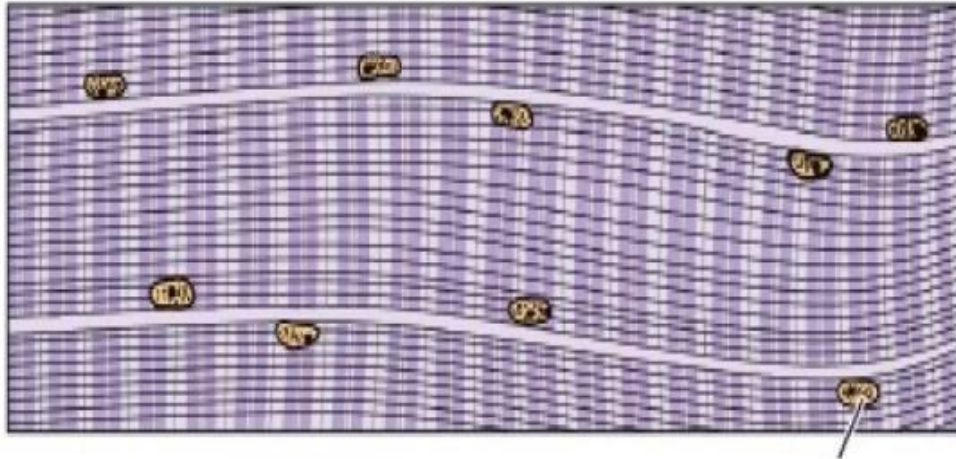
- Each muscle is composed of numerous muscle fascicles.
- Each muscle fascicle has numerous muscle fibres.
- Each muscle fibre is a multinucleated, cross-striated cylindrical cell (myocyte).



MYOCYTE

- Sarcolemma- membrane
- Peripheral nuclei – Multinucleated
- Sarcoplasm- cytoplasm
- Longitudinal myofibrils

Skeletal muscle

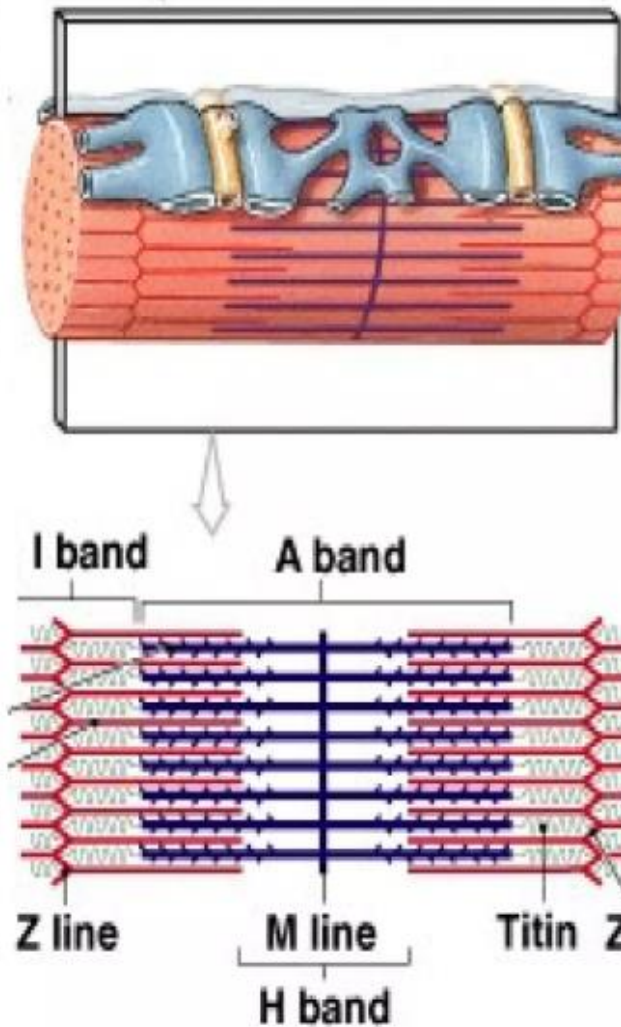


Cross sections

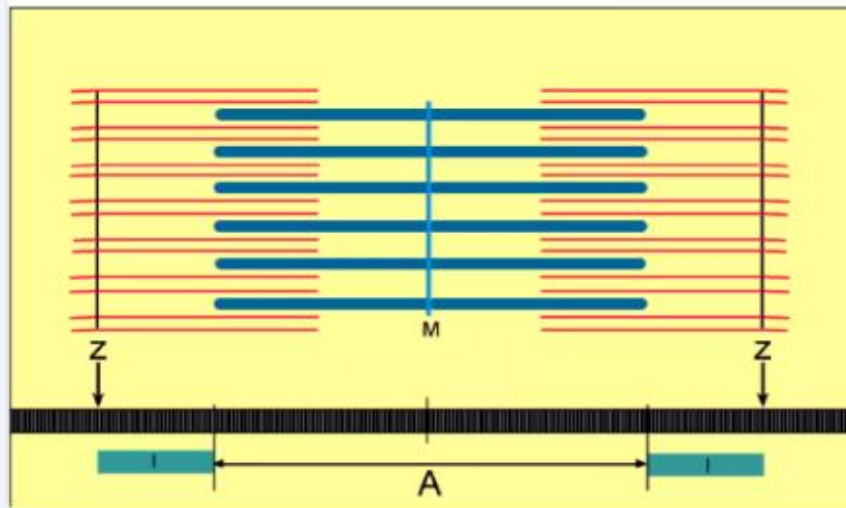


MYOFIBRIL

- Each myofibril is composed of longitudinal protein filaments, called **myofilaments**:
 - **Actin (thin)**
 - **Myosin (thick)**
- Each myofibril shows alternate dark and light bands
 - **Dark bands :**
A bands (anisotropic)
 - **Light bands:**
I bands (isotropic).
- In the middle of the A band, there is a light **H band** with **M line** (dark) in the middle.
- In the middle of the I band there is a dark **Z disc** or Krauses membrane.



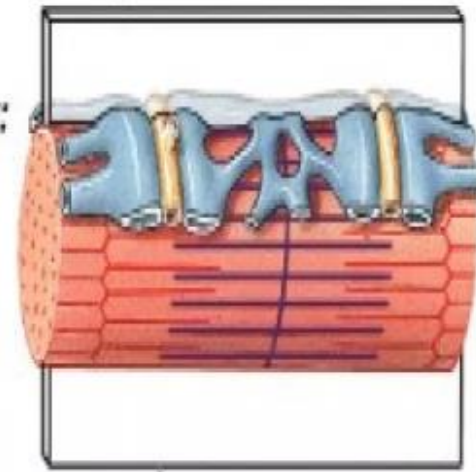
- The segment of myofibril between two Z discs is called sarcomere.
- Sarcomere is the structural and functional unit of muscle.



MYOFIBRIL

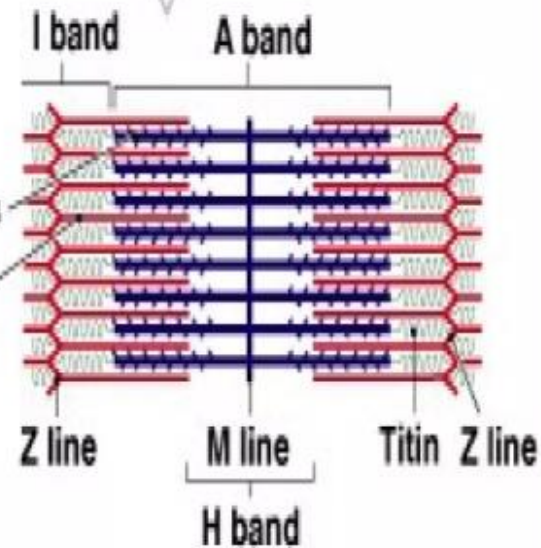
Surrounded by:
Sarcoplasmic
reticulum

Consists of:
Sarcomeres
(Z line to Z line)



SARCOMERE

Contains:
Thick filaments
Thin filaments



B. SUPPORTING TISSUE

- It helps in the organization of the muscle.
- **Epimysium**
- **Perimysium**
- **Endomysium**
- The connective tissue of the muscle becomes continuous with the tendon.

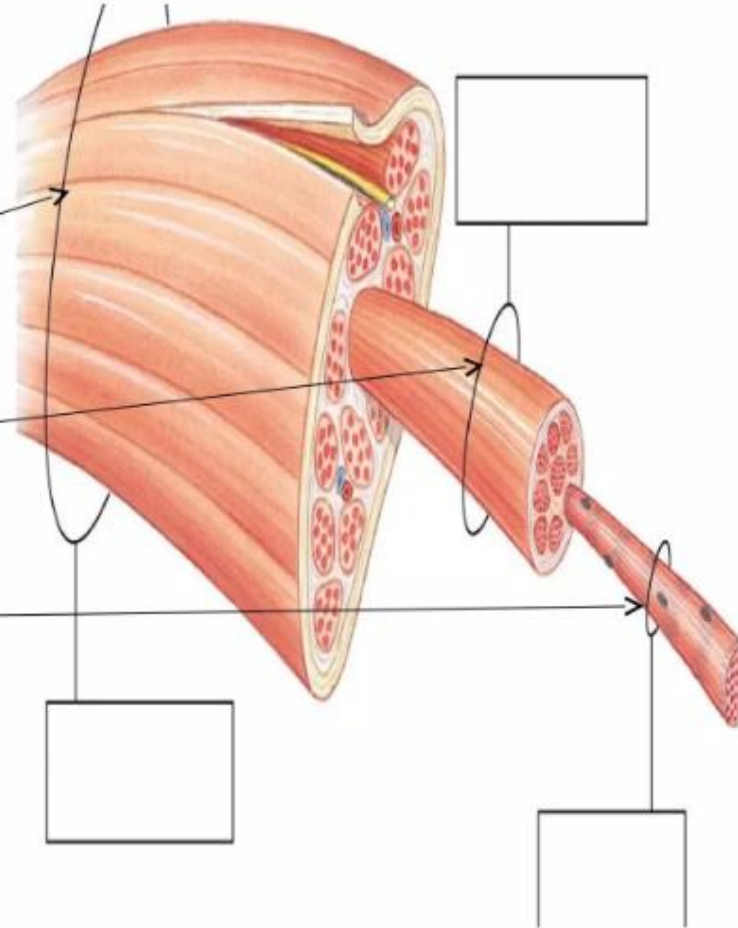
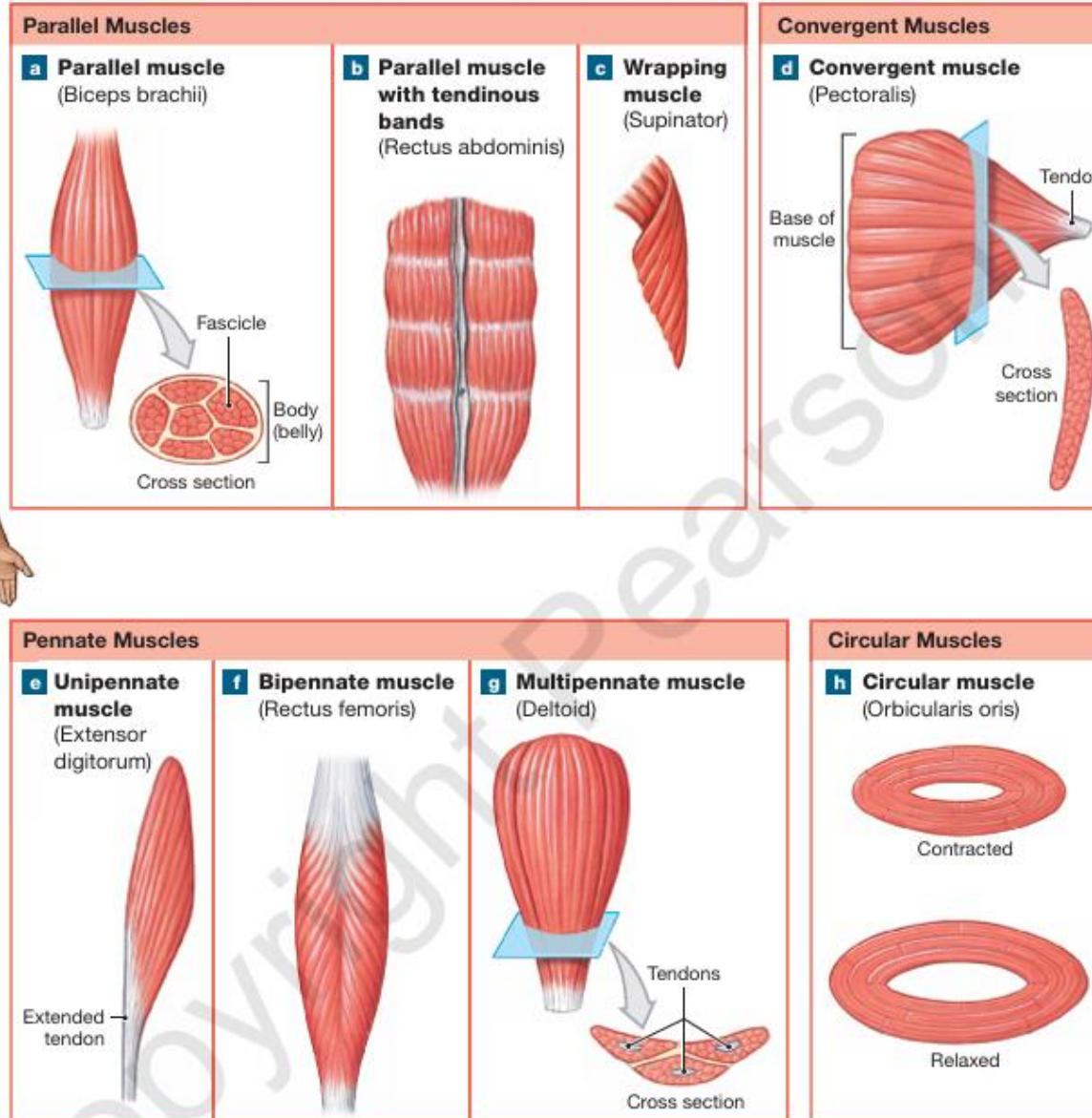
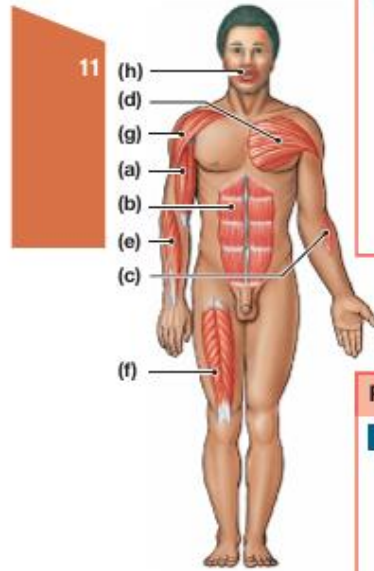


Figure 11-1 Muscle Types Based on Pattern of Fascicle Arrangement.



Anatomy of the Muscular System

Origins, Insertions, and Actions

1. Origin

Muscle attachment to the more stationary bone

2. Insertion

Muscle attachment to the bone that moves

3. Action

What joint movement a muscle produces

Anatomy of the Muscular System

Primary Action Categories

1. Prime mover

- Main muscle in an action

2. Synergist

- Helper muscle in an action

3. Antagonist

- Opposed muscle to an action

Anatomy of the Muscular System

Muscle Terminology

- *Axial musculature*— Muscles with origins on the axial skeleton that position and move head, spine, rib cage
- *Appendicular musculature*— Muscles that stabilize or move appendicular components (arms and legs)

Naming Muscles

Muscles are named in the following ways:

1. **# of origins or insertions**: biceps, triceps
2. **Location of origin or insertion**:
sternocleidomastoid
3. **General location**: temporalis is attached to temporal bone
4. **Shape**: deltoid (triangle), trapezius (trapezoid)
5. **Direction of muscle fibers**: rectus (parallel), transverse (perpendicular), oblique (at an angle)
6. **Size**: maximus (largest), minimus (smallest), longus (longest), brevis (shortest)
7. **Action**: flexor, extensor, adductor, etc.

Anatomy of the Muscular System

The Axial Muscles

- Four groups of axial muscles
 - Head and neck
 - Spine
 - Trunk
 - Pelvic floor

Anatomy of the Muscular System

Selected Muscles of the Head

- *Frontalis* - raises eyebrows
- *Orbicularis oris* - kissing muscle
- *Orbicularis oculi* - winking/blinking
- *Buccinator* - blowing muscle
- *Masseter* - for chewing
- *Temporalis* - helps with chewing
- *Zygomaticus* - smiling muscle
- *Depressor anguli oris* - frowning muscle

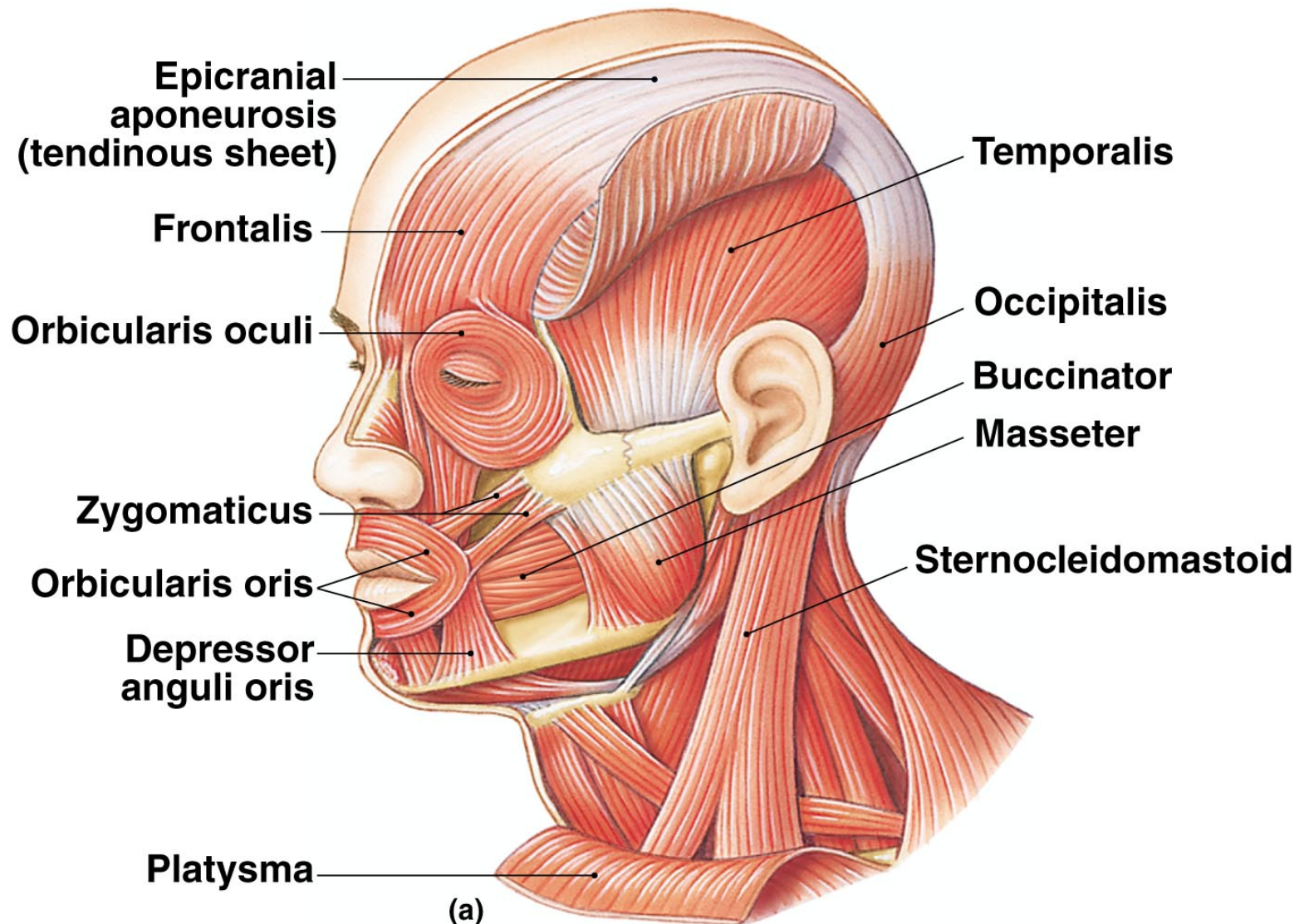
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Selected Muscles of the Neck

- *Platysma* --pouting muscle
- *Sternocleidmastoid* - rotates head

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Muscles of the Head and Neck



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Muscles of the Head and Neck

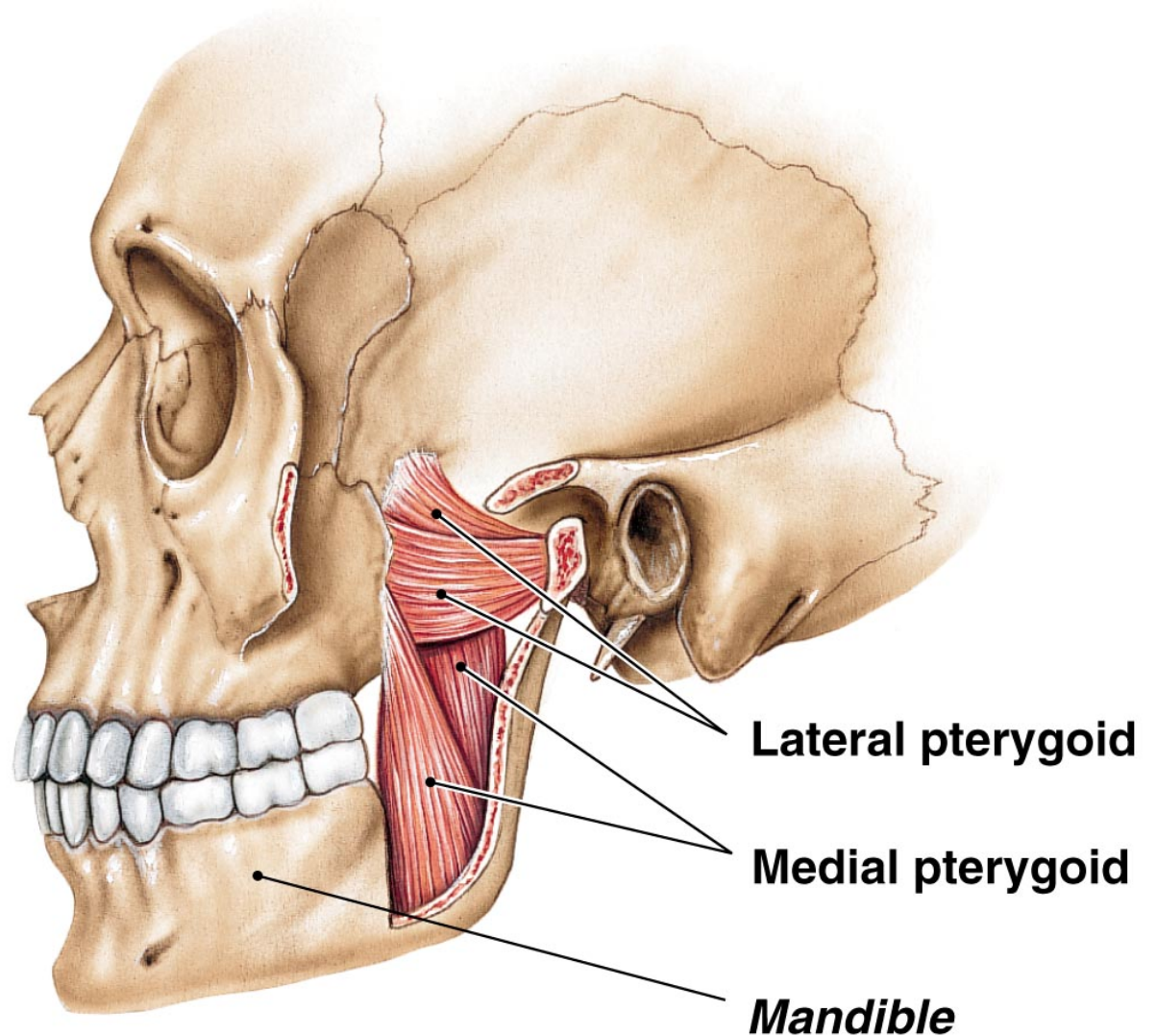
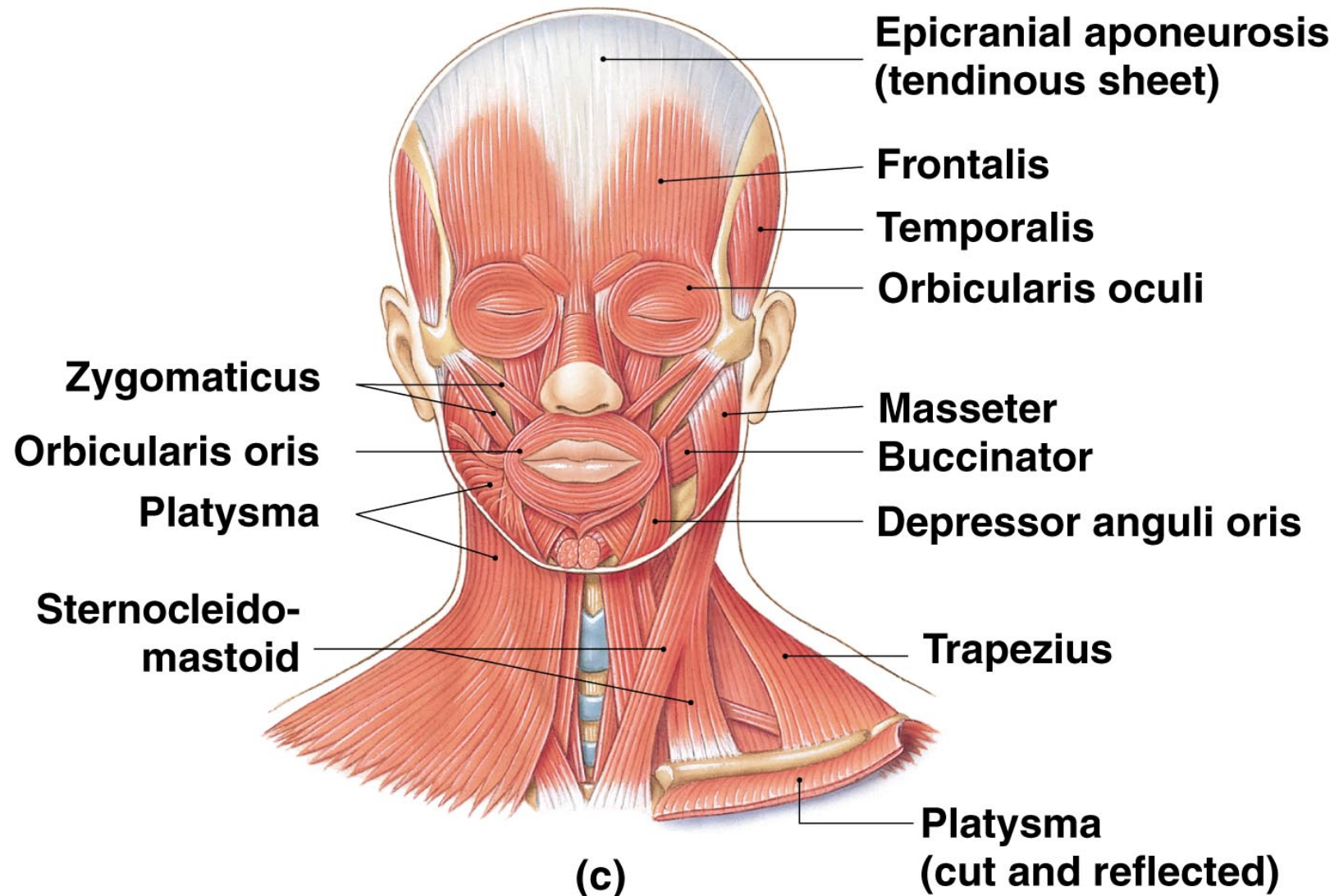


Figure 7-12(b)

(b) Lateral view, pterygoid muscles exposed

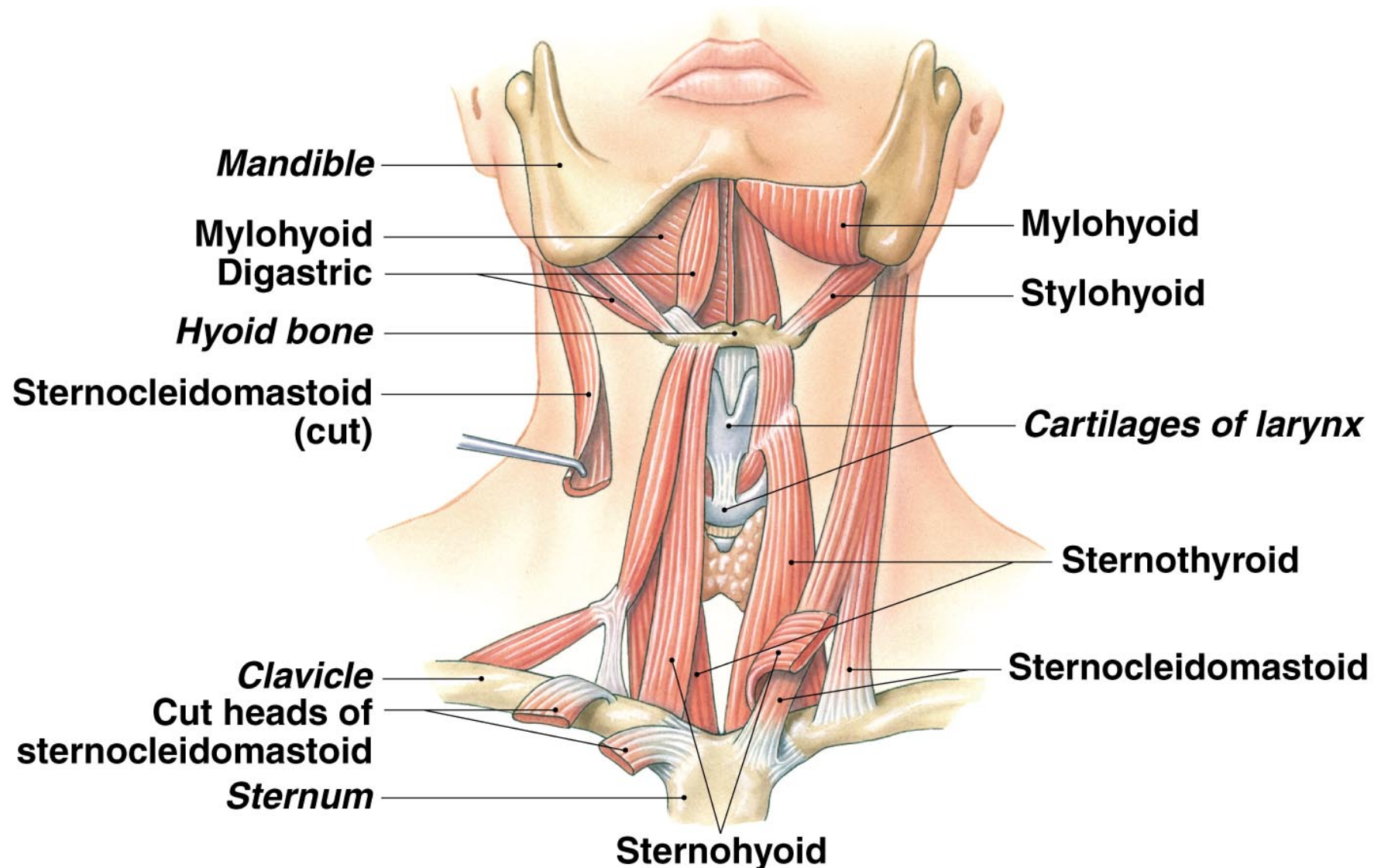
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Muscles of the Head and Neck



Anatomy of the Muscular System

Muscles of the Anterior Neck



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Selected Muscles of the Spine

- *Splenius capitis*
- *Semispinalis capitis*
- *Erector spinae* groups
 - *Spinalis*
 - *Longissimus*
 - *Iliocostalis*

Anatomy of the Muscular System

Muscles of the Spine

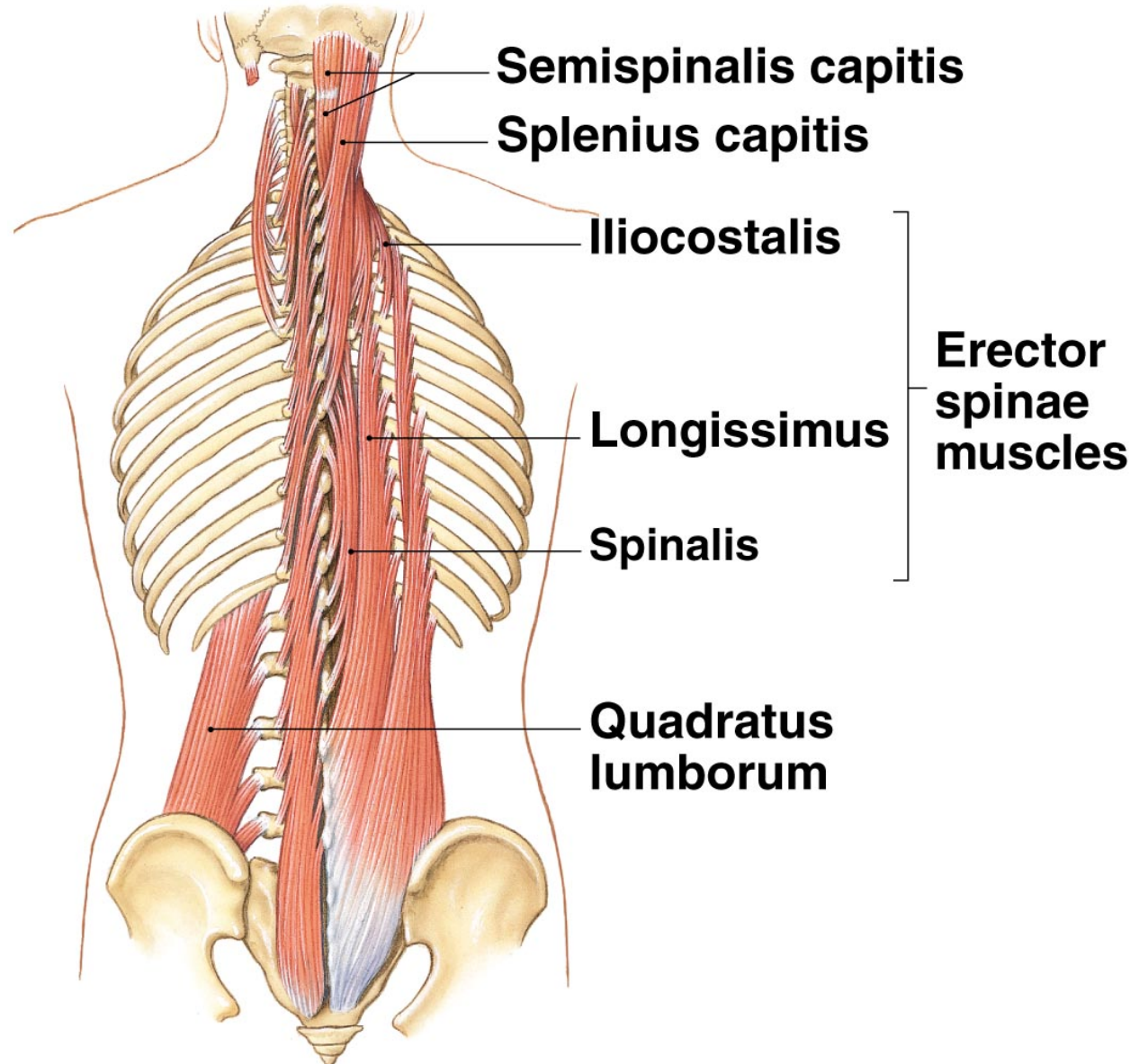


Figure 7-14

Anatomy of the Muscular System

Axial Muscles of the Trunk

- Thoracic region
 - *External intercostals* - inhaling
 - *Internal intercostals* - exhaling
 - *Diaphragm*
- Abdominal region (external to internal)
 - *Rectus abdominis* - 6 pack abs
 - *External oblique* - posture
 - *Internal oblique* - posture
 - *Transversus abdominis* - deepest ab muscle; works like a back support belt

Anatomy of the Muscular System

Oblique and Rectus Muscles and the Diaphragm

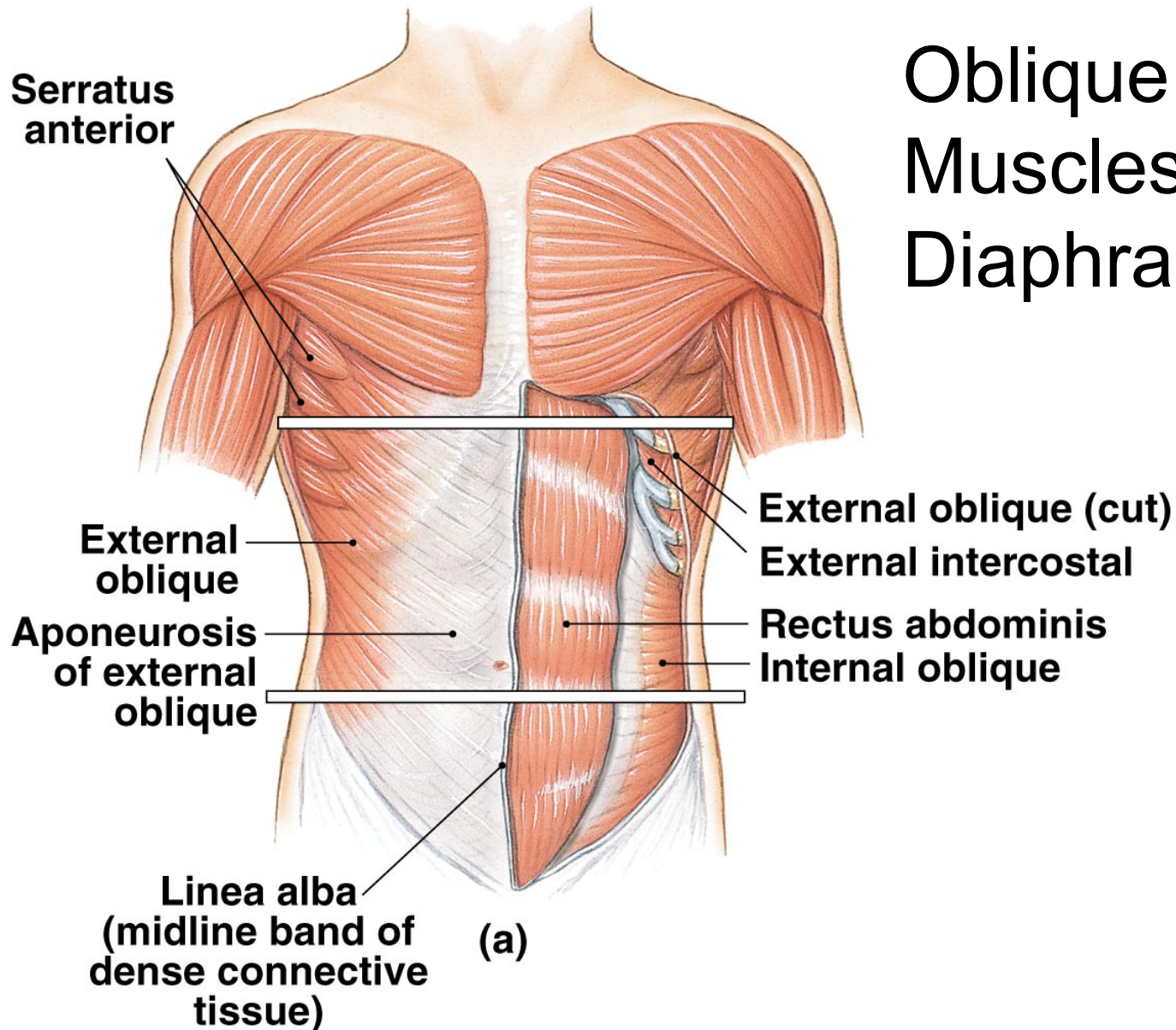
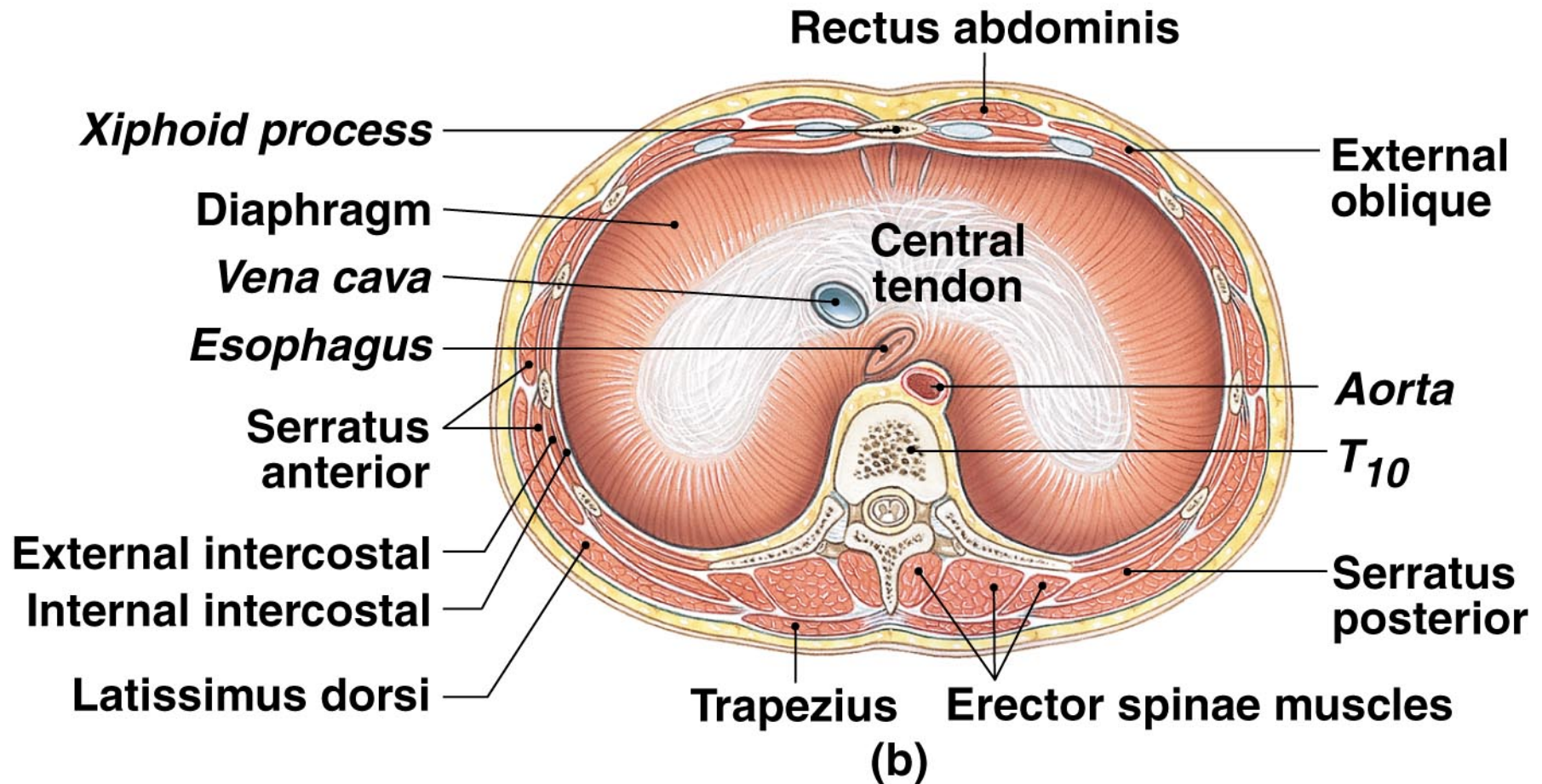


Figure 7-15(a)

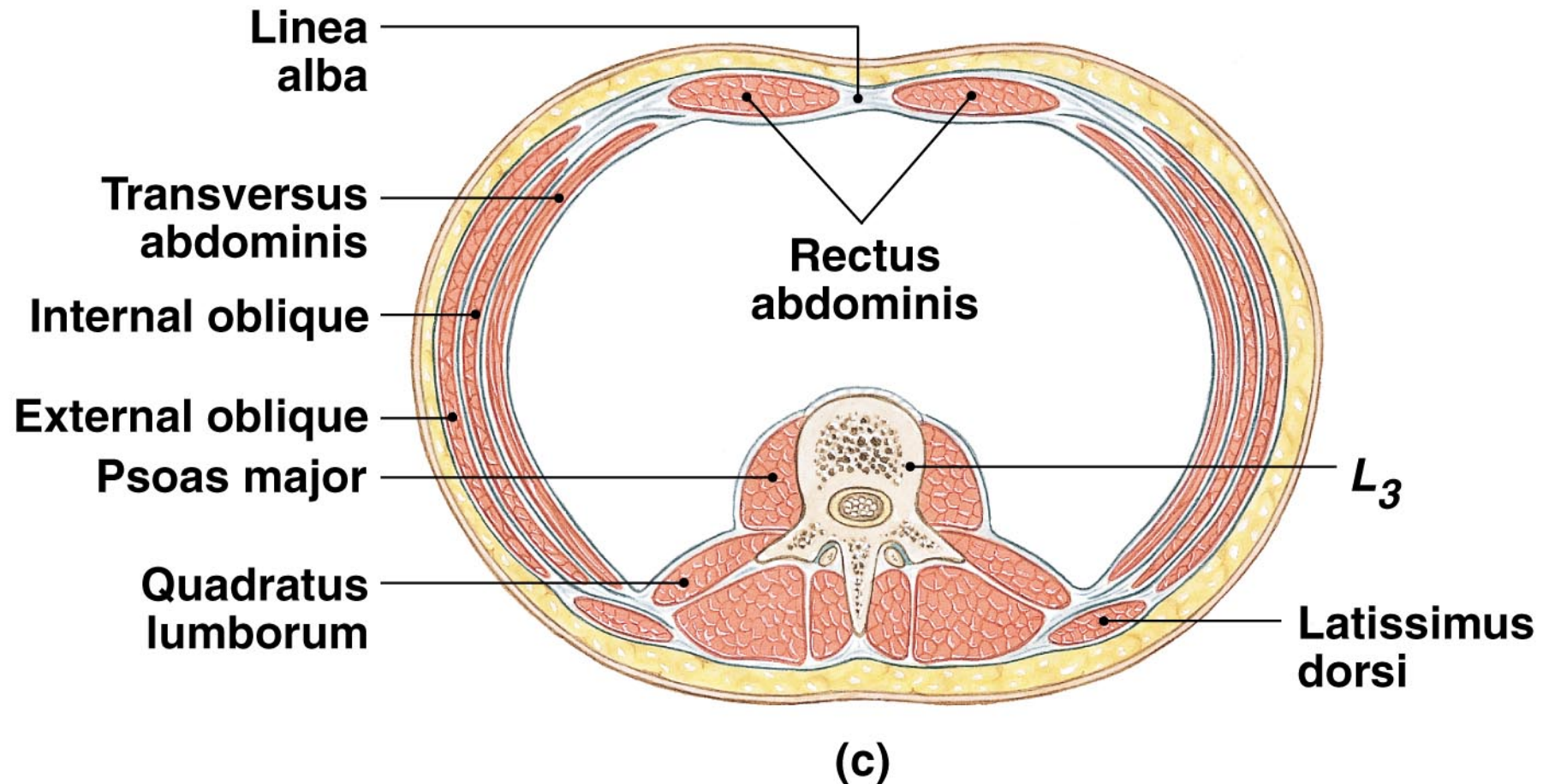
Anatomy of the Muscular System

Oblique and Rectus Muscles and the Diaphragm



Anatomy of the Muscular System

Oblique and Rectus Muscles and the Diaphragm



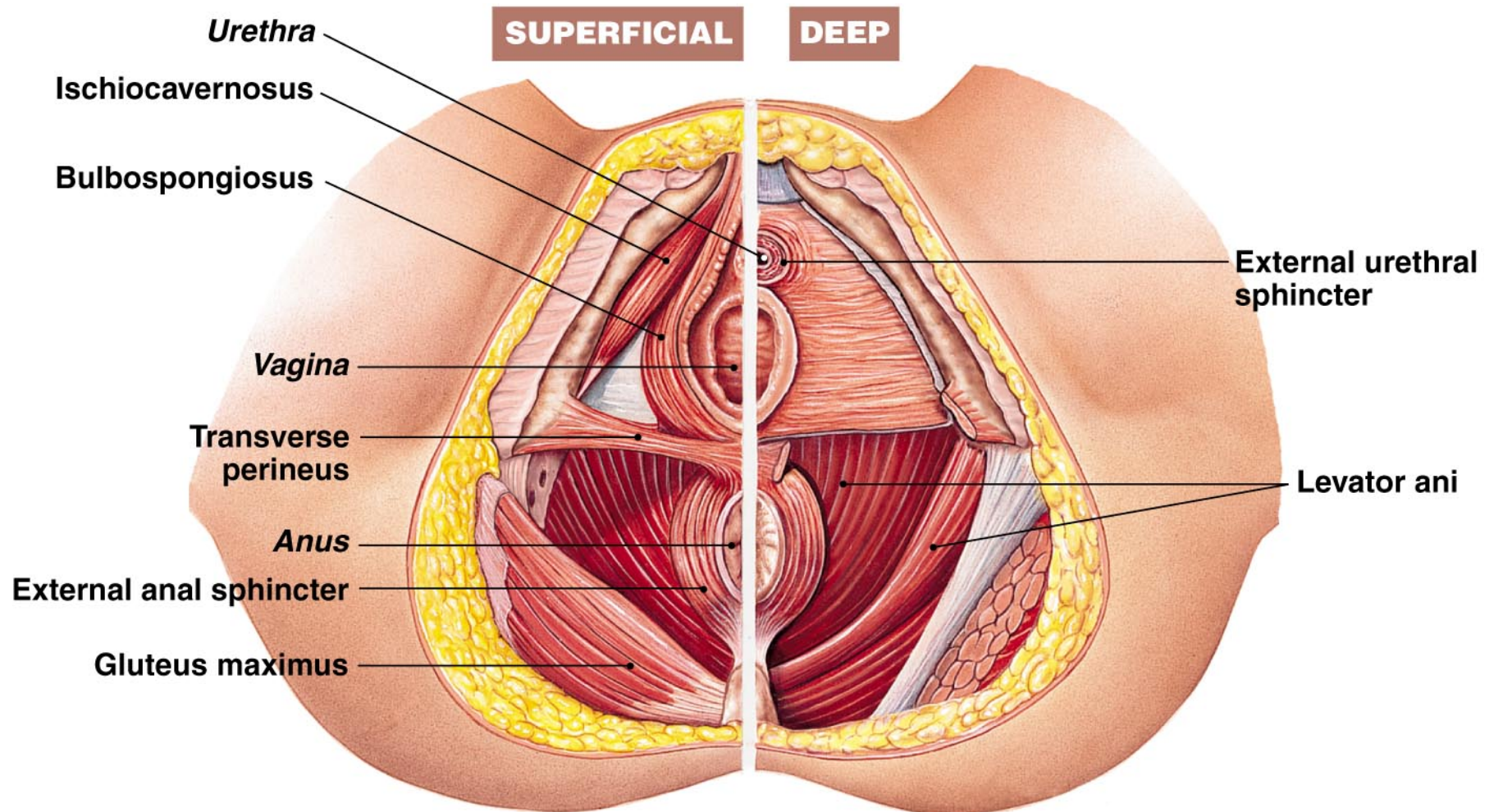
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Muscles of the Pelvic Floor (*Perineum*)

- Sheets of muscle
 - From *sacrum* and *coccyx*
 - To *pubis* and *ischium*
- Pelvic organ support
- Control of material passing through urethra and anus

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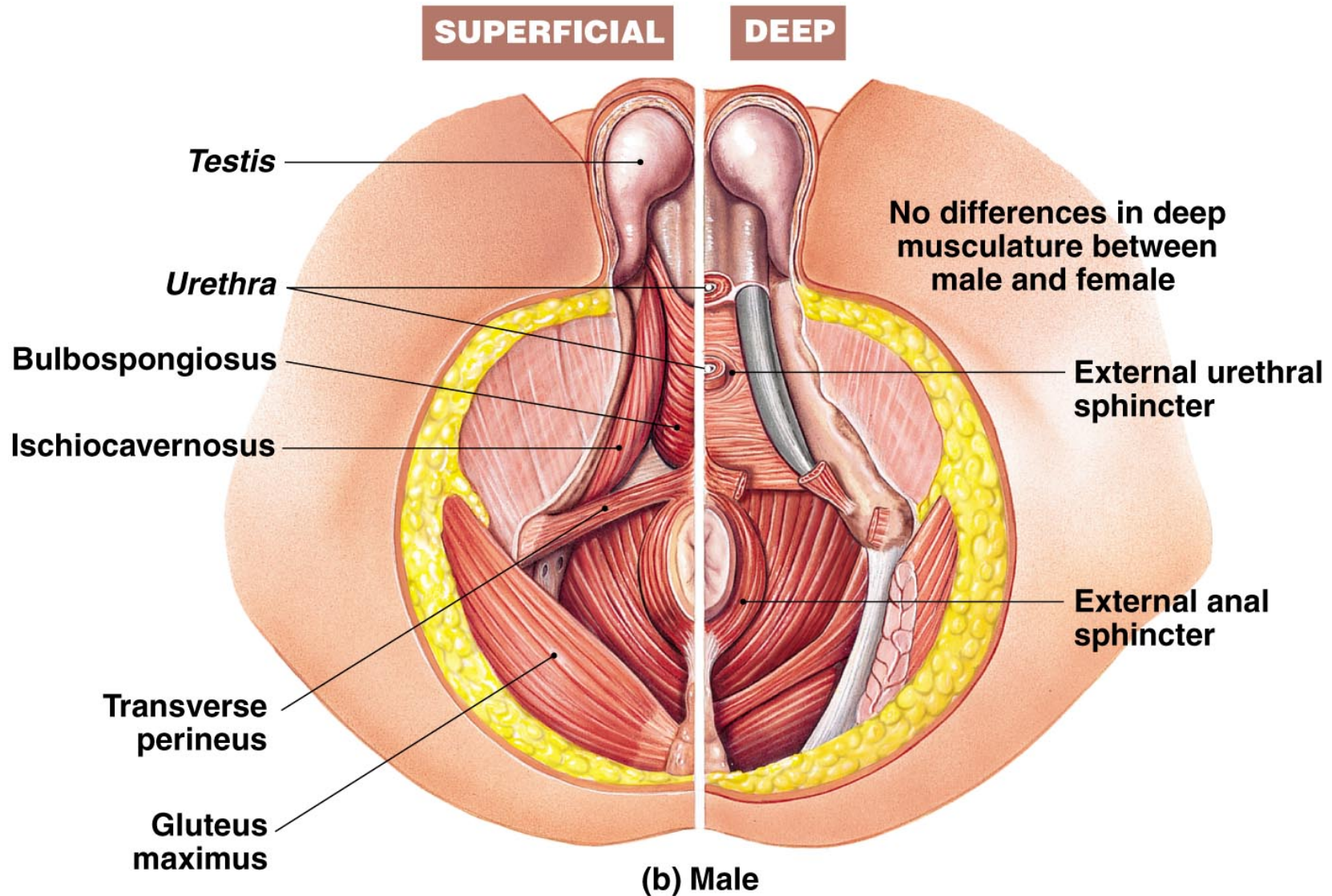
Muscles of the Perineum—Female



(a) Female

Anatomy of the Muscular System

Muscles of the Perineum—Male



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The Appendicular Muscles

- Two functionally distinct groups
 - Muscles of the shoulder and upper limbs
 - Muscles of the pelvic girdle and lower limbs

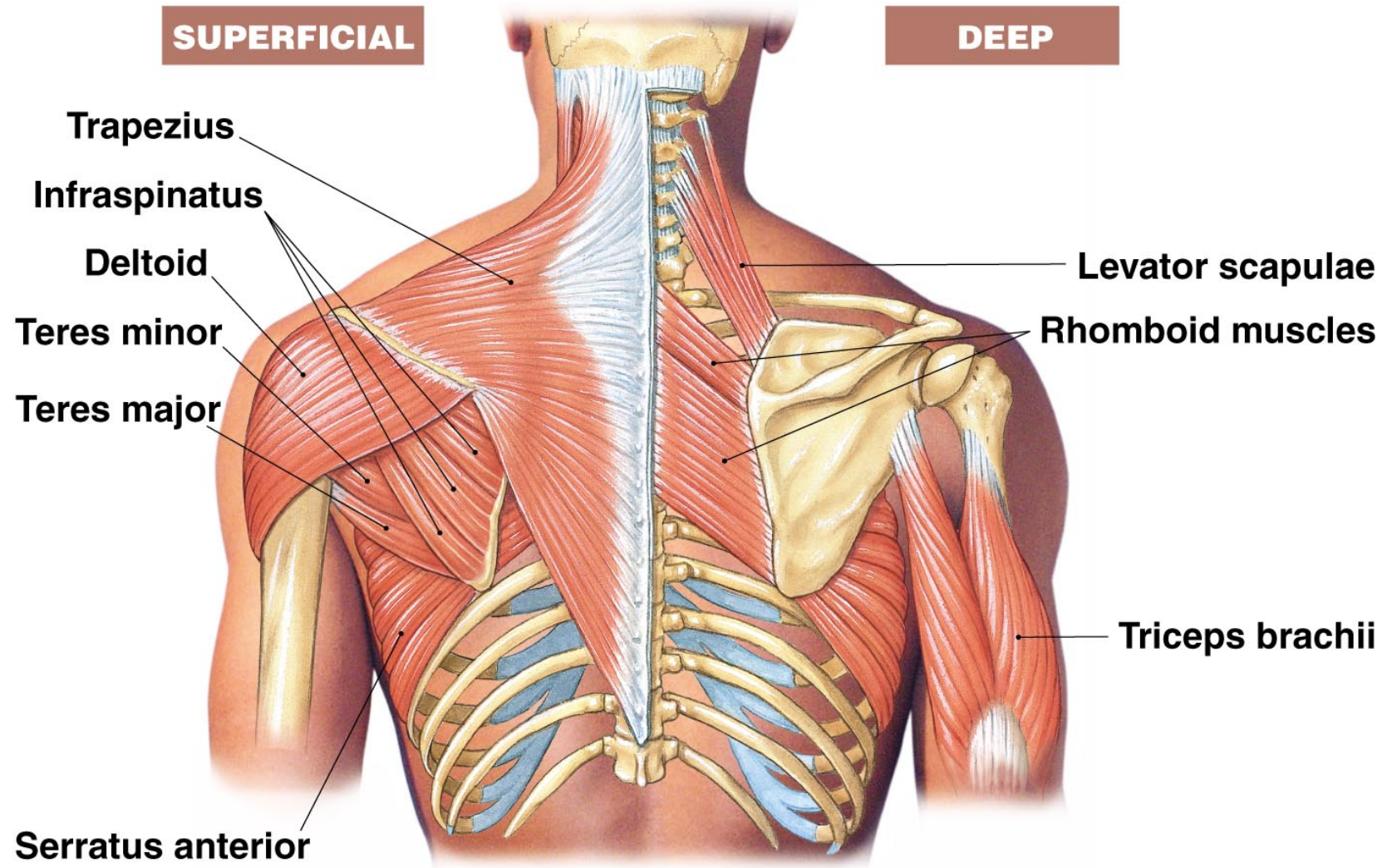
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Selected Shoulder Muscles

- *Trapezius* - coat hanger muscle
- *Rhomboid* - Christmas tree muscle
- *Levator scapulae*
- *Pectoralis minor*

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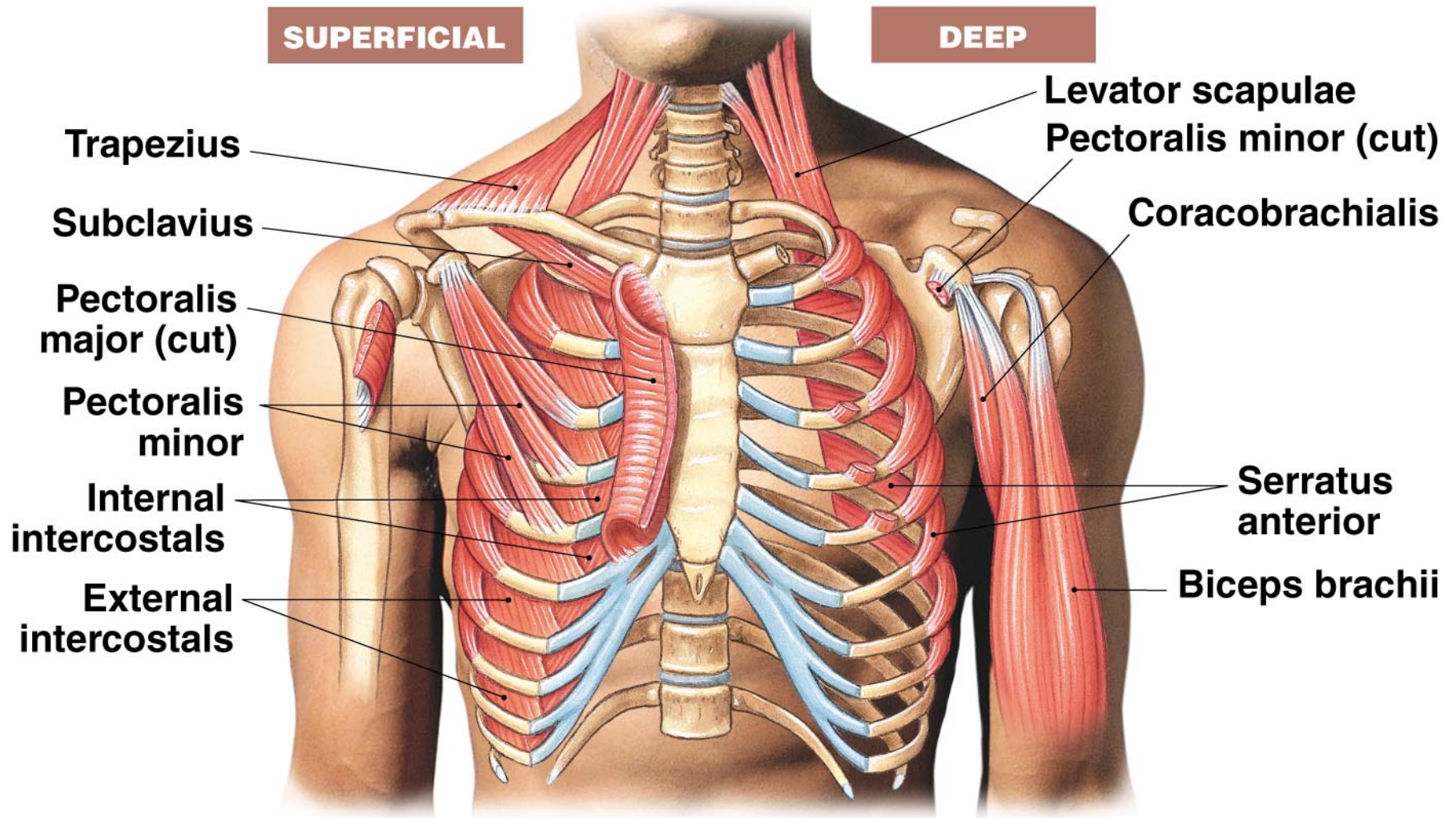
Muscles of the Shoulder



(a) Posterior view

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Muscles of the Shoulder



(b) Anterior view

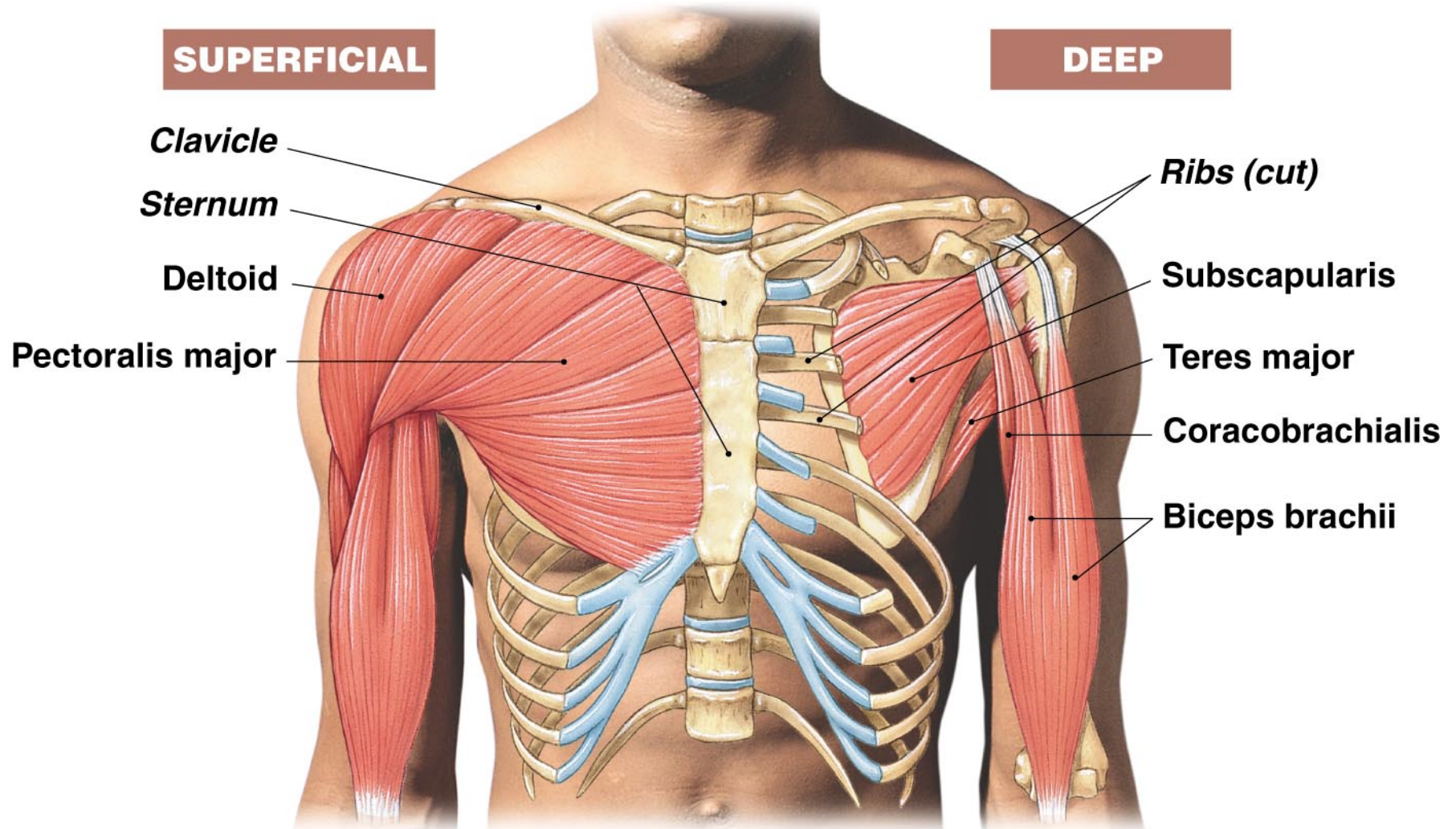
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Muscles that Move the Arm

- *Deltoid* - shoulder
- *Pectoralis major* - chest
- *Latissiumus dorsi* - lower back;
swimmer's muscle

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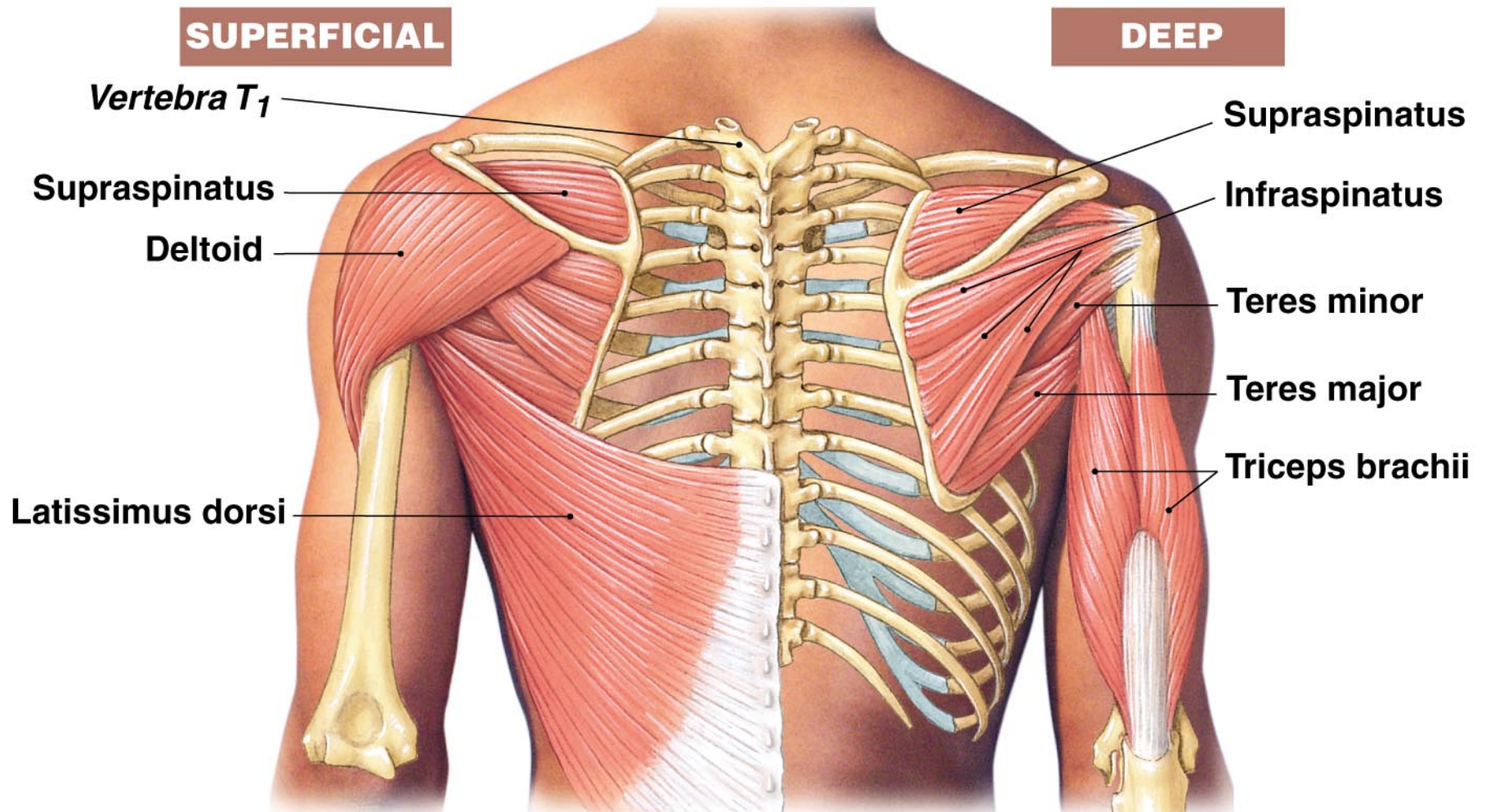
Muscles that Move the Arm



(a) Anterior view

Anatomy of the Muscular System

Muscles that Move the Arm



(b) Posterior view

Anatomy of the Muscular System

Muscles That Move the Forearm

- *Biceps brachii* - corkscrew muscle
- *Triceps brachii* - boxer's muscle
- *Brachialis* - helps biceps
- *Pronators*
- *Supinator*

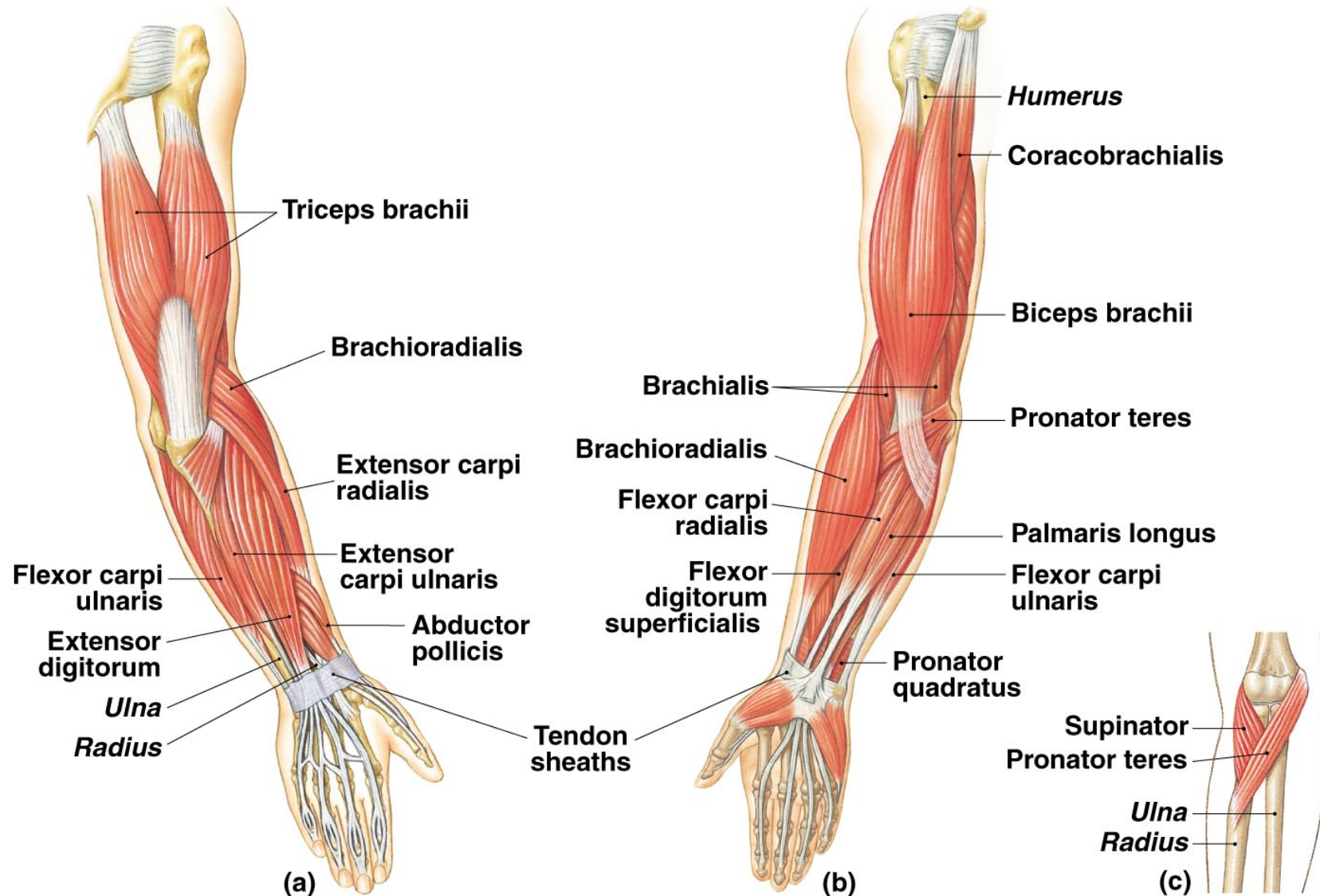
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Muscles That Move the Wrist

- **Wrist flexors**
 - *Flexor carpi ulnaris*
 - *Flexor carpi radialis*
 - *Palmaris longus*
- **Wrist extensors**
 - *Extensor carpi radialis*
 - *Extensor carpi ulnaris*

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Muscles That Move the Forearm and Wrist



Anatomy of the Muscular System

Muscle of the Pelvis and Lower Limbs

- Three functional groups
 1. Thigh movement
 2. Leg movement
 3. Ankle, foot, and toe movement

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Muscles That Move the Thigh

1. Gluteal muscles

2. Thigh adductors - a pulled groin is a strain in 1 of these muscles:

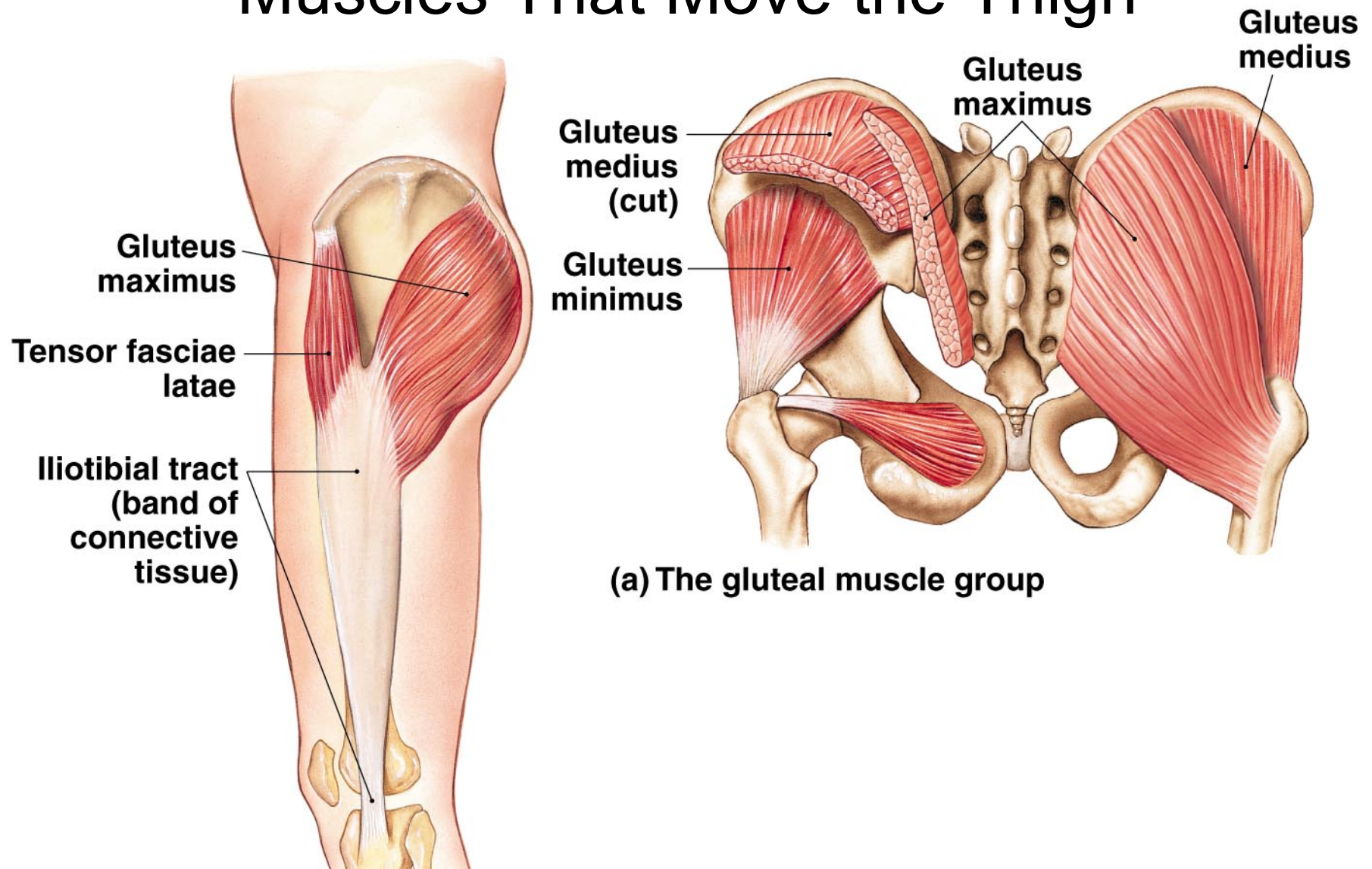
- *Adductor magnus*
- *Adductor brevis*
- *Adductor longus*
- *Pectineus*
- *Gracilis*

3. Thigh flexors

- *Iliopsoas (psoas major + iliacus)*

Anatomy of the Muscular System

Muscles That Move the Thigh



Anatomy of the Muscular System

Muscles That Move the Thigh

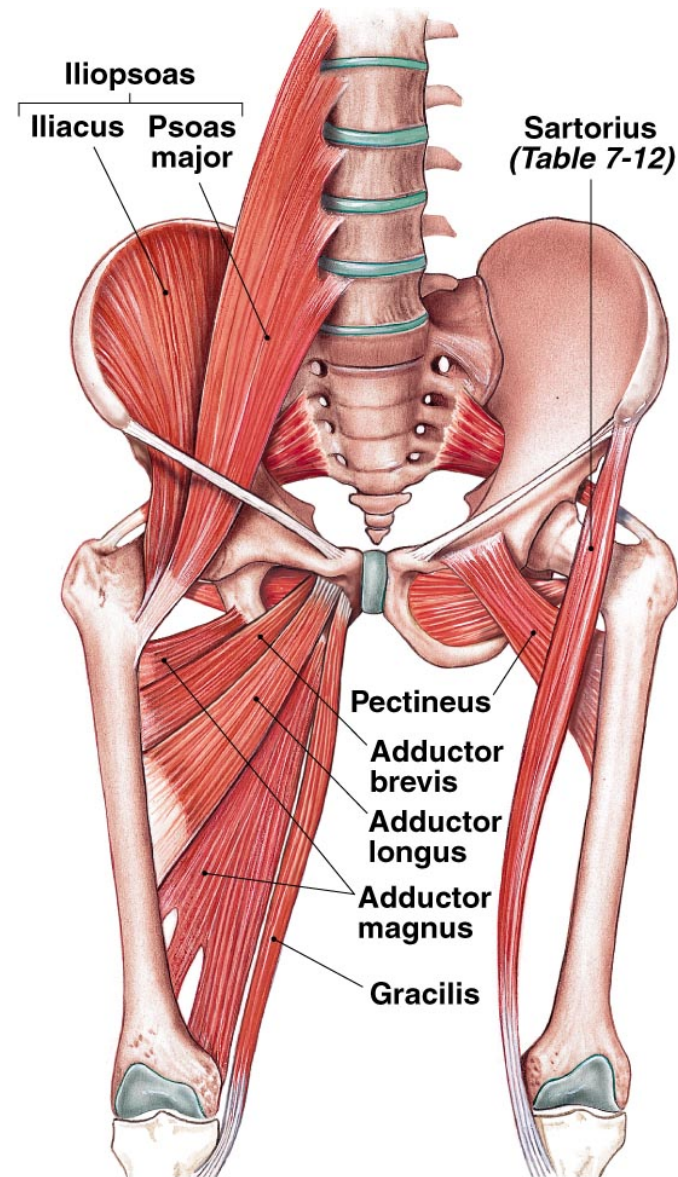


Figure 7-20(b)

(b) The iliopsoas muscle and the adductor group

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Anatomy of the Muscular System

Flexors of the Knee:

Hamstring group:

1. *Biceps femoris*
2. *Semimembranosus*
3. *Semitendinosus*
4. *Sartorius*

Popliteus

- Synergist muscle unlocks knee

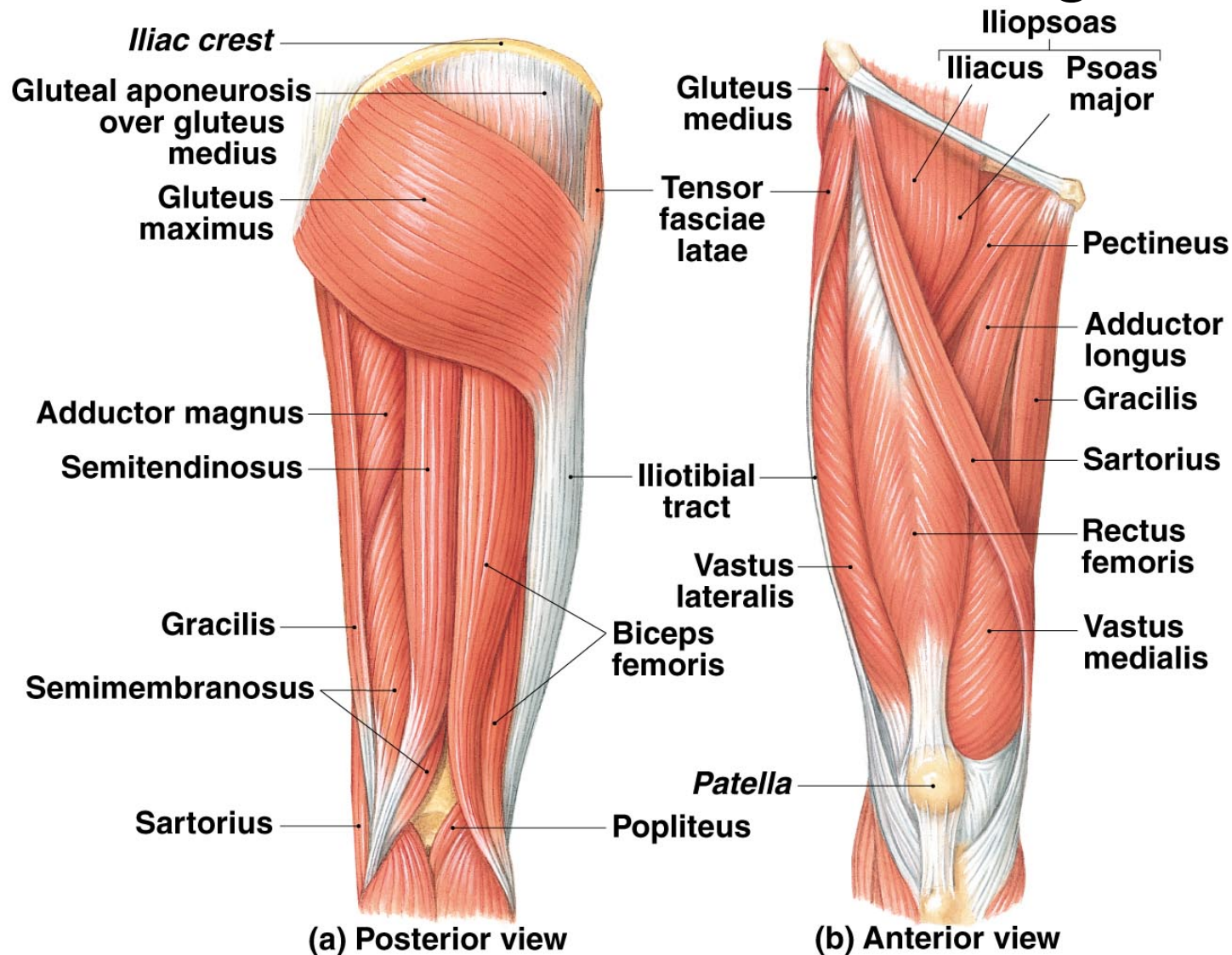
Anatomy of the Muscular System

Extensors of the Knee

- *Quadriceps femoris* group
 1. Rectus femoris
 2. Vastus lateralis
 3. Vastus intermedius
 4. Vastus medialis

Anatomy of the Muscular System

Muscles That Move the Leg



Anatomy of the Muscular System

Muscles That Move the Foot

1. Plantar flexion

- *Gastrocnemius* - *toe dancer's muscle*

2. Eversion and plantar flexion

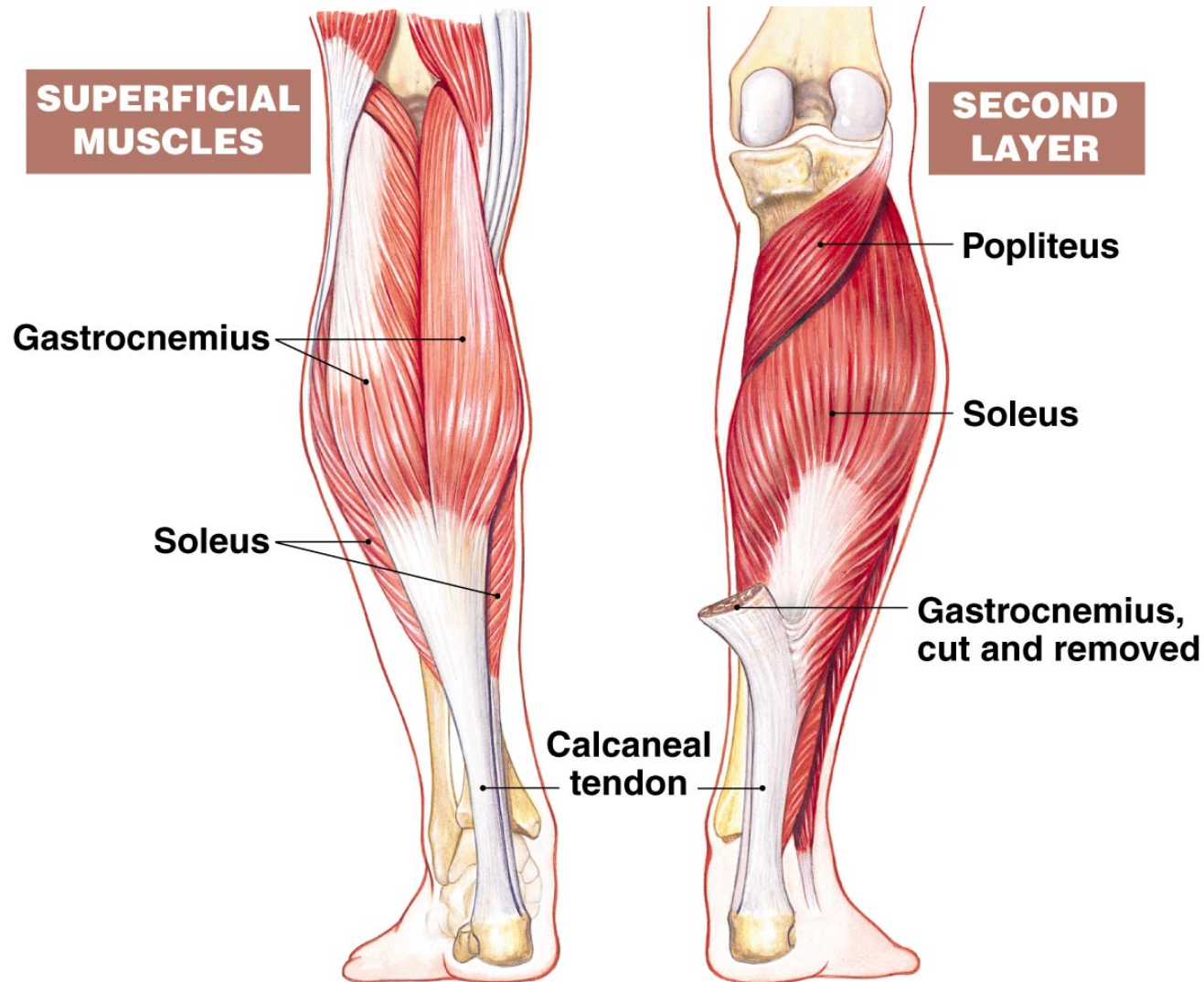
- *Fibularis (peroneus)*

3. Dorsiflexion

- *Tibialis anterior* - *shin splints*

Anatomy of the Muscular System

Muscles That Move the Foot and Toes



(a) Posterior view

Anatomy of the Muscular System

Muscles That Move the Foot and Toes

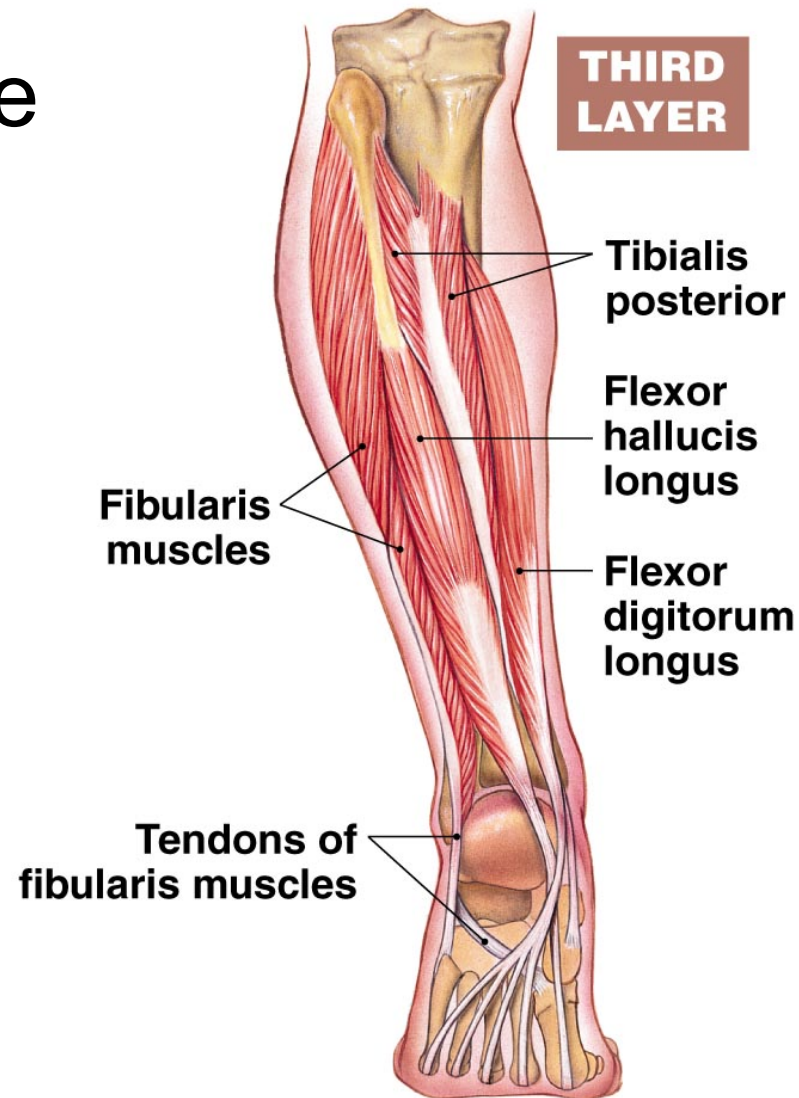


Figure 7-22(b)

(b) Posterior view, left leg

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Muscles That Move the Foot and Toes

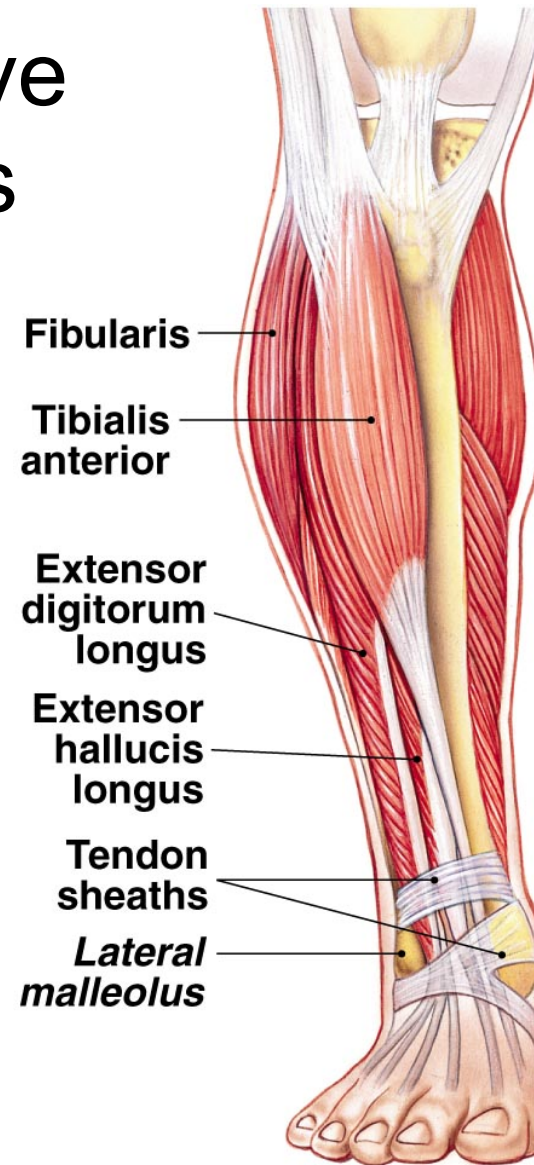


Figure 7-22(c)

(c) Anterior view, right leg

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Muscles That Move the Foot and Toes

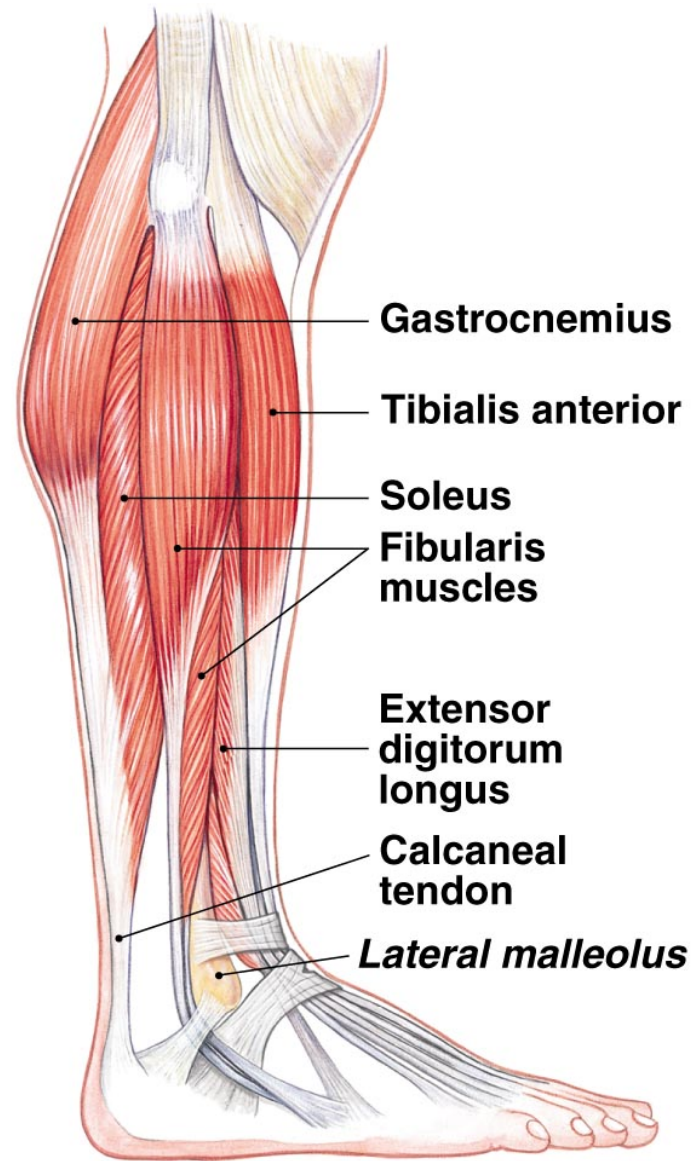


Figure 7-22(d)

(d) Lateral view

Aging and the Muscular System

Age-Related Reductions

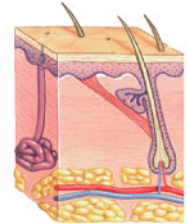
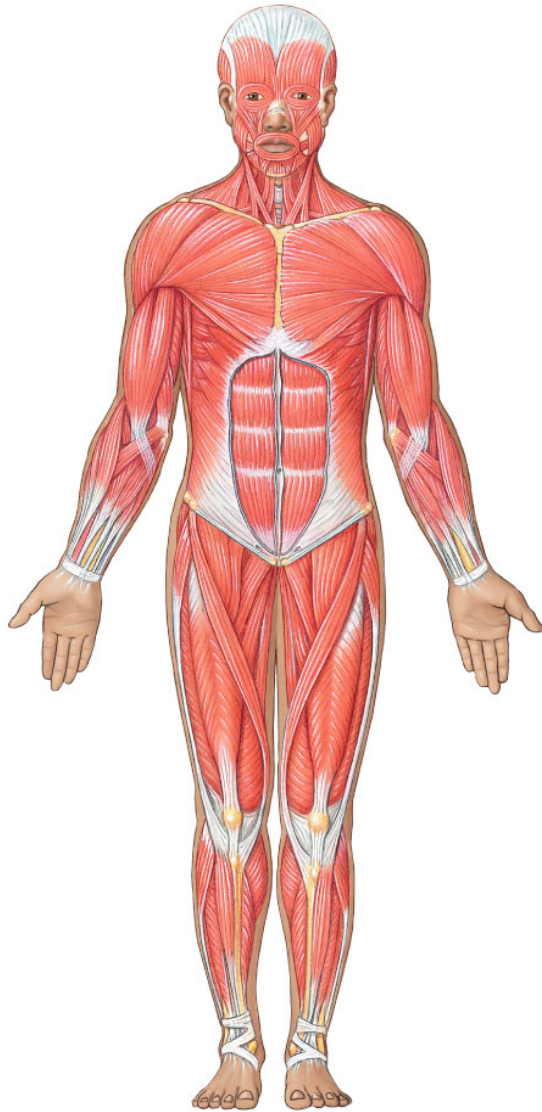
- Muscle size
- Muscle elasticity
- Muscle strength
- Exercise tolerance
- Injury recovery ability

The Muscular System in Perspective

FIGURE 7-23

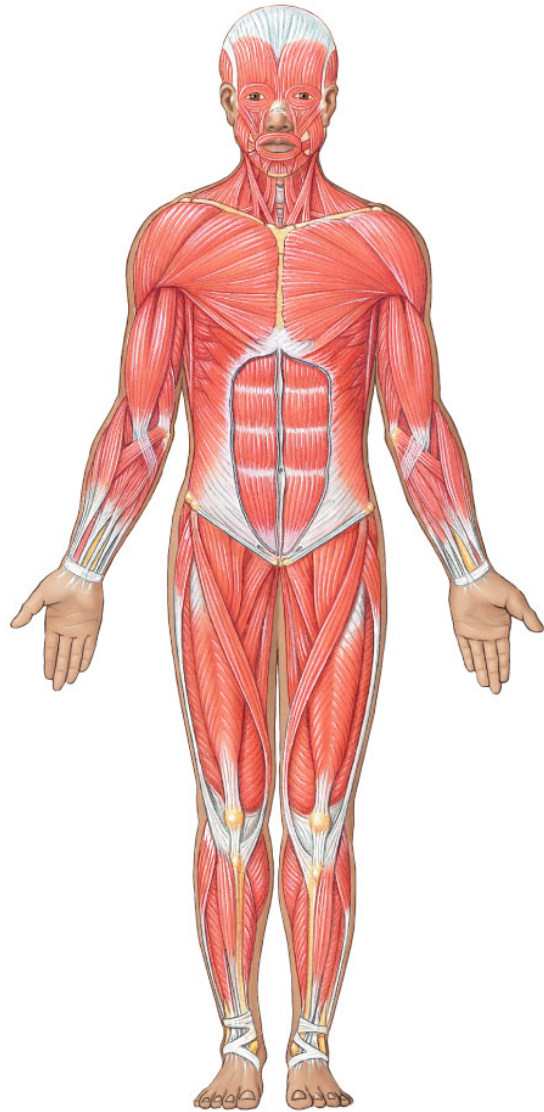
Functional Relationships Between
the Muscular System and Other Systems

The Integumentary System



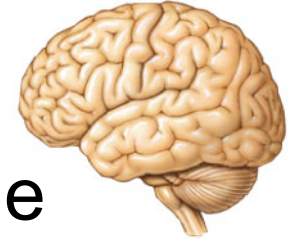
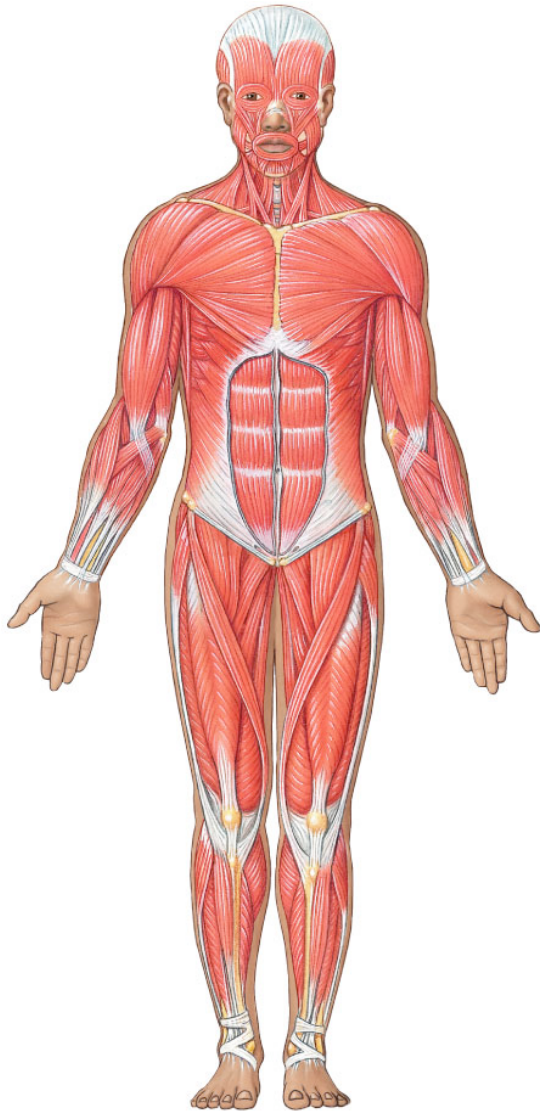
- ◀ • Removes excess body heat; synthesizes vitamin D₃ for calcium and phosphate absorption; protects underlying muscles
- ➔ • Skeletal muscles pulling on skin of face produce facial expressions

The Skeletal System



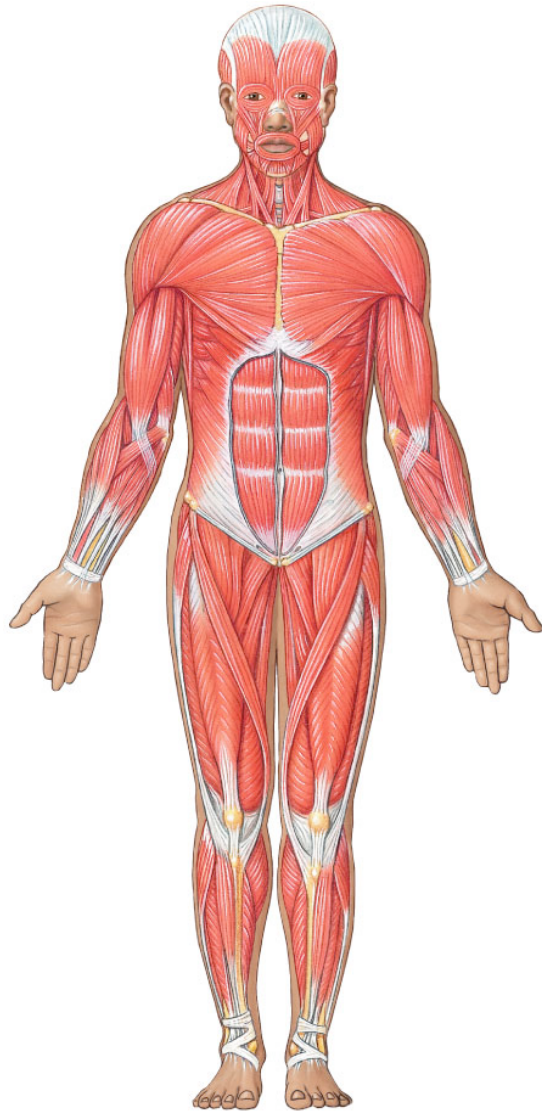
- ◀ • Maintains normal calcium and phosphate levels in body fluids; supports skeletal muscles; provides sites of attachment
- ➔ • Provides movement and support; stresses exerted by tendons maintain bone mass; stabilizes bones and joints

The Nervous System



- ◀ • Controls skeletal muscle contractions; adjusts activities of respiratory and cardiovascular systems during periods of muscular activity
- ➡ • Muscle spindles monitor body position; facial muscles express emotion; muscles of the larynx, tongue, lips and cheeks permit speech

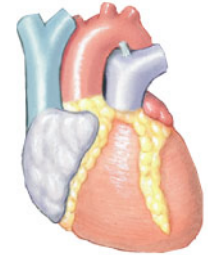
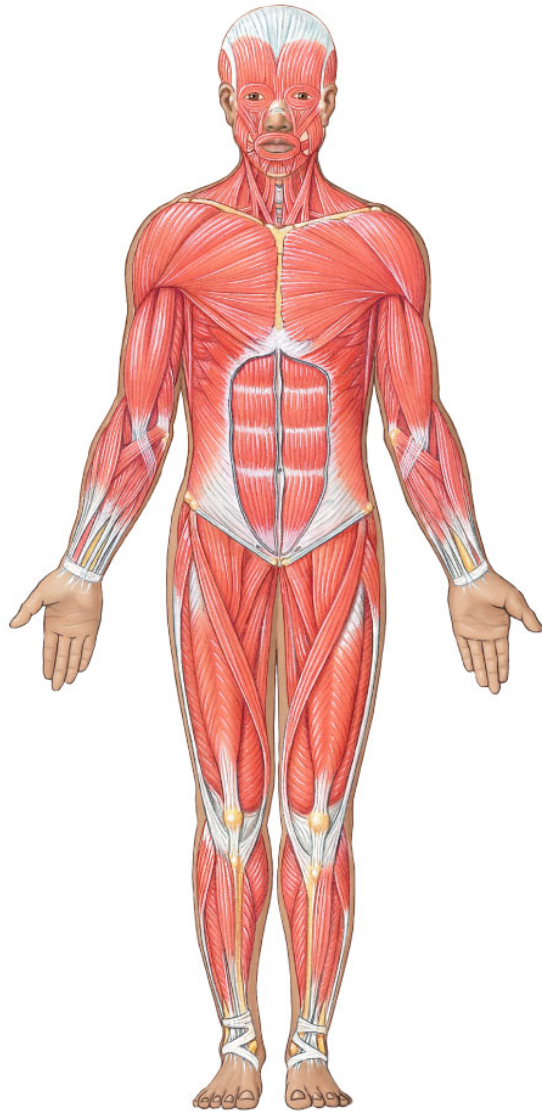
The Endocrine System



- ◀ • Hormones adjust muscle metabolism and growth; parathyroid hormone and calcitonin regulate calcium and phosphate ion concentrations
- ➡ • Skeletal muscles provide protection for some endocrine organs

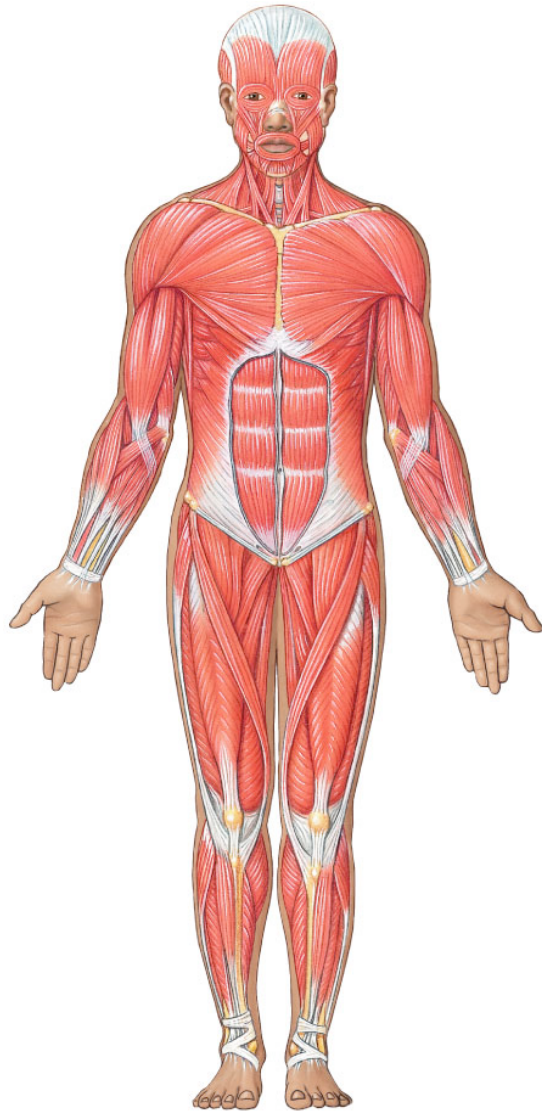


The Cardiovascular System



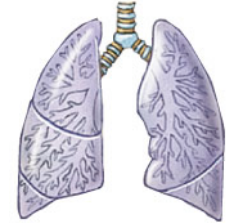
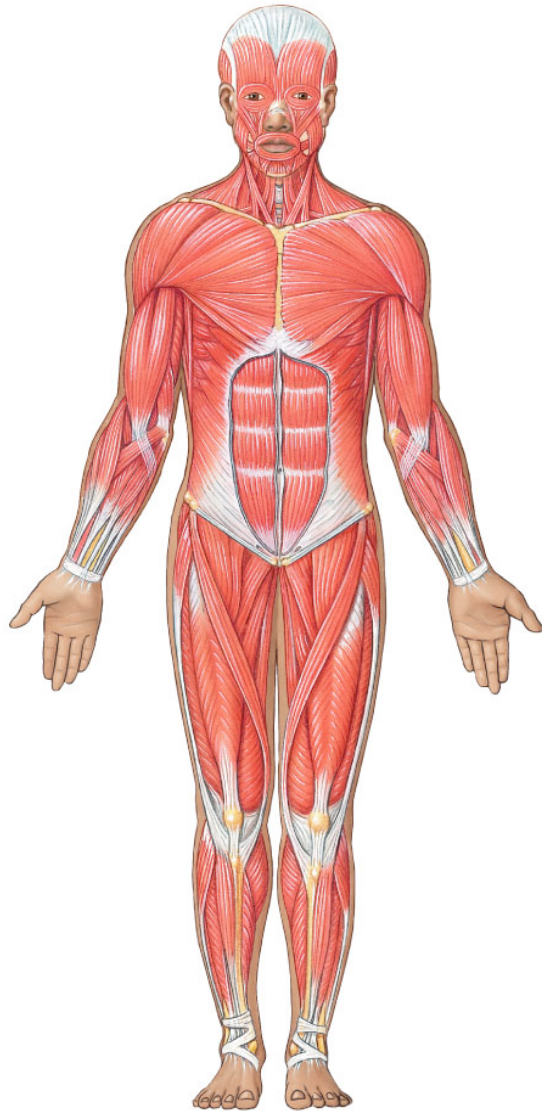
- ◀ • Delivers oxygen and nutrients; removes carbon dioxide, lactic acid, and heat
- ➡ • Skeletal muscle contractions assist in moving blood through veins; protects deep blood vessels

The Lymphatic System



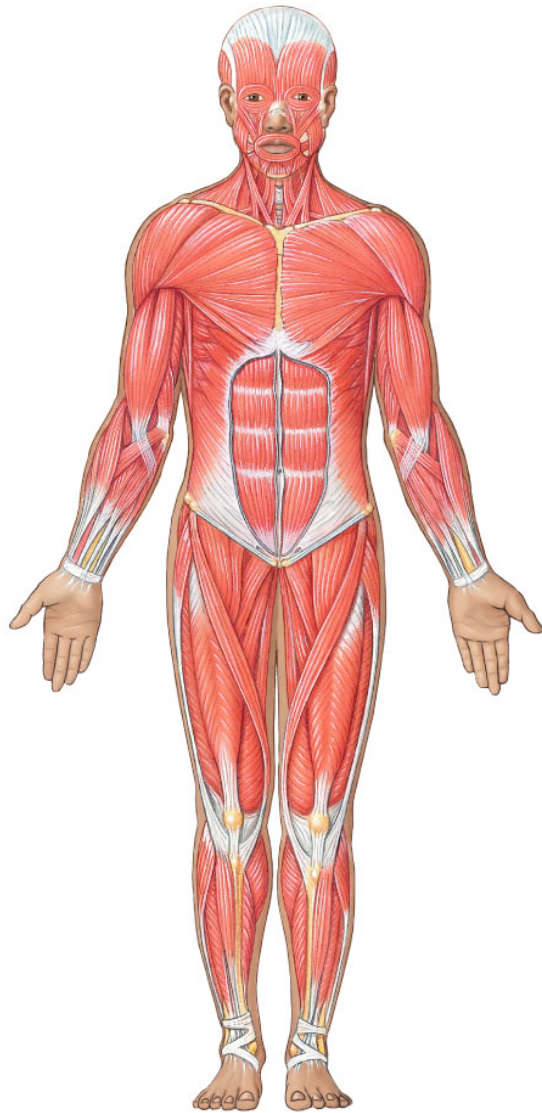
- ◀ • Defends skeletal muscles against infection and assists in tissue repairs after injury
- ➡ • Protects superficial lymph nodes and the lymphatic vessels in the abdominopelvic cavity

The Respiratory System



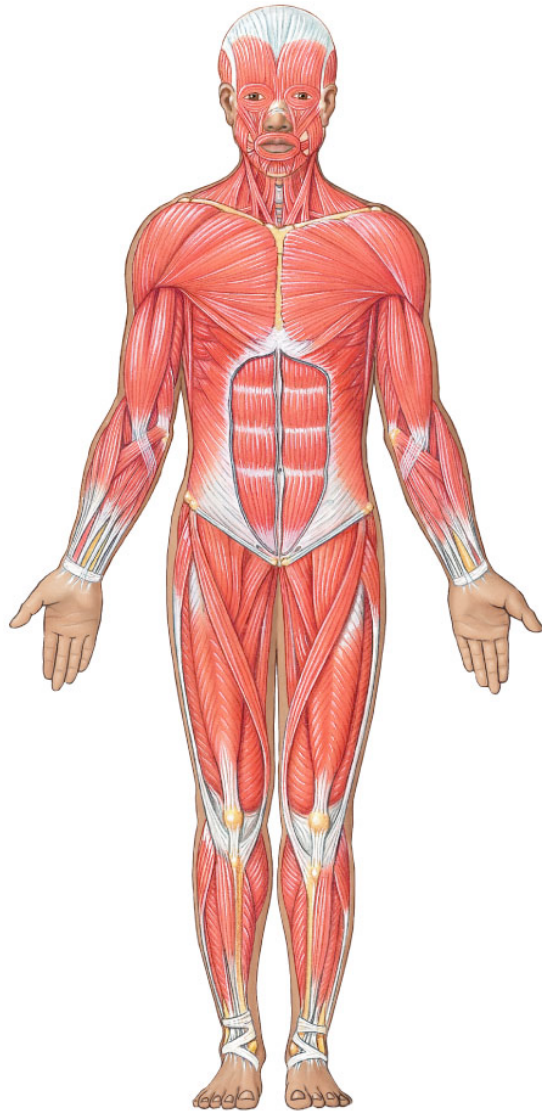
- ◀ • Provides oxygen and eliminates carbon dioxide
- ▶ • Muscles generate carbon dioxide; control entrances to respiratory tract, fill and empty lungs, control airflow through larynx, and produce sounds

The Digestive System



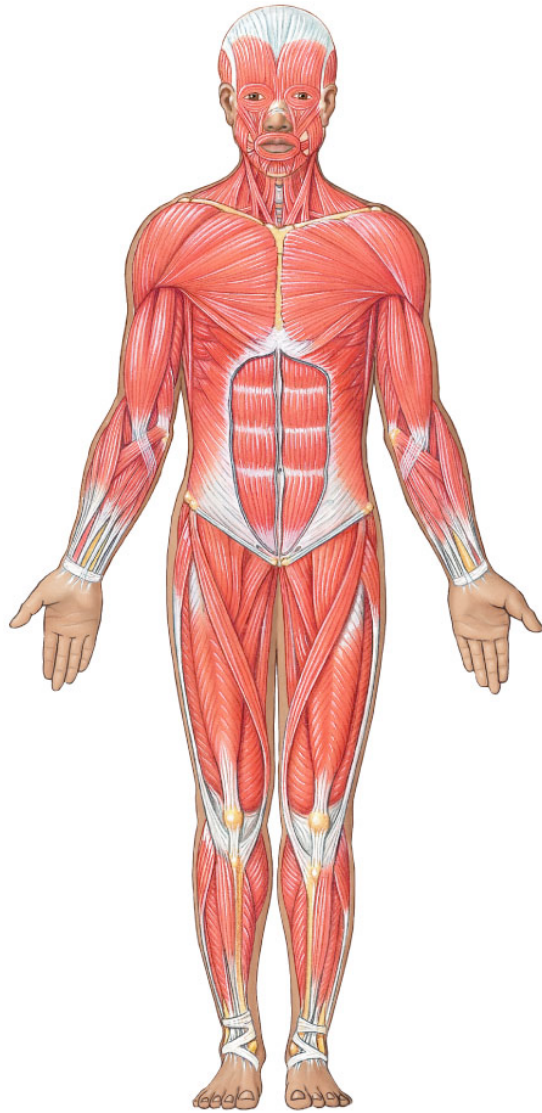
- ◀ • Provides nutrients; liver regulates blood glucose and fatty acid levels and removes lactic acid from circulation
- ➡ • Protects and supports soft tissues in abdominal cavity; controls entrances to and exits from digestive tract

The Urinary System



- ◀ • Removes waste products of protein metabolism; assists in regulation of calcium and phosphate concentrations
- ➡ • External sphincter controls urination by constricting urethra

The Reproductive System



- Reproductive hormones accelerate skeletal muscle growth
- Contractions of skeletal muscles eject semen from male reproductive tract; muscle contractions during sex act produce pleasurable sensations

