

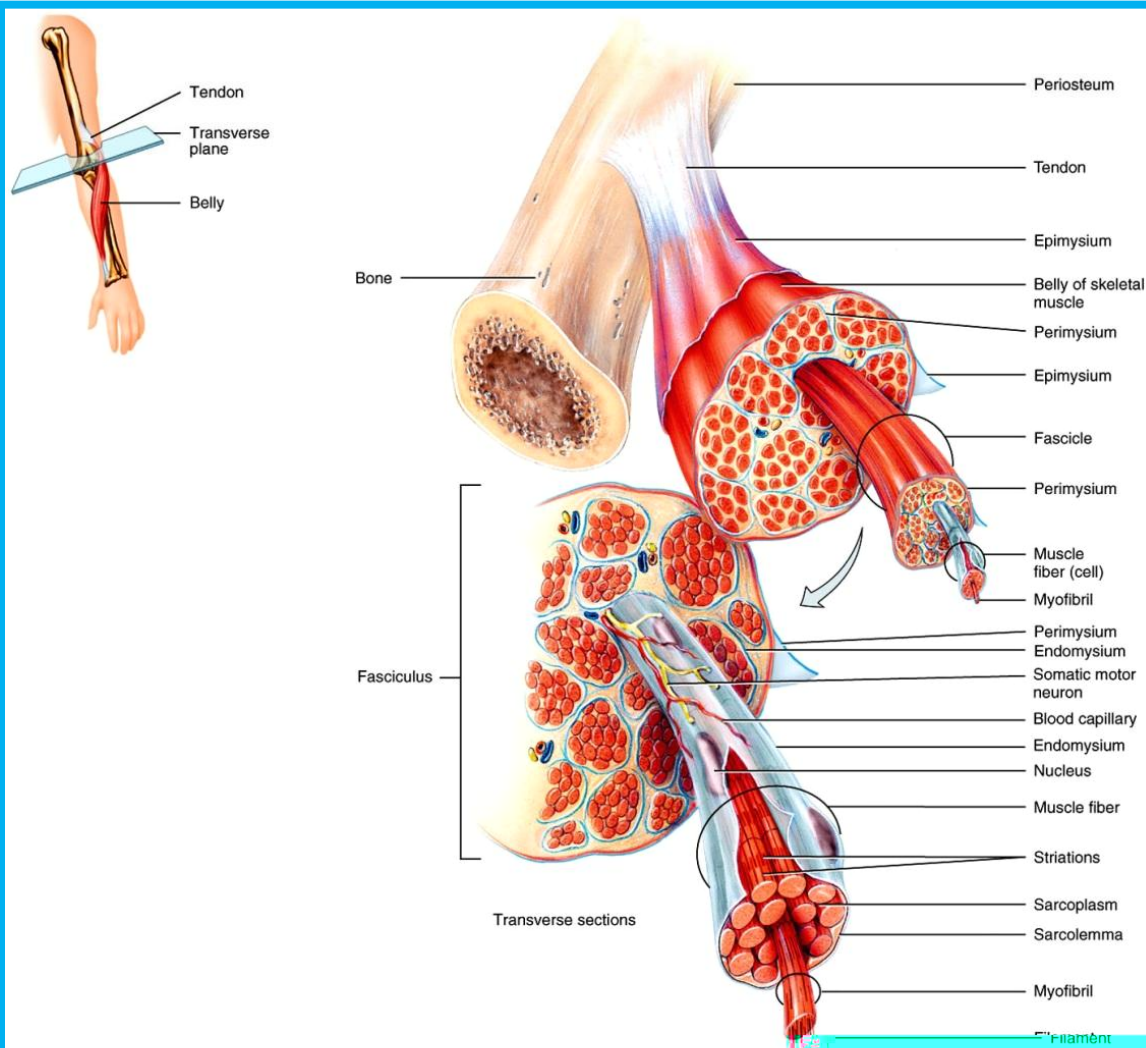
# Muscle groups of the body

and the  
Musculoskeletal  
system

# Lecture Objectives

- Muscles
  - What are muscles?
  - How can they be classified?
  - What is their function?
- Musculoskeletal system
  - Components
- Histological slides

# Skeletal Muscle



- One muscle cell = fibre
- Bundle of fibres = fascicle
- Bundle of fascicles = muscle
- Tendon connects it to bone
- Functions
  - Producing body movements
  - Stabilizing body positions
  - Storing and moving substances
  - Generates heat

# Arrangement of fascicles

- All skeletal muscle fibers run parallel to each other
- Their function/action determines how the fibers are arranged with relation to the tendon
- Parallel, Fusiform, Circular, Triangular, Penate

## PARALLEL

Fascicles parallel to longitudinal axis of muscle; terminate at either end in flat tendons.



*Example:* Stylohyoid muscle (see [Figure 11.8](#))

## FUSIFORM

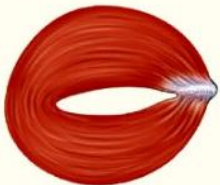
Fascicles nearly parallel to longitudinal axis of muscle; terminate in flat tendons; muscle tapers toward tendons, where diameter is less than at belly.



*Example:* Digastric muscle (see [Figure 11.8](#))

## CIRCULAR

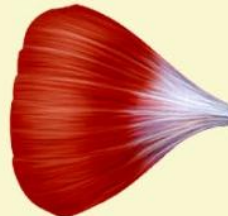
Fascicles in concentric circular arrangements form sphincter muscles that enclose an orifice (opening).



*Example:* Orbicularis oculi muscle (see [Figure 11.4a](#))

## TRIANGULAR

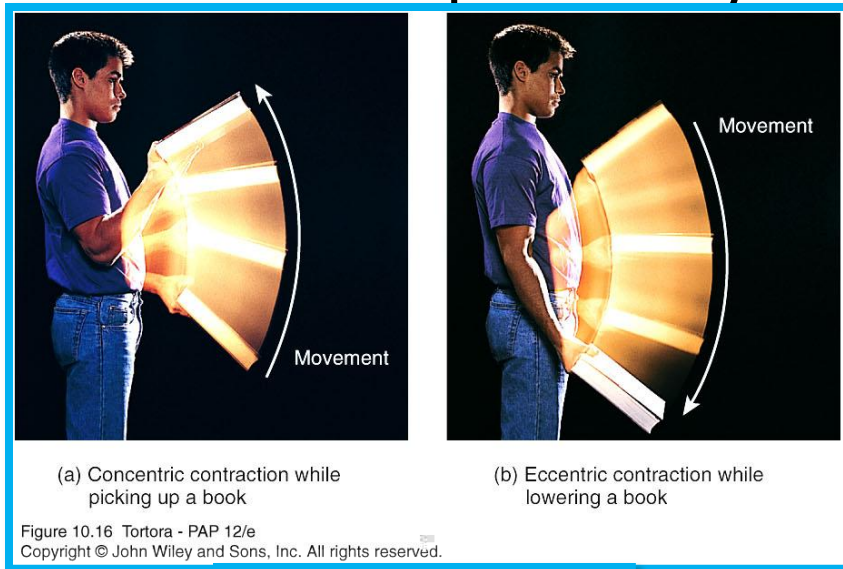
Fascicles spread over broad area converge at thick central tendon; gives muscle a triangular appearance.



*Example:* Pectoralis major muscle (see [Figure 11.3a](#))

# Contraction

- Isotonic contraction; tension remains practically the same while muscle shortens
  - Concentric
  - Eccentric



- Isometric contraction; tension is great enough to exceed object being moved, muscle doesn't shorten



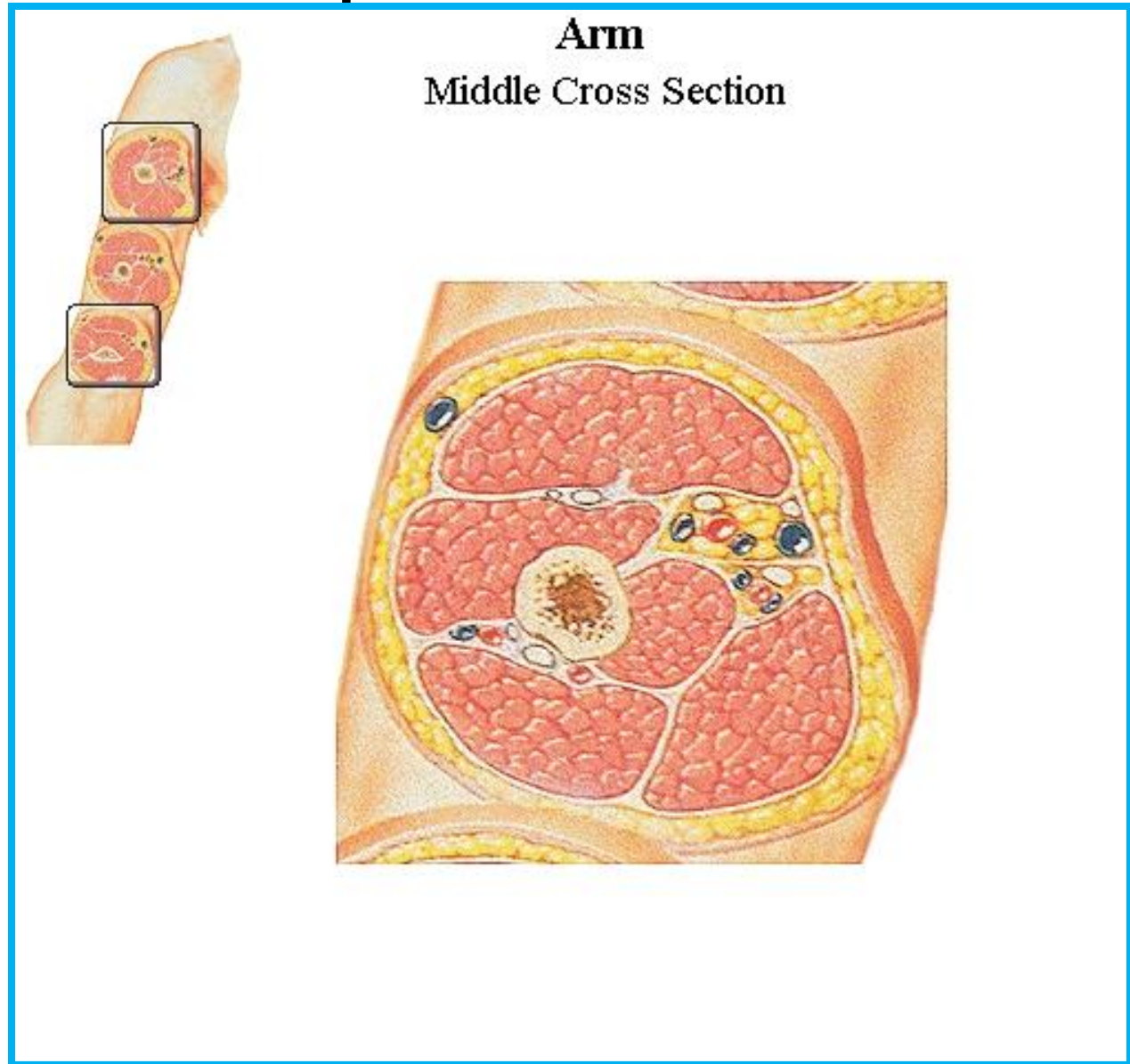
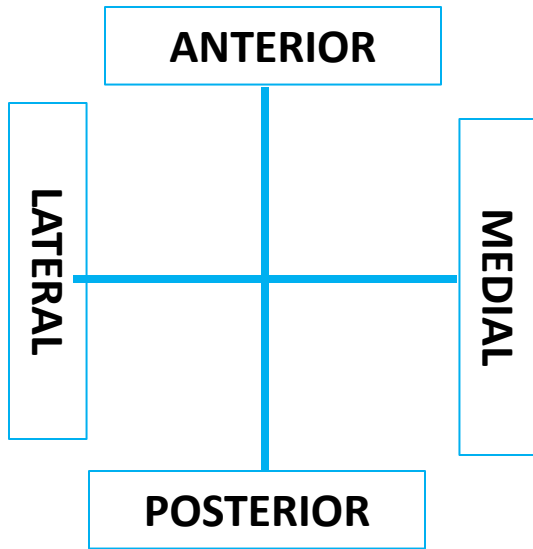
# Roles of a muscle

- Prime mover
  - a muscle that is responsible for a particular movement either alone or in a group
- Antagonist
  - any muscle that opposes a prime mover
- Fixator
  - stabilizes the prime mover's origin
- Synergist
  - these muscles contract to stabilize intermediate joints while a prime mover is contracting to ensure the intended joint is moved

# Muscle compartments

- Are separated by fascia
- Are arranged in layers
- Also have other groupings
  - Muscles of facial expression
- Usually share
  - Innervation (stimulus)
  - Blood supply (artery)
  - Venous drainage (vein)

# Muscle compartments





# Muscles

- Named according to;
  - Shape
  - Size
  - Length
  - Position
  - Depth
  - Attachments
  - Number of bellies
  - Action
- Usually number of the above

# Example

- Extensor digitorum longus
  - Shape
  - Size
  - Length - long
  - Position
  - Depth
  - Attachments - digits
  - Number of bellies
  - Action - extends

# Muscles of Mastication

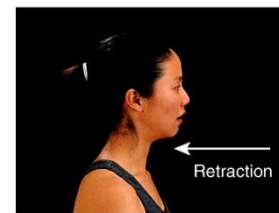
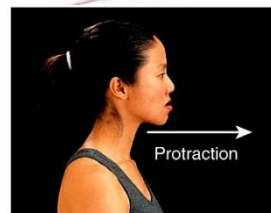
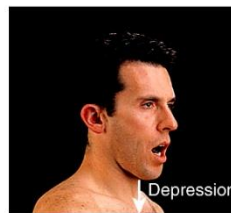
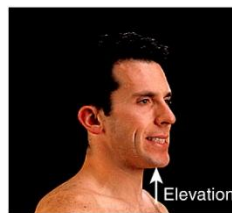
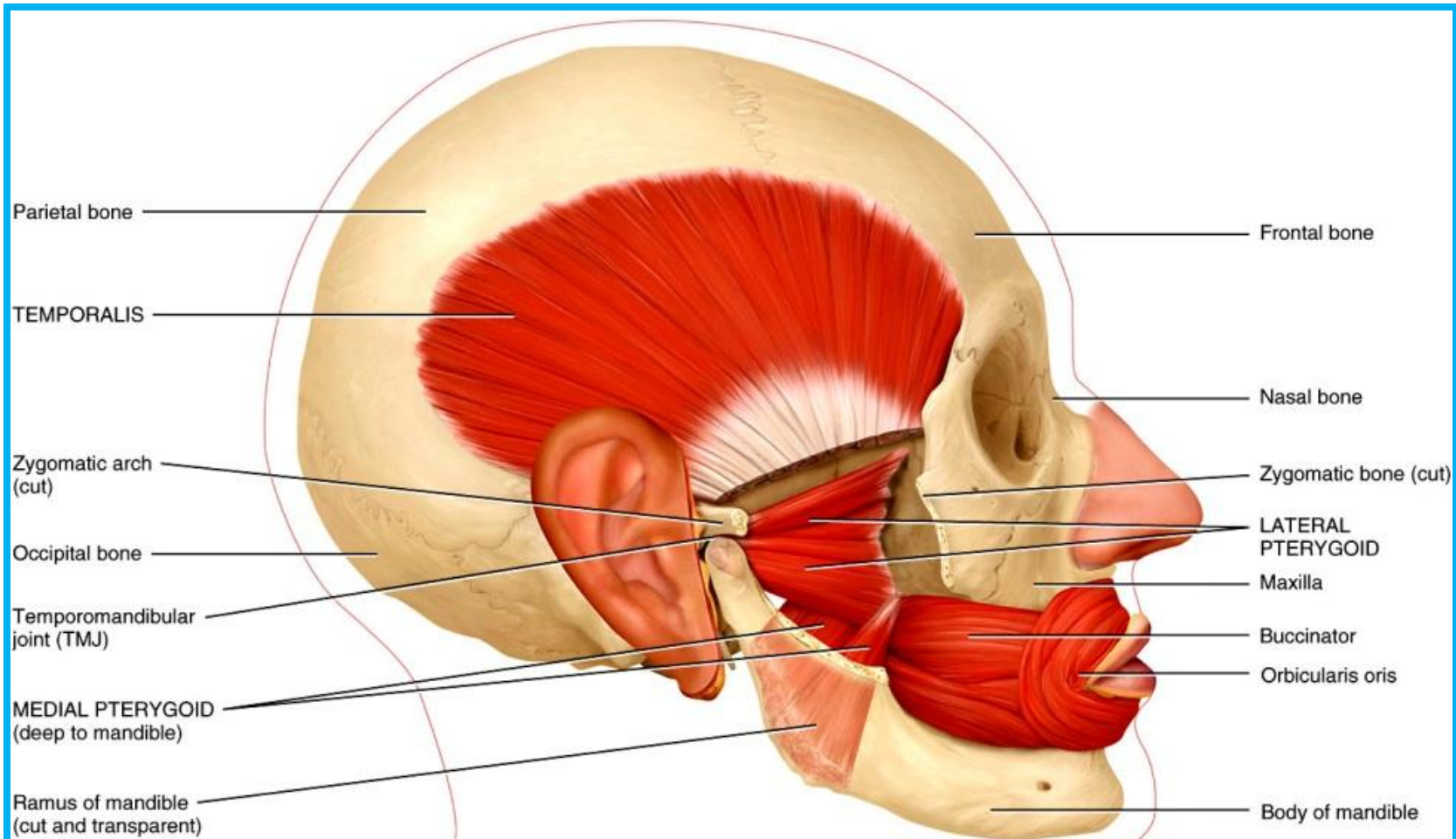


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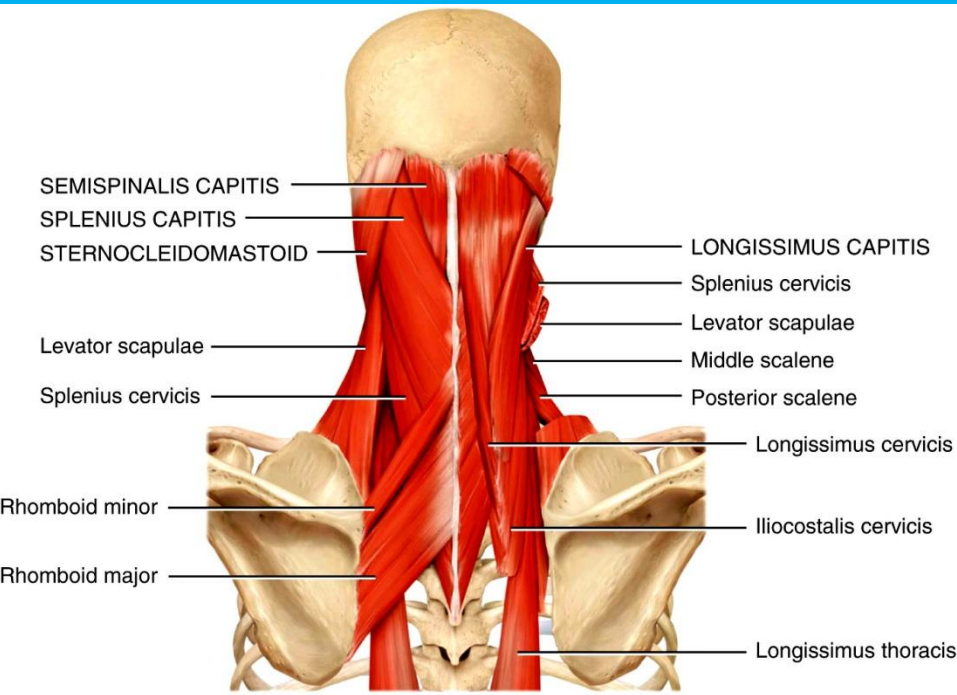
(a) Temporomandibular joint

(b)

(c) Temporomandibular joint

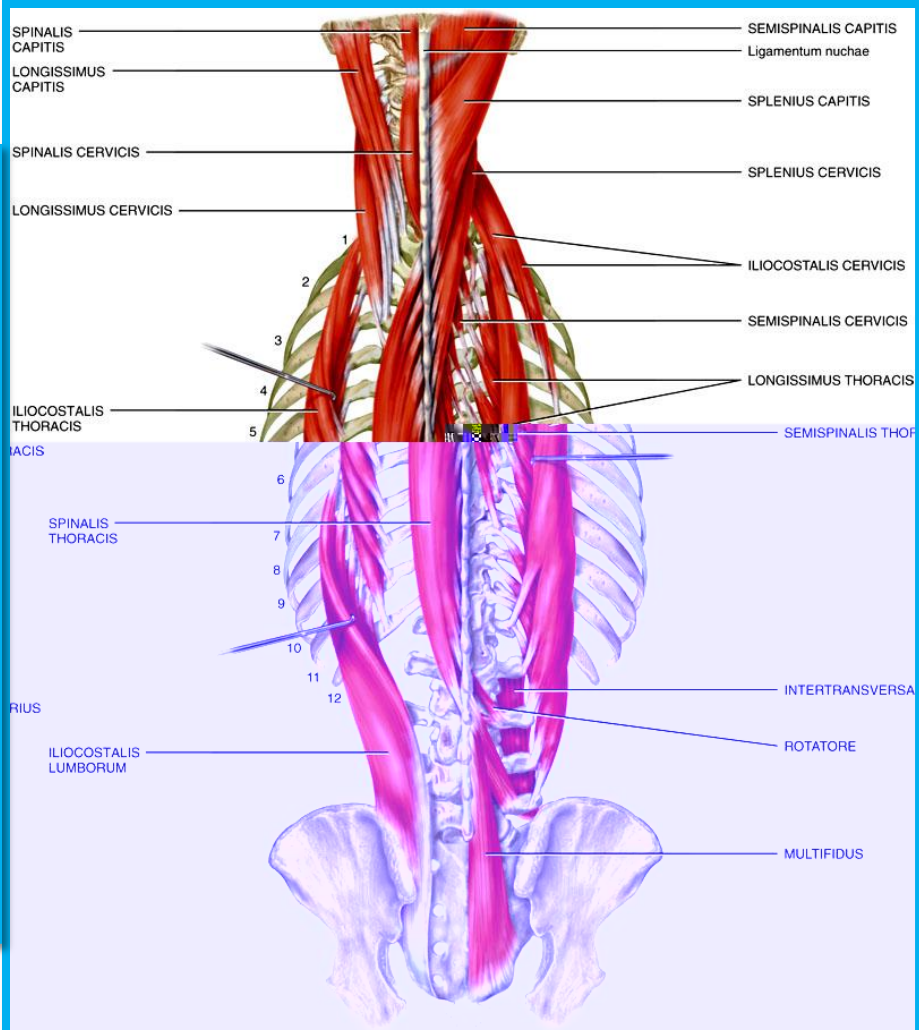
(d)

# Back Muscles



(a) Posterior superficial view (left) and deep view (right)

Figure 11.09a Tortora - PAP 12/e  
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(a) Posterior view

Figure 11.19a Tortora - PAP 12/e  
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# Trunk muscles

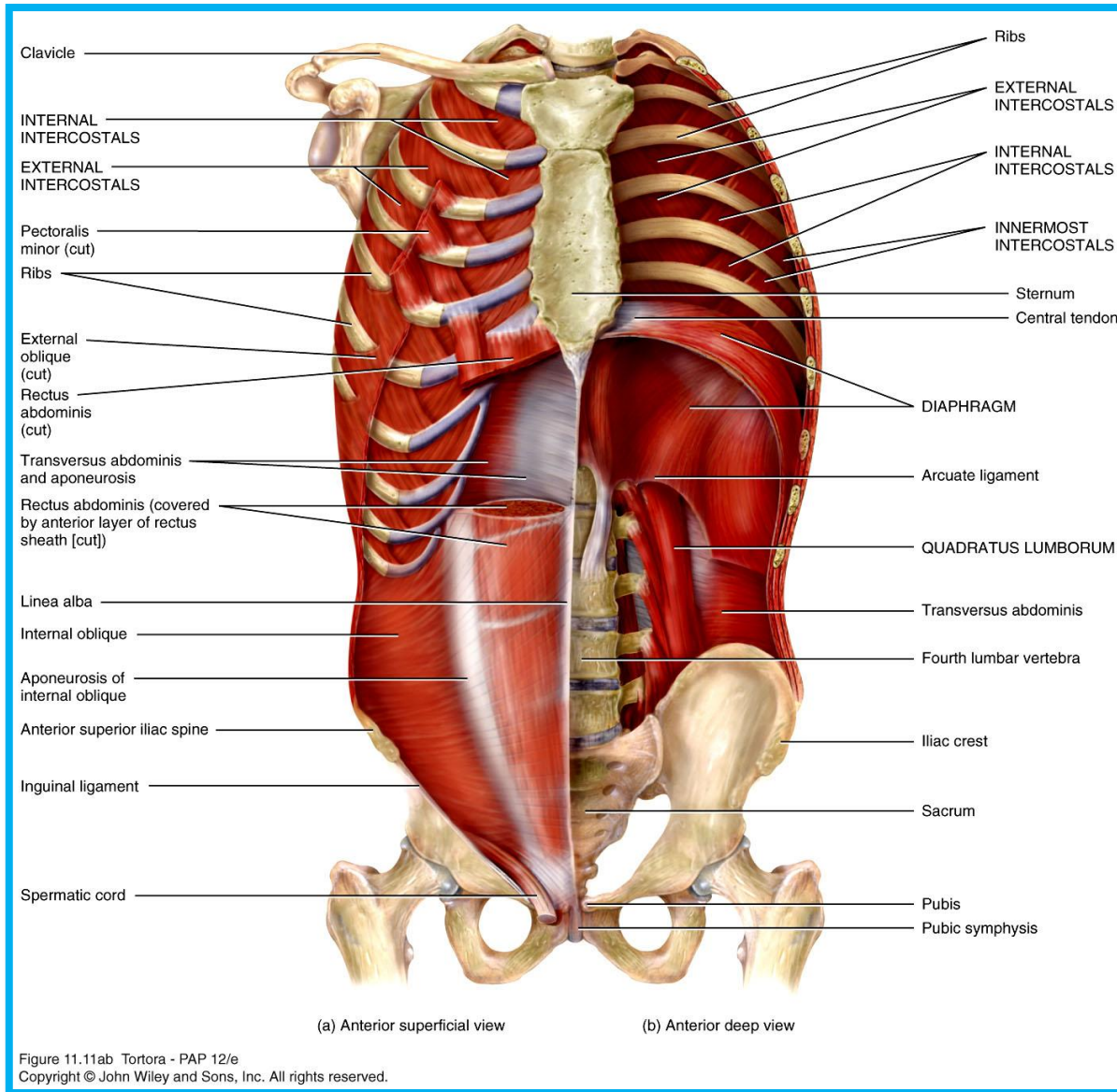
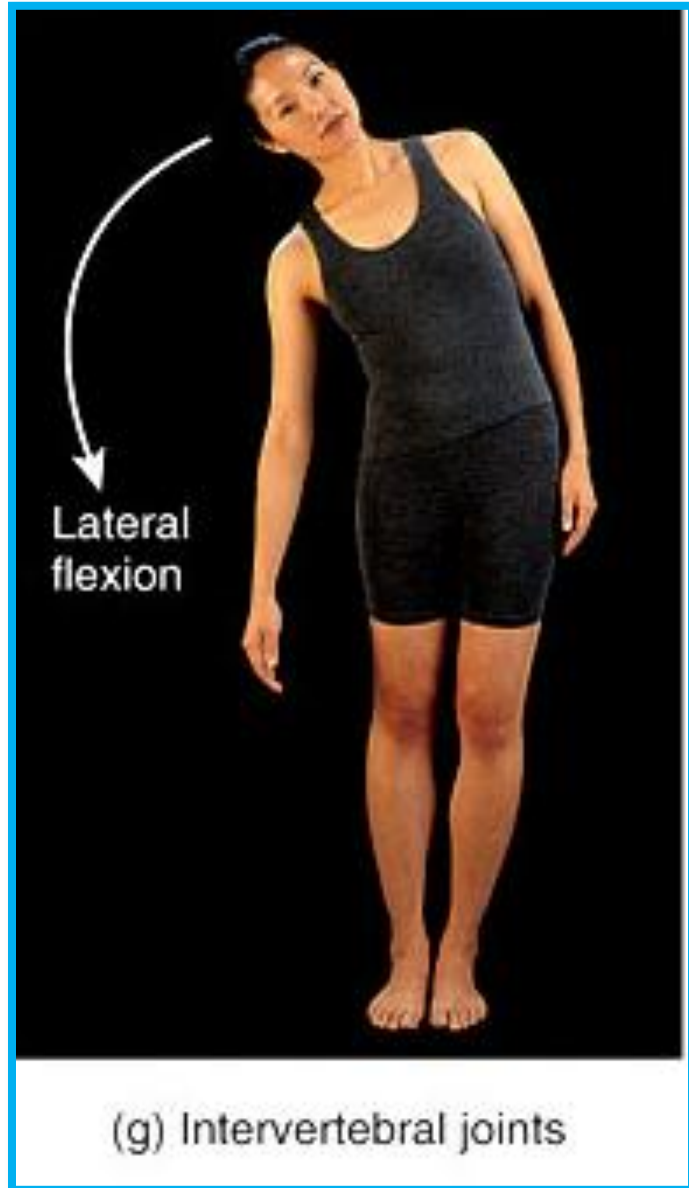


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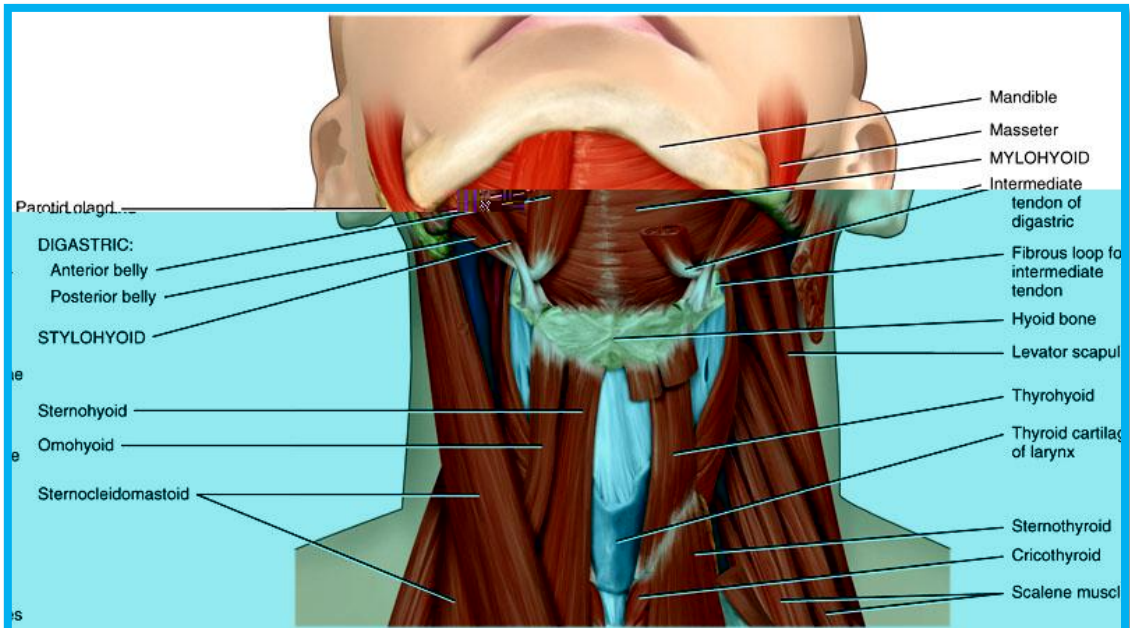
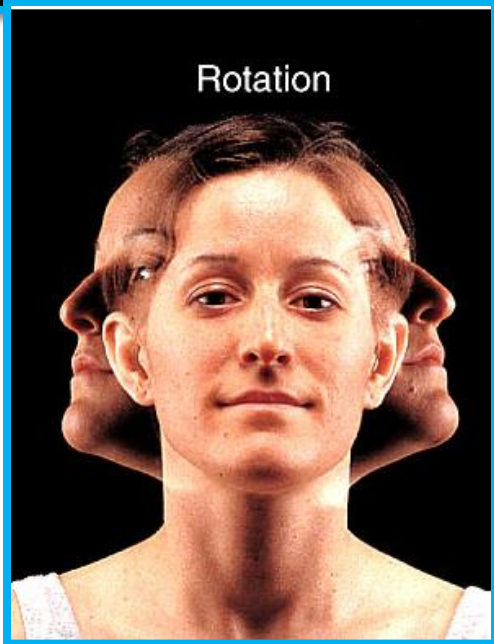
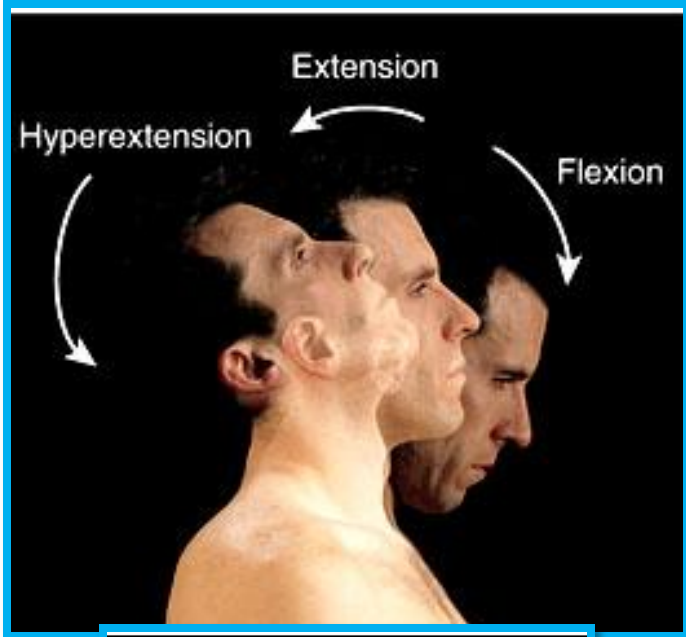
# Movements

- Back muscles
  - Posture
- Back and trunk muscles together
  - Lateral flexion – unilaterally
  - Flexion and extension – bilaterally
- Trunk muscles also aid in forced breathing



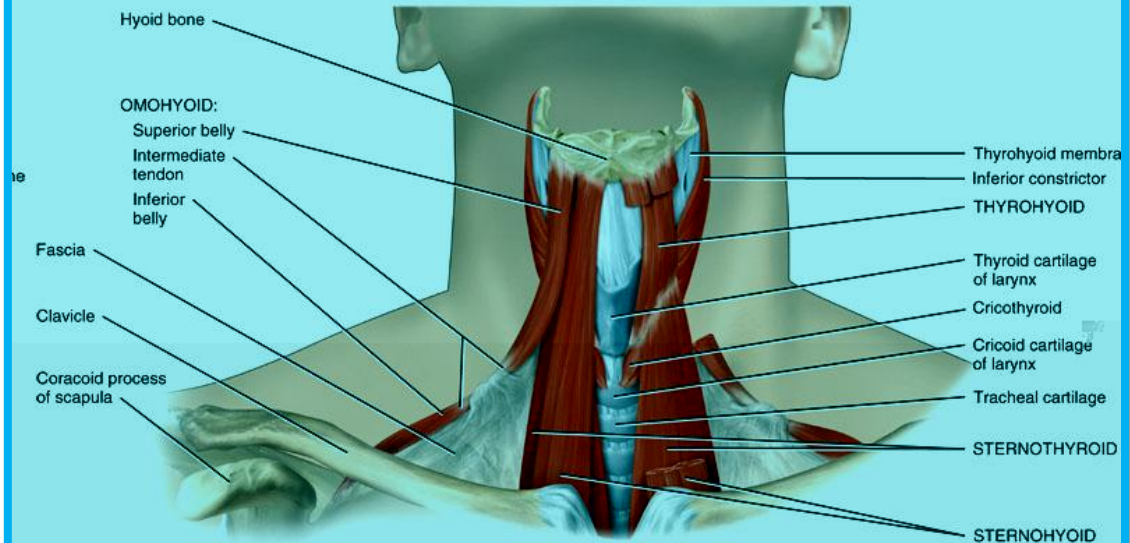


# Neck



(a) Anterior superficial view

(b) Anterior deep view



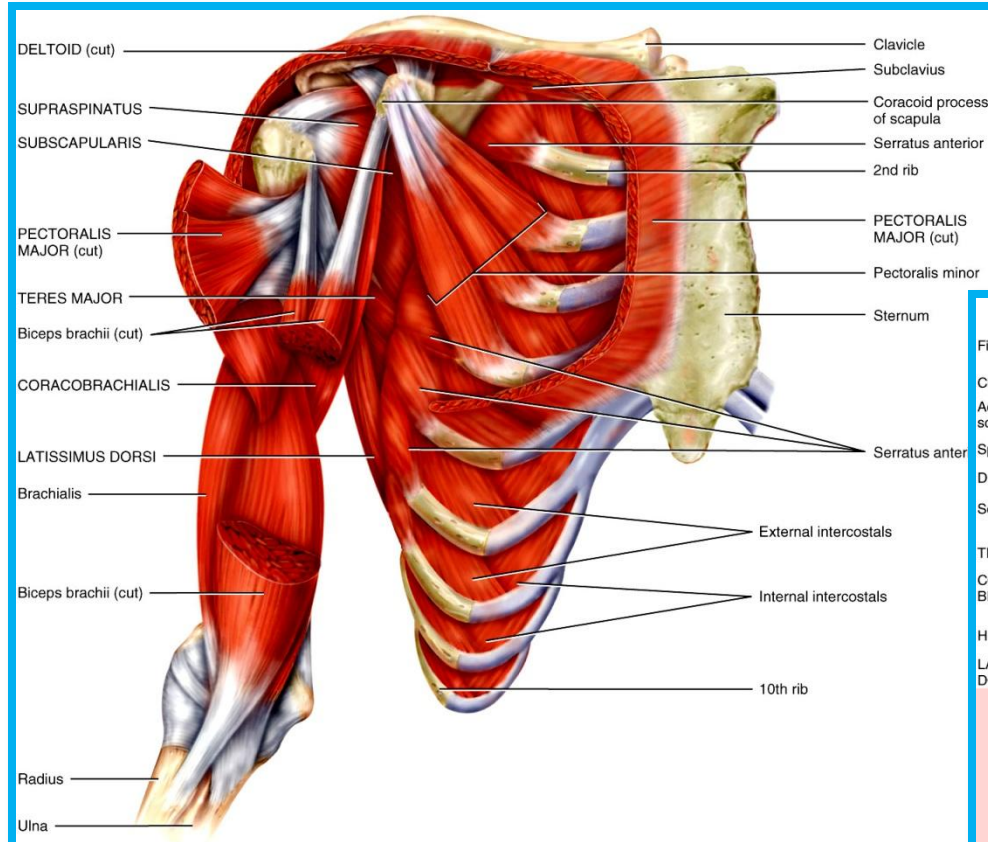
Anterior superficial view

(c)

Anterior deep view

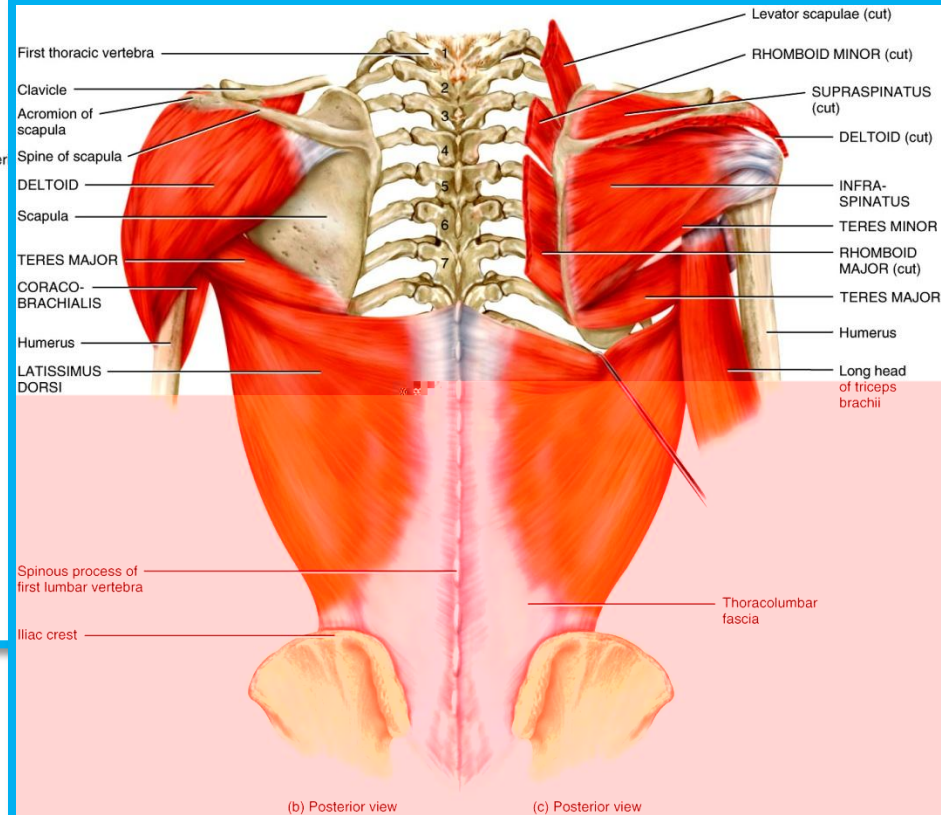
Figure 11.08abc Tortora - PAP 12/e  
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# Glenohumeral muscles



(a) Anterior deep view (the intact pectoralis major muscle is shown in figure 11.12a)

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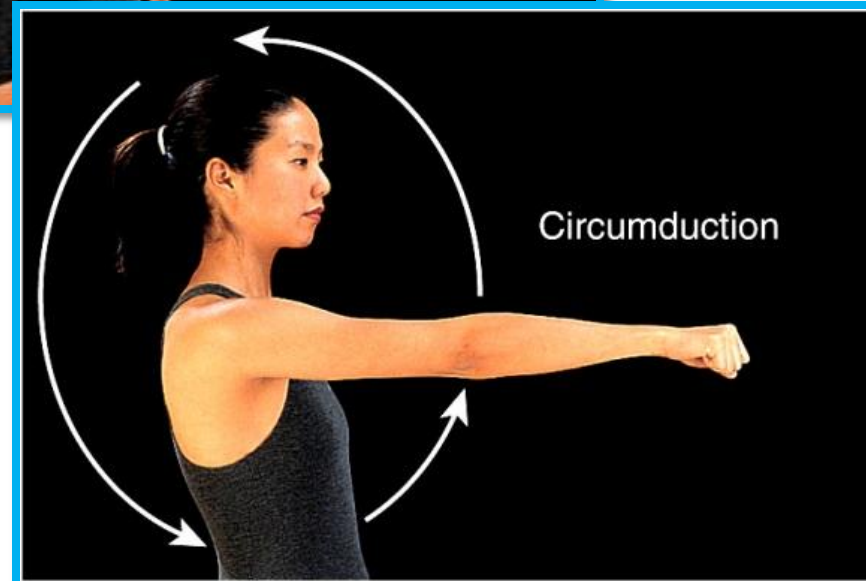
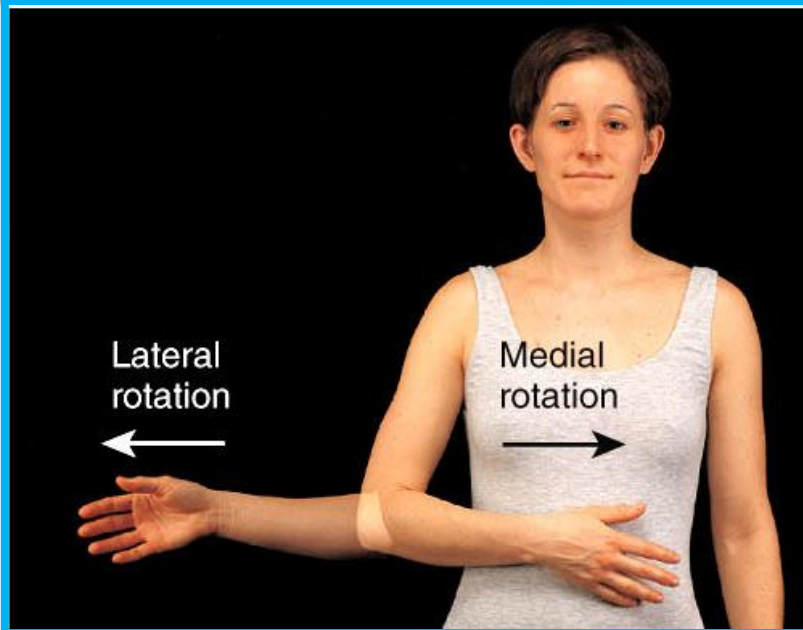
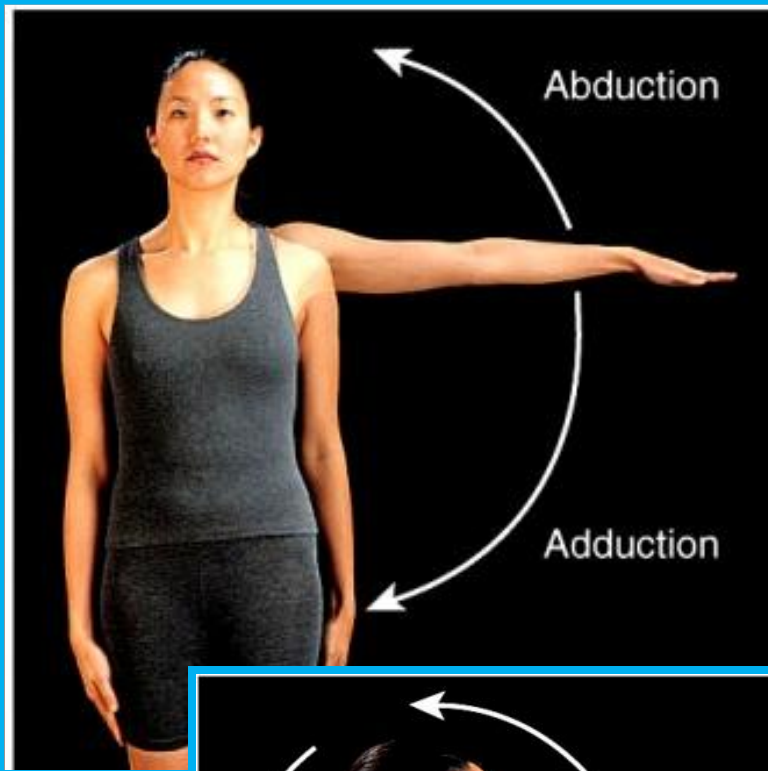
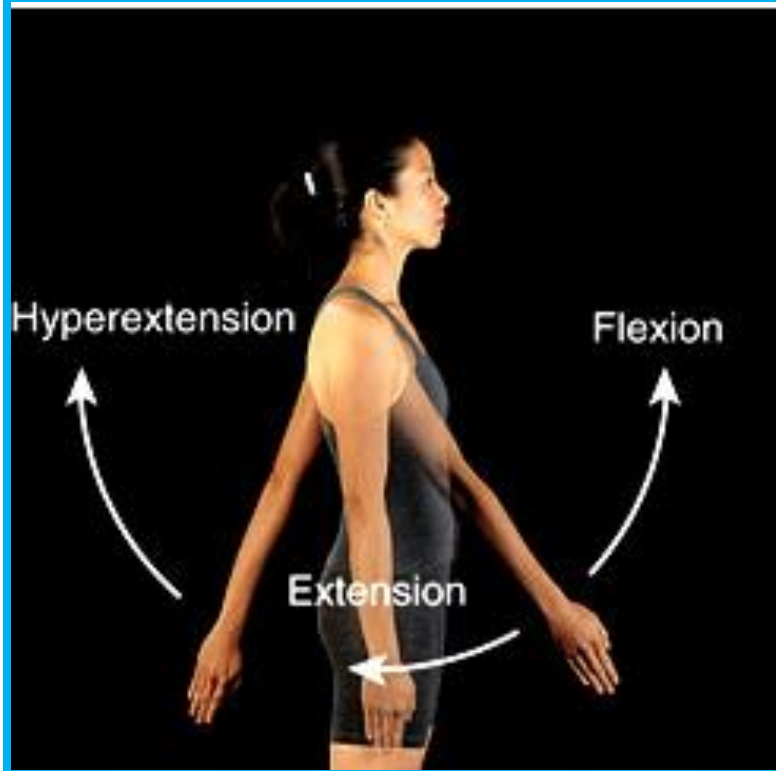


(b) Posterior view

(c) Posterior view

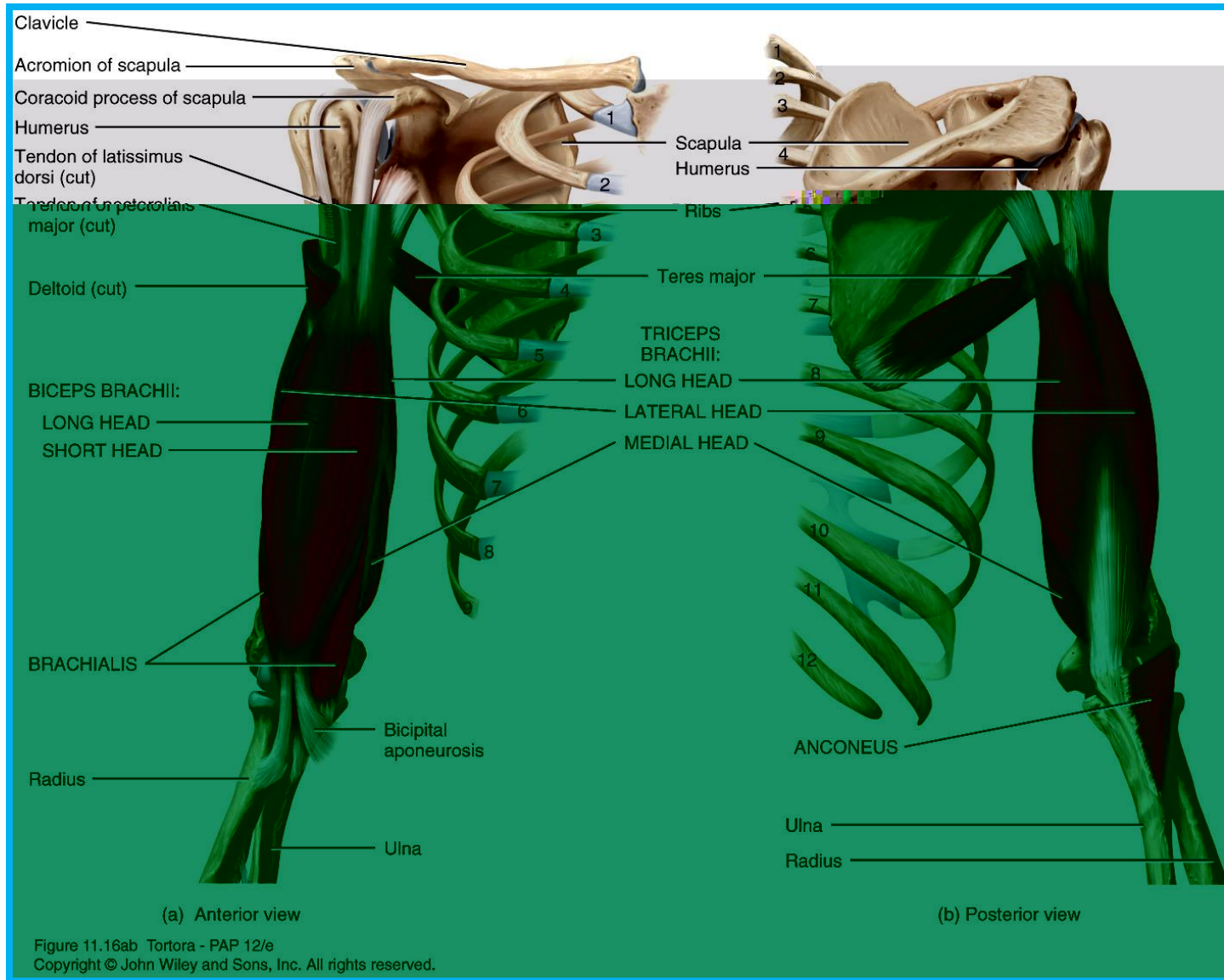
Figure 11.15bc Tortora - PAP 12/e  
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(a) Shoulder joint

# Arm muscles



# Forearm

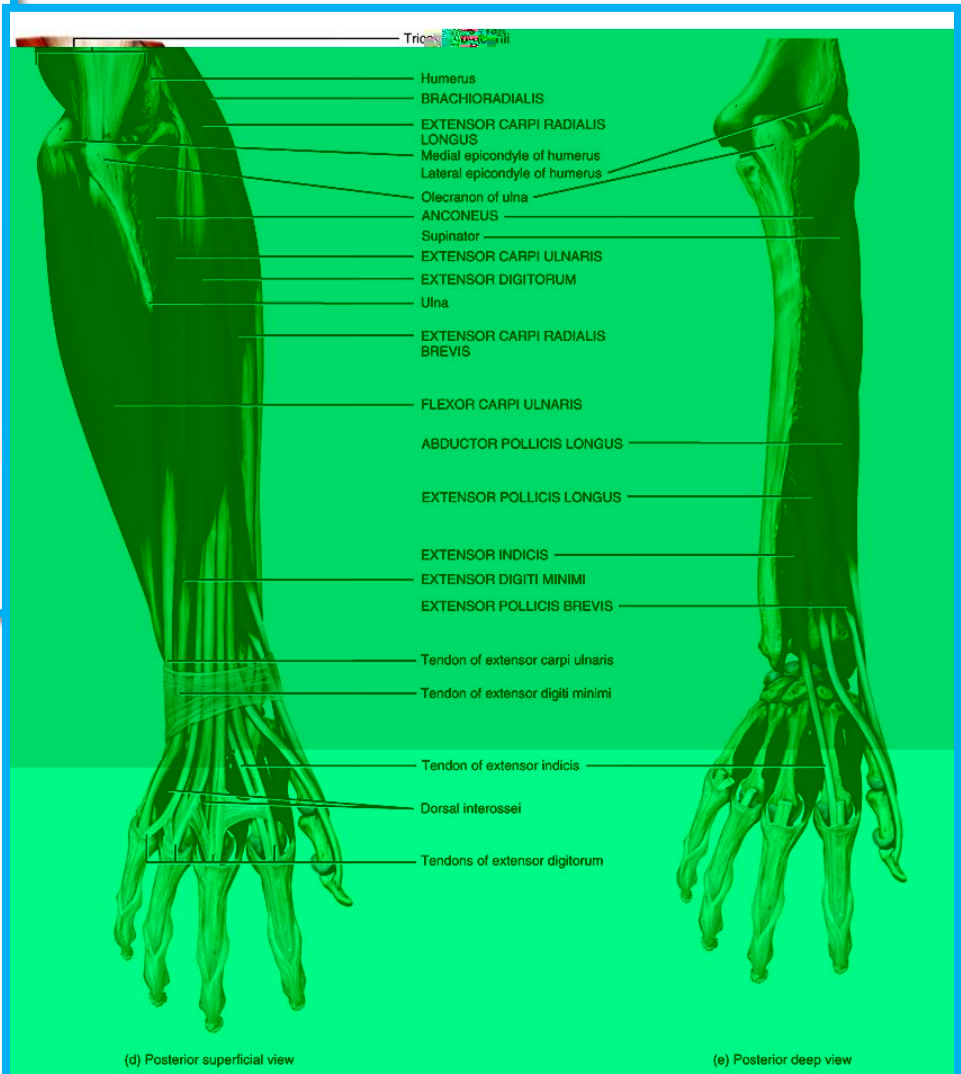
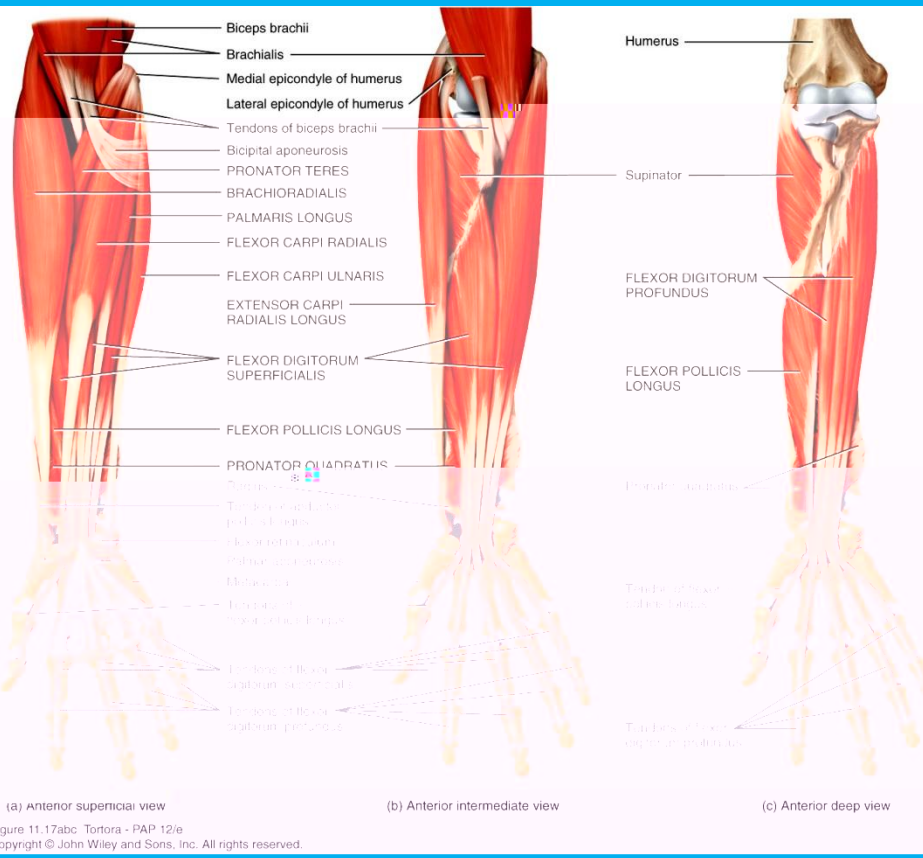
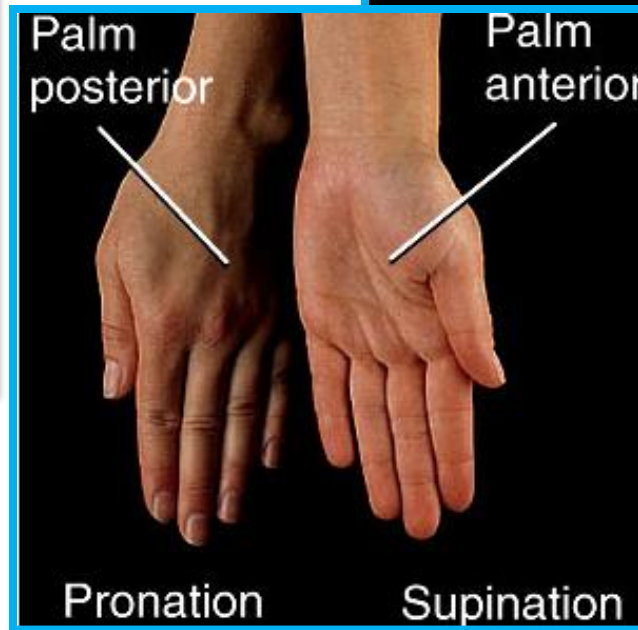
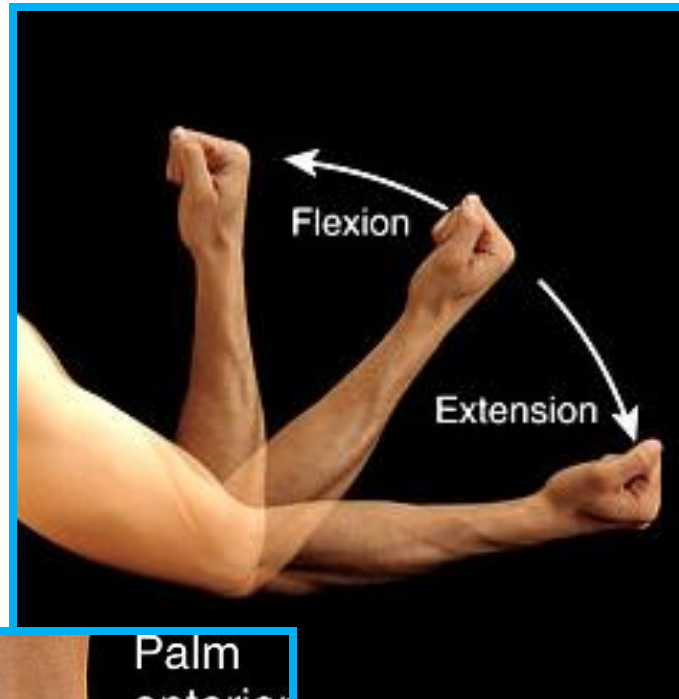
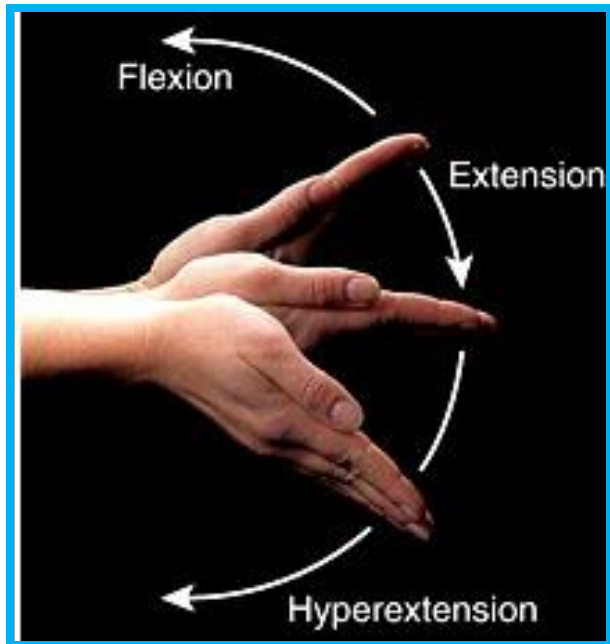
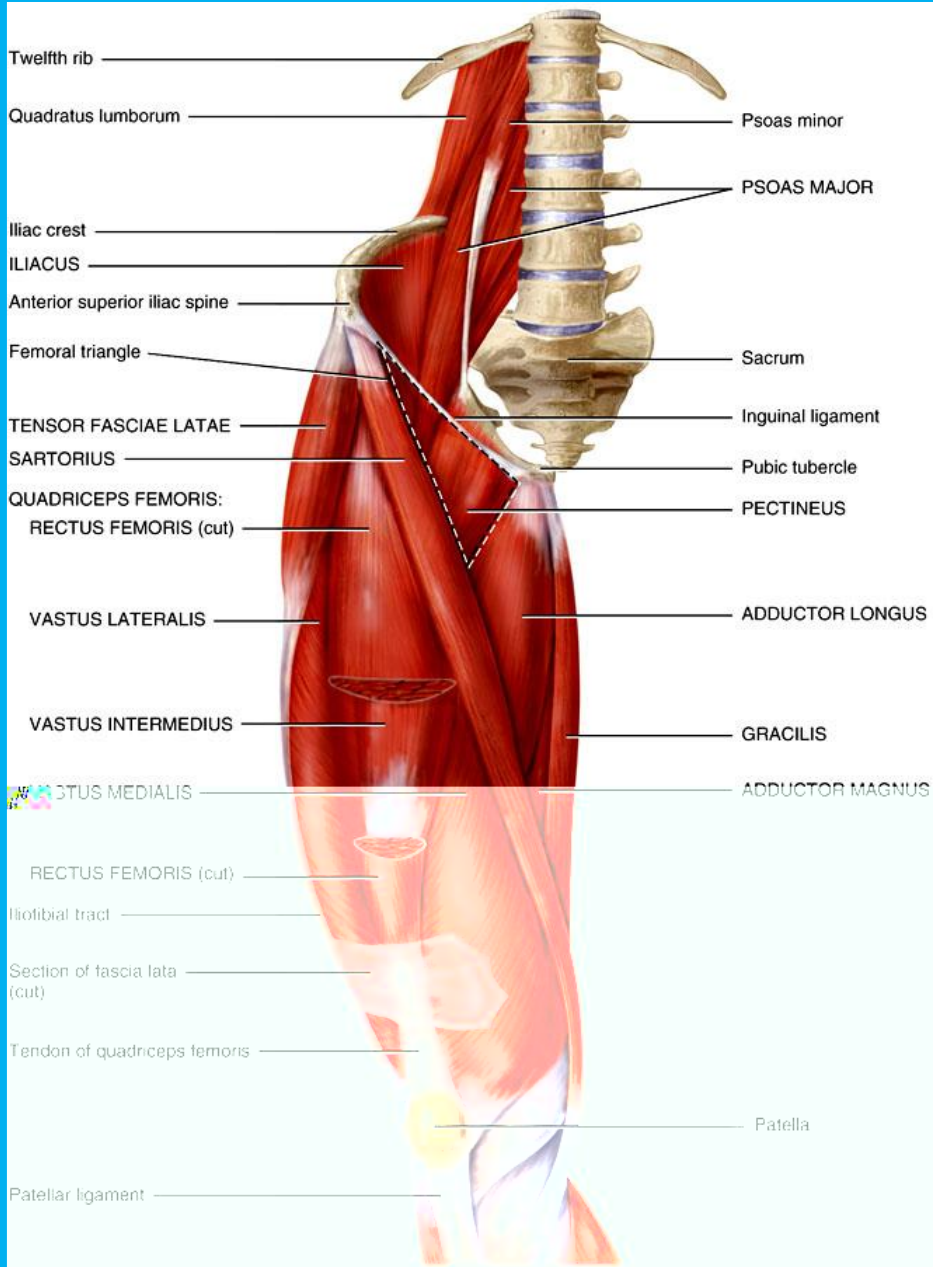


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# Movements Arm and Forearm

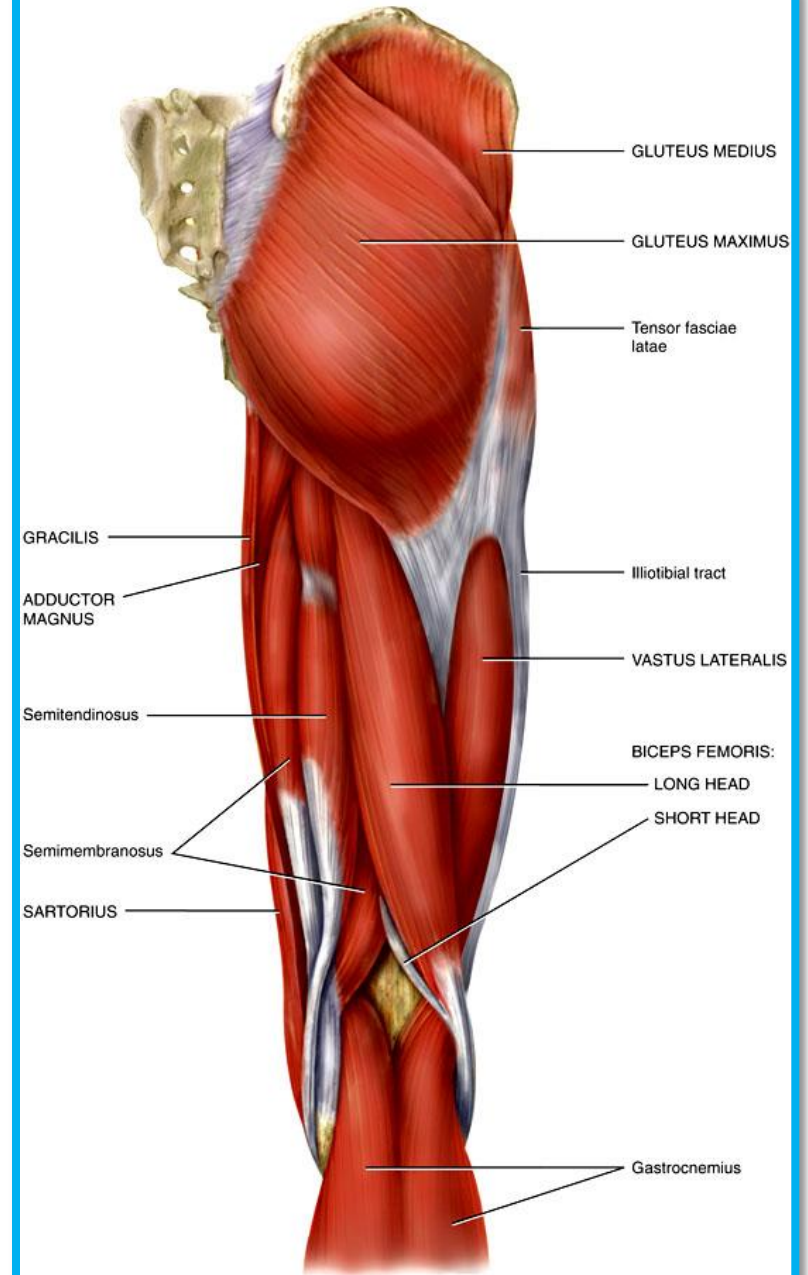






(a) Anterior superficial view (the femoral triangle is indicated by a dashed line)

Figure 11.20a Tortora - PAP 12/e  
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(c) Posterior superficial view

Figure 11.20c Tortora - PAP 12/e  
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# Leg and foot

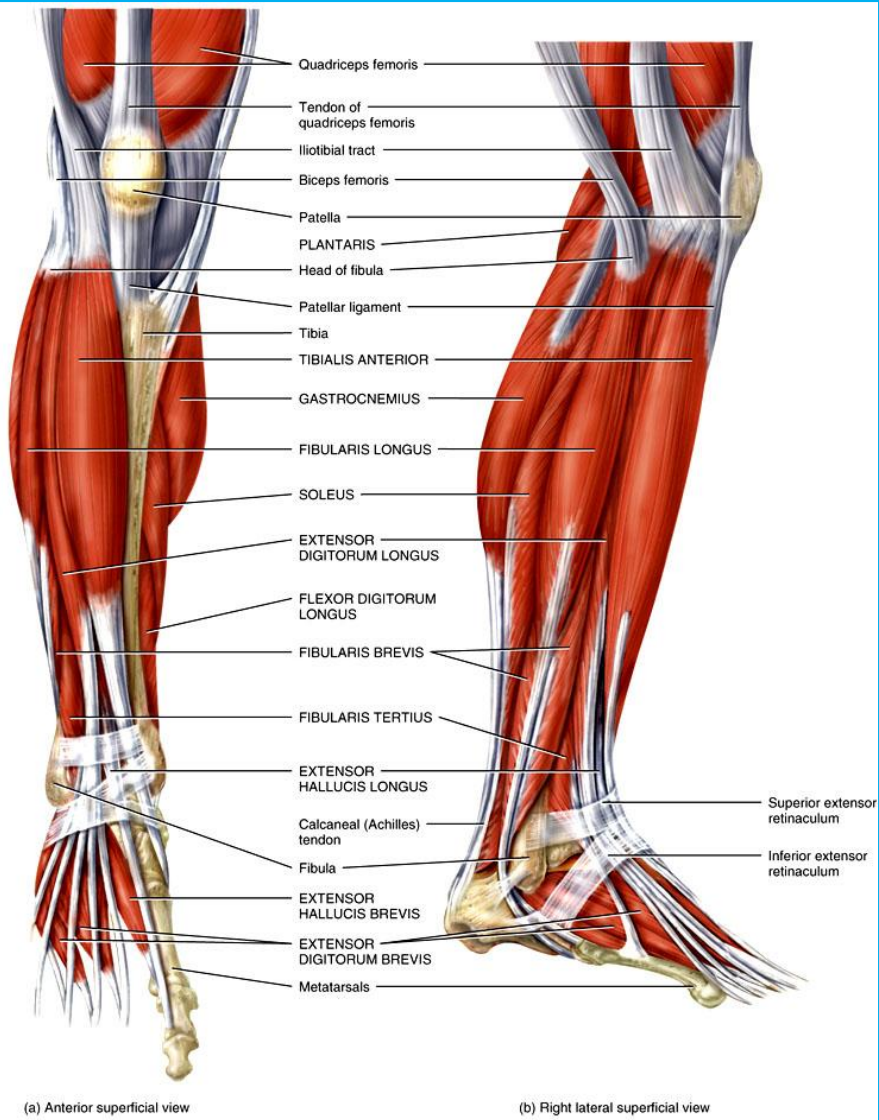


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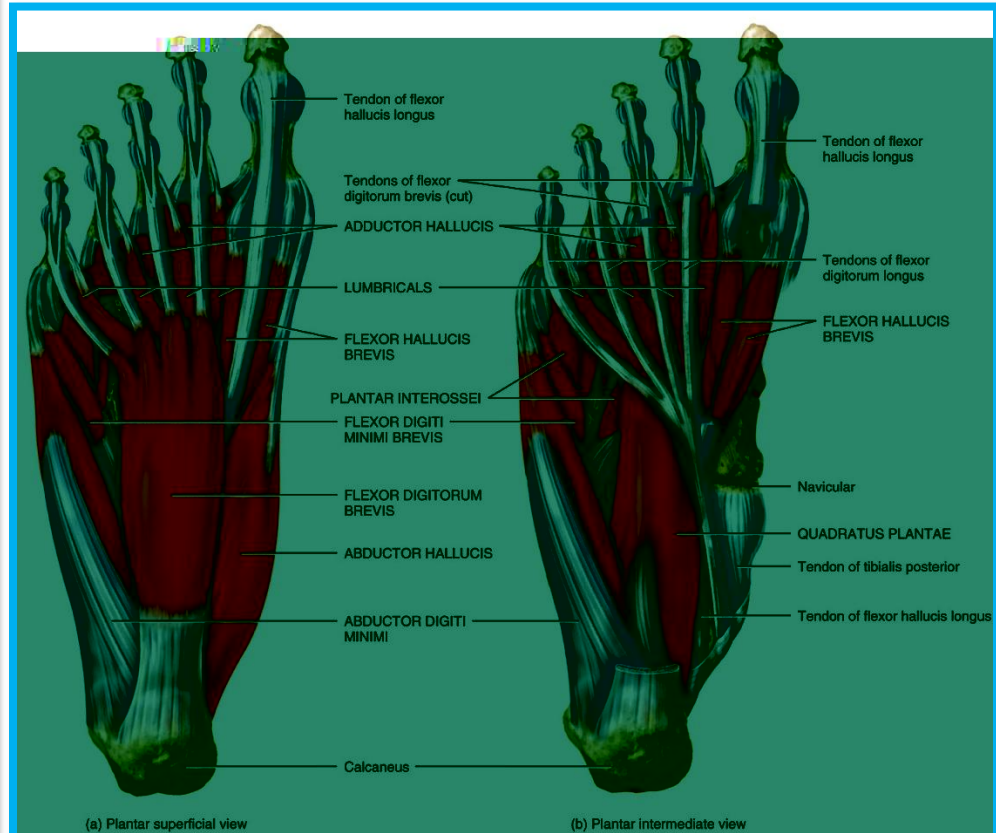
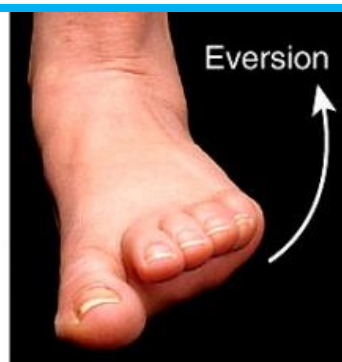
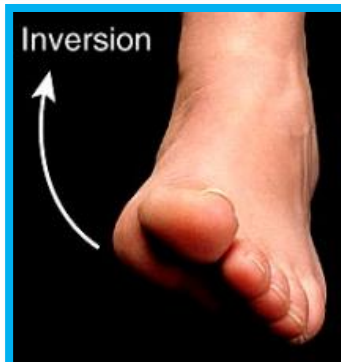
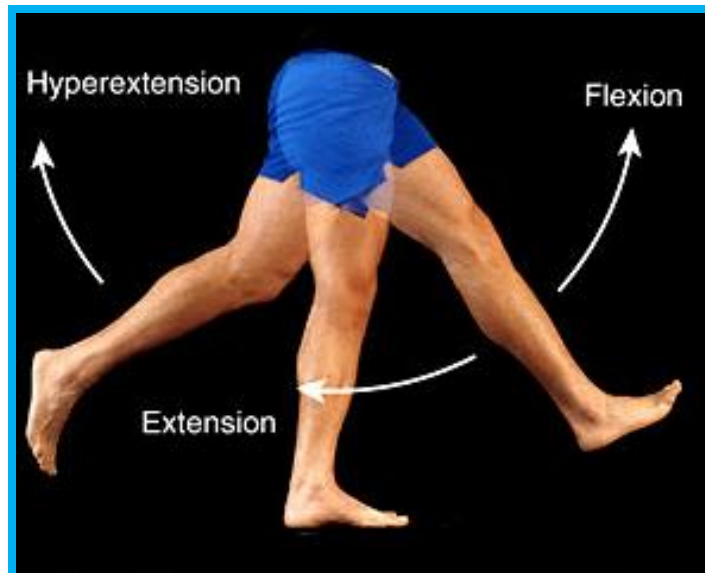


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# Movements Thigh and Leg



# Intramuscular injections

- Why?
- Where?
  - Gluteal (buttock)
  - Vastus lateralis
  - Deltoid



# Musculoskeletal system

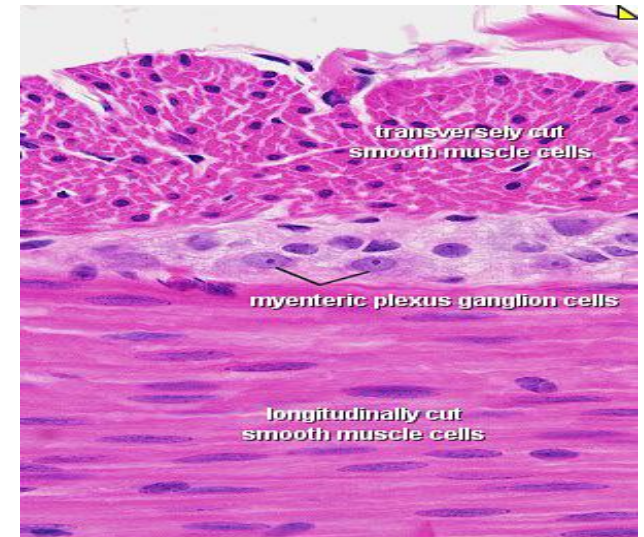
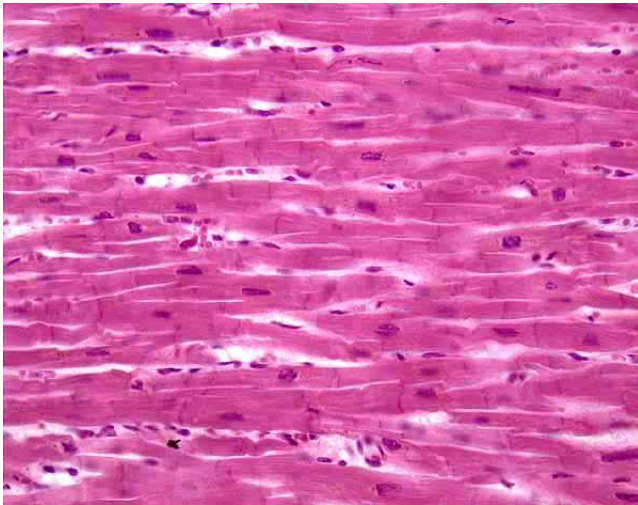
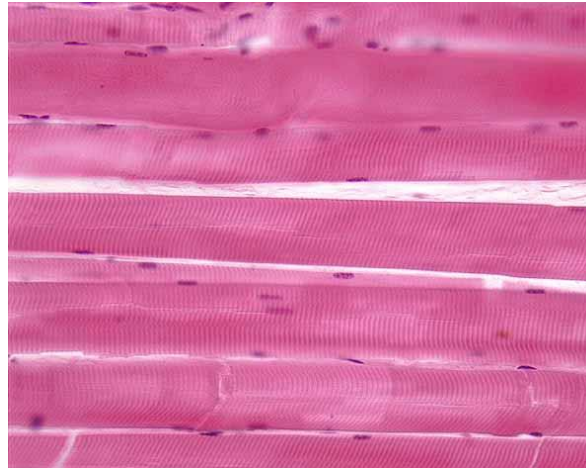
- A system composed of levers and pulleys
- Functioning as a unit to allow movement and execution of intricate tasks
  - As well as some metabolic functions
- Components
  - Skeletal
    - Framework (levers and pulleys)
    - Bones and joints
      - Bone tissue
      - Cartilage tissue
      - Connective tissue ligaments
  - Muscles
    - Skeletal muscle tissue
    - Tendons
  - (Nerves, blood vessels)

# Muscle

- Functions of muscle
  - Body movement
- Special characteristics of muscle
  - Contain actin and myosin proteins that produce movement or contraction
- Classification of muscle
  - Based on the presence of striations and control of movement

# Types of Muscle

- Skeletal
- Cardiac
- Smooth



# Connective Tissue Wrappings

## Endomysium

Delicate layer immediately surrounding individual muscle fiber

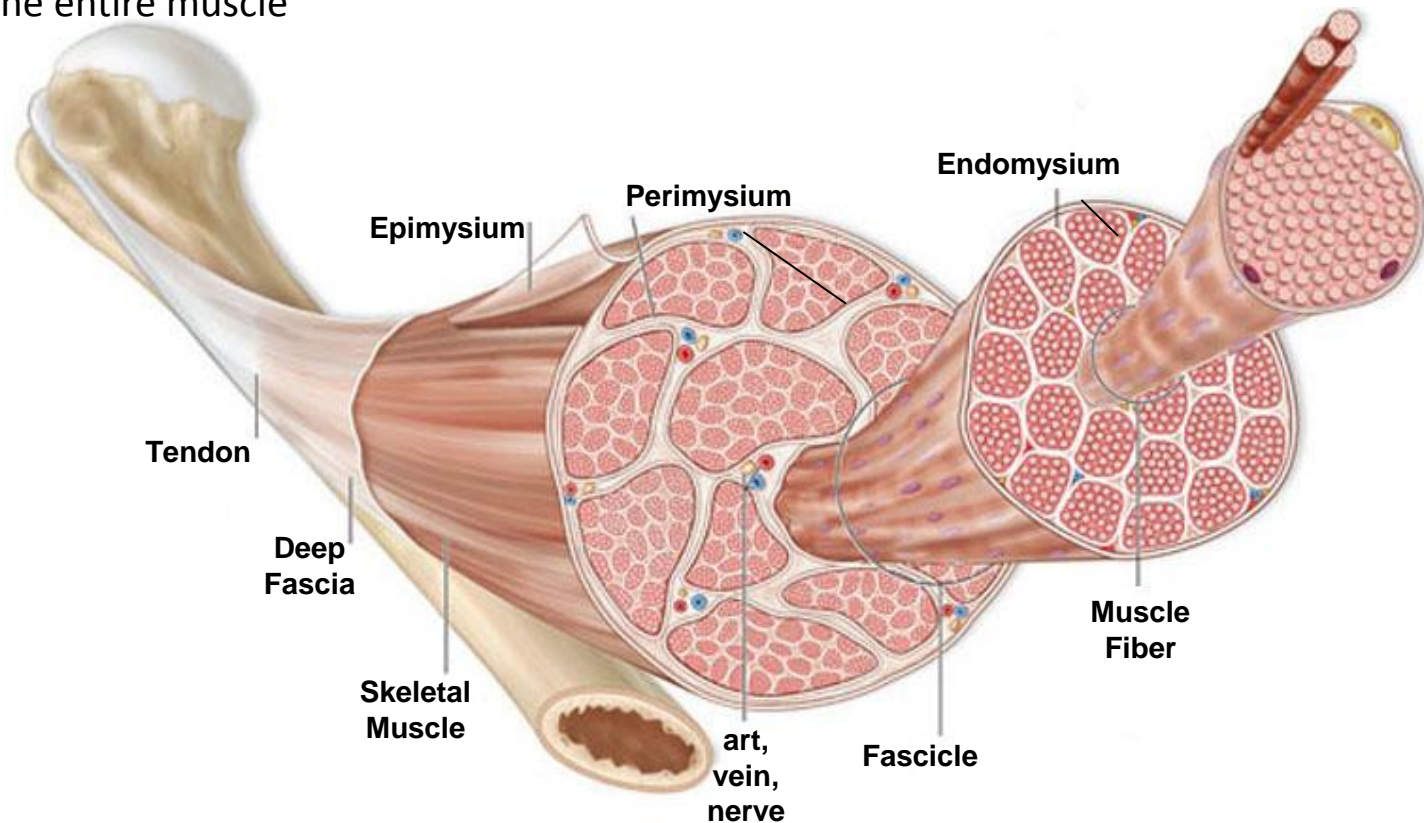
## Perimysium

Thicker layer of CT surrounding a group of fibers to form a bundle (functional unit)

Larger blood vessels & nerves

## Epimysium

Surrounds the entire muscle



# Muscle is classified according to the appearance of the contractile cells.

## - Two principal types of muscle

- Striated muscle

- Skeletal

- Attached to bone, extraocular muscles

- Visceral

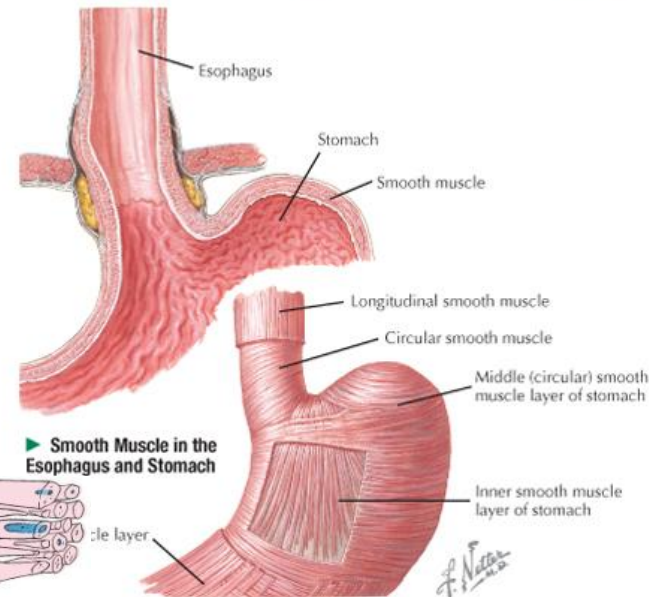
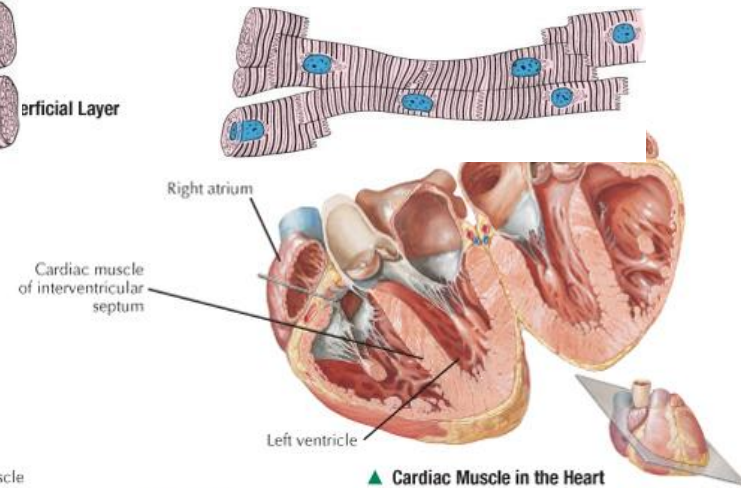
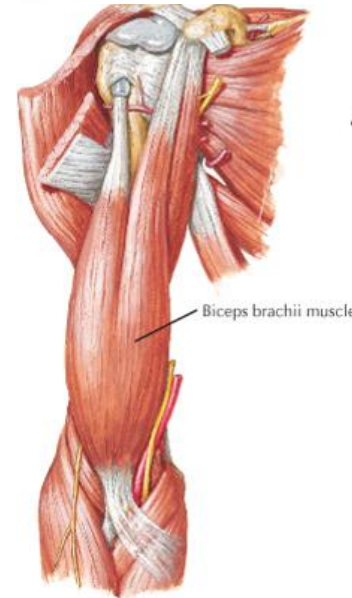
- Tongue, pharynx diaphragm

- Cardiac

- Walls of heart, base of veins entering heart

- Smooth muscle

- In viscera, vascular system, arrector pili of skin, intrinsic muscles of eye



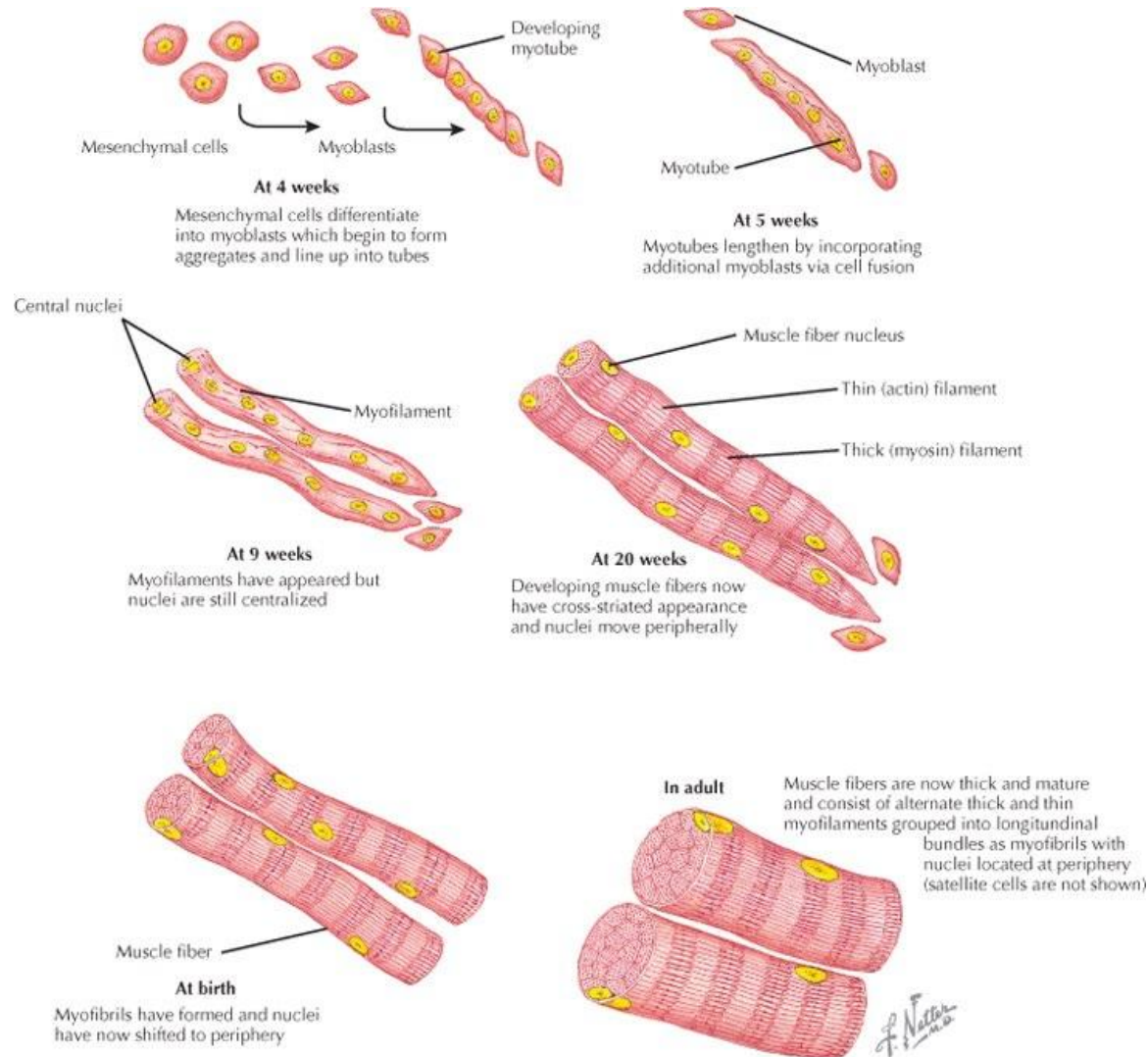
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# A skeletal muscle cell is a multinucleated syncytium.

## - Muscle fibers

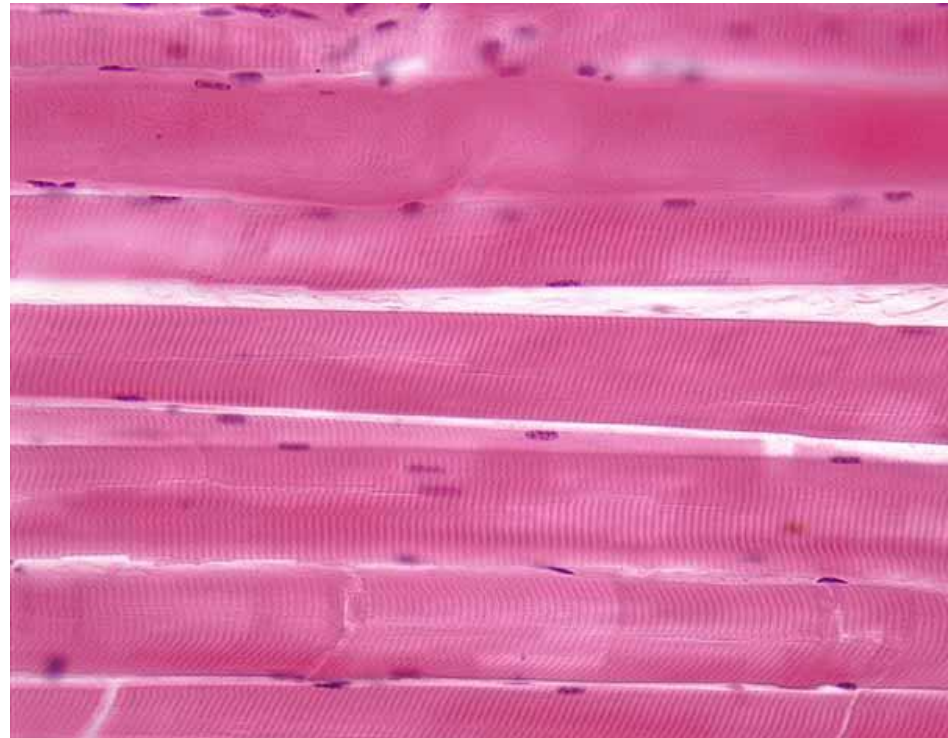
- Formed by fusion of small individual muscle cells called myoblasts
- These cells line up and form tubes of cells aggregates
- Myofilaments appear and nuclei are centralized
- Developing fibers thicken, mature forming alternating rows of thick and thin myofilaments
- Nuclei get shifted to the periphery



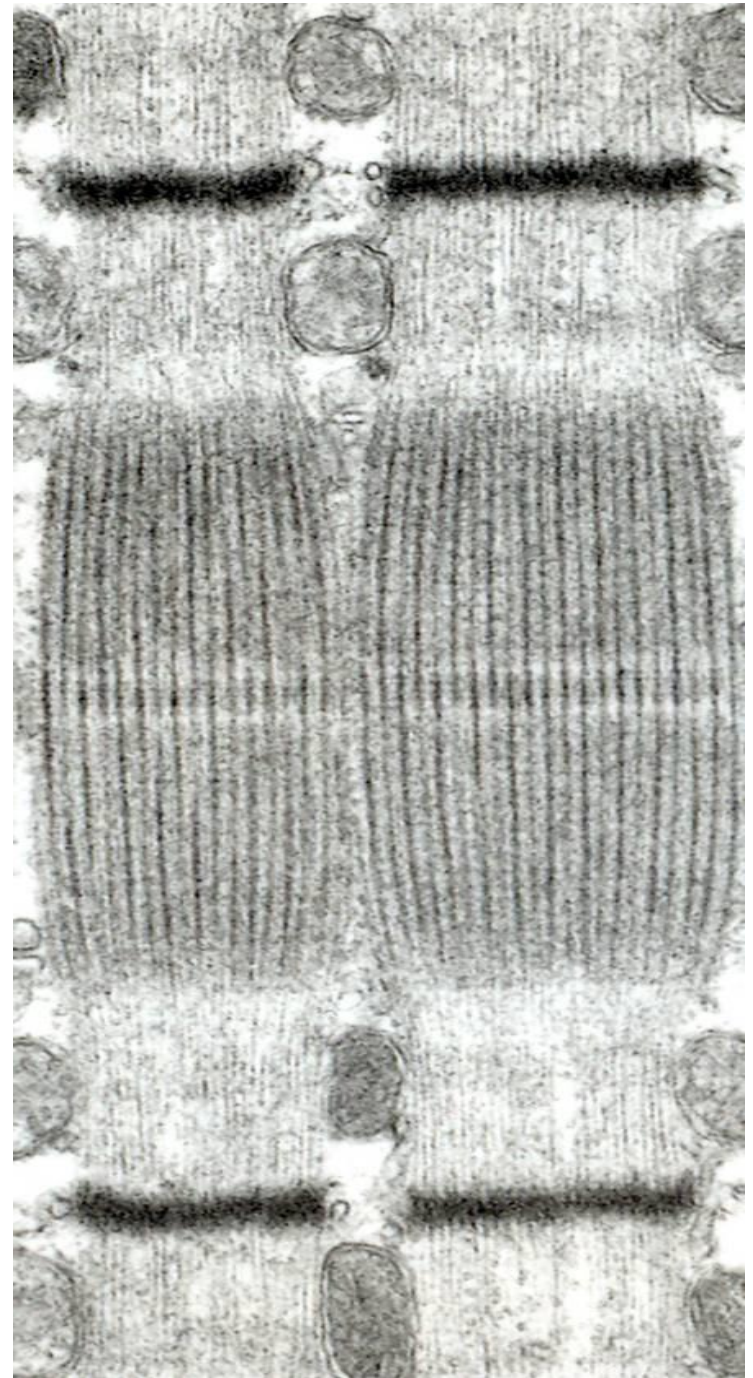
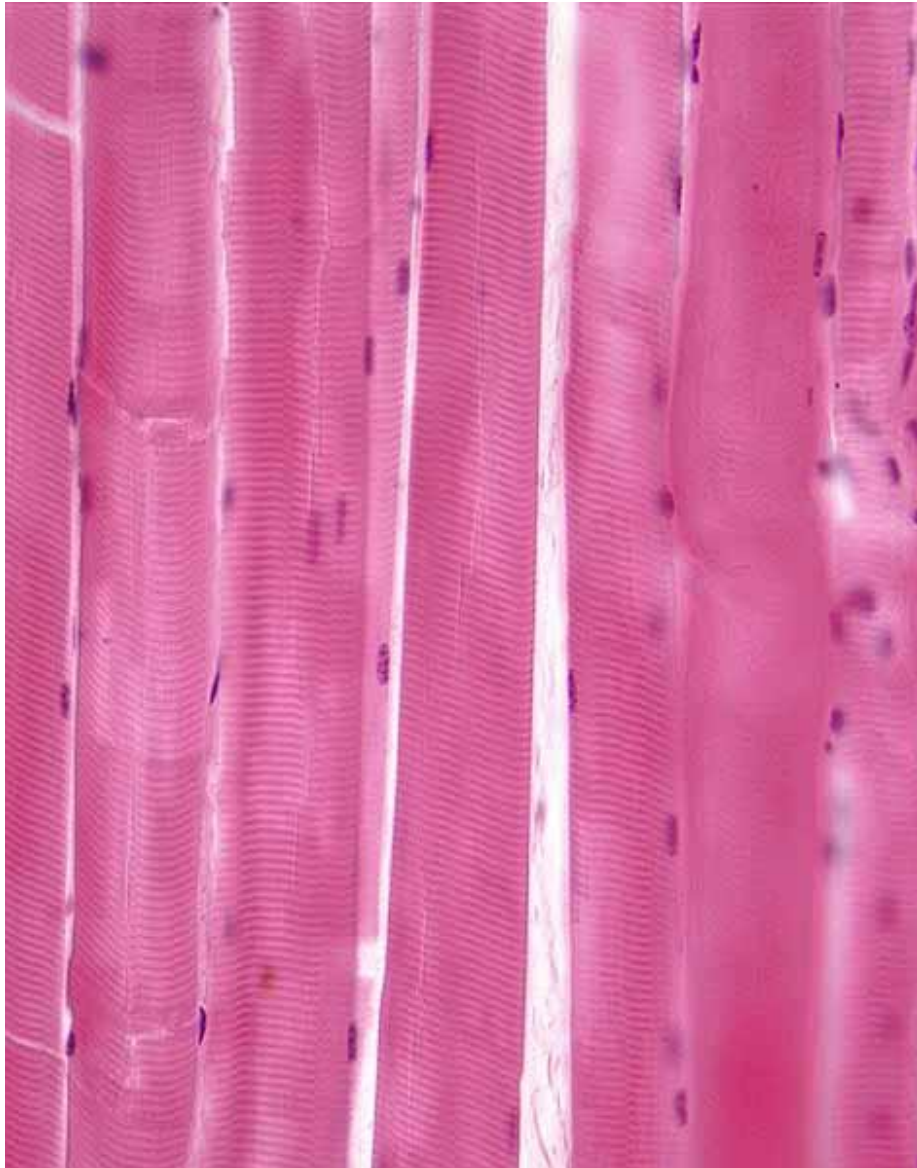
# Skeletal muscle

## Skeletal muscle

- Striated, voluntary, multinucleated cells, arranged in long, cylindrical cells
- Function:
  - Voluntary movement;
    - locomotion;
    - manipulation of the environment;
    - facial expression;
      - » voluntary control
- Location
  - Attached to bones or sometimes skin

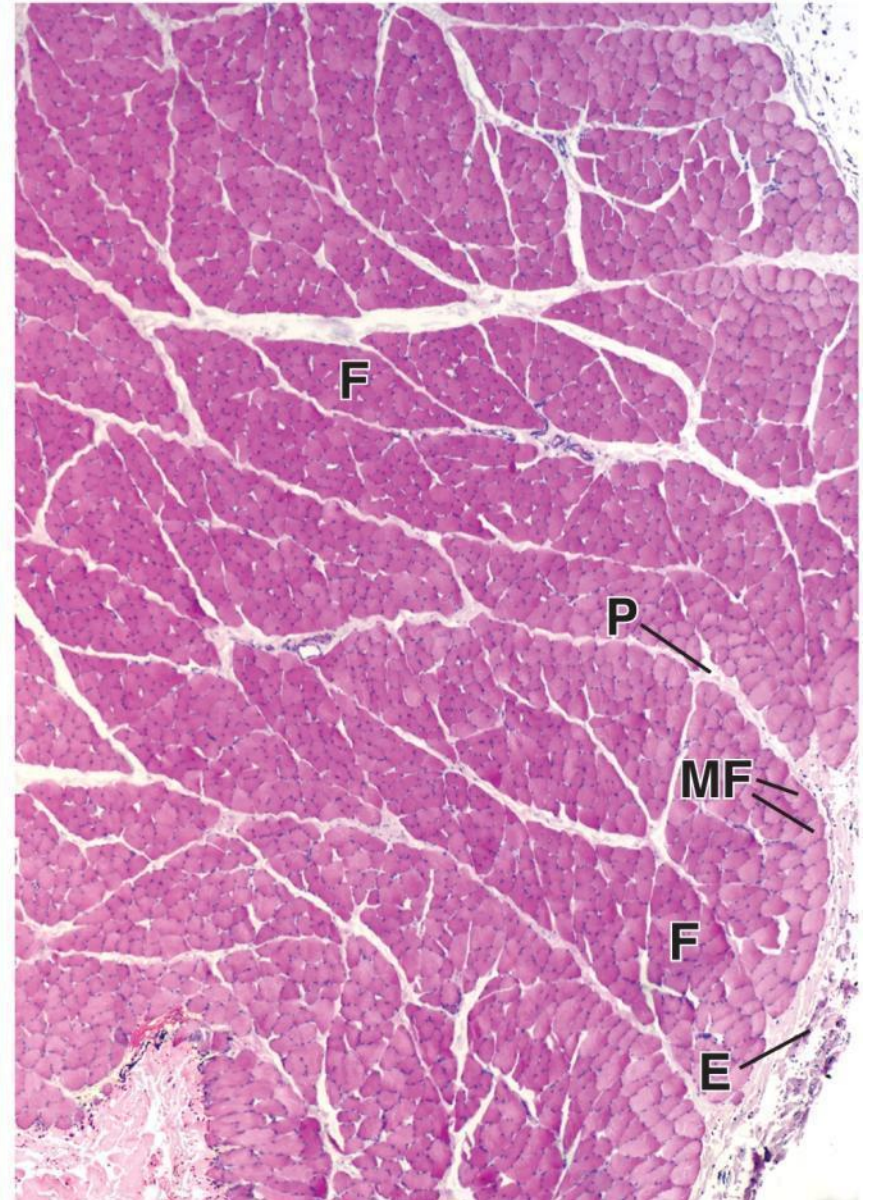
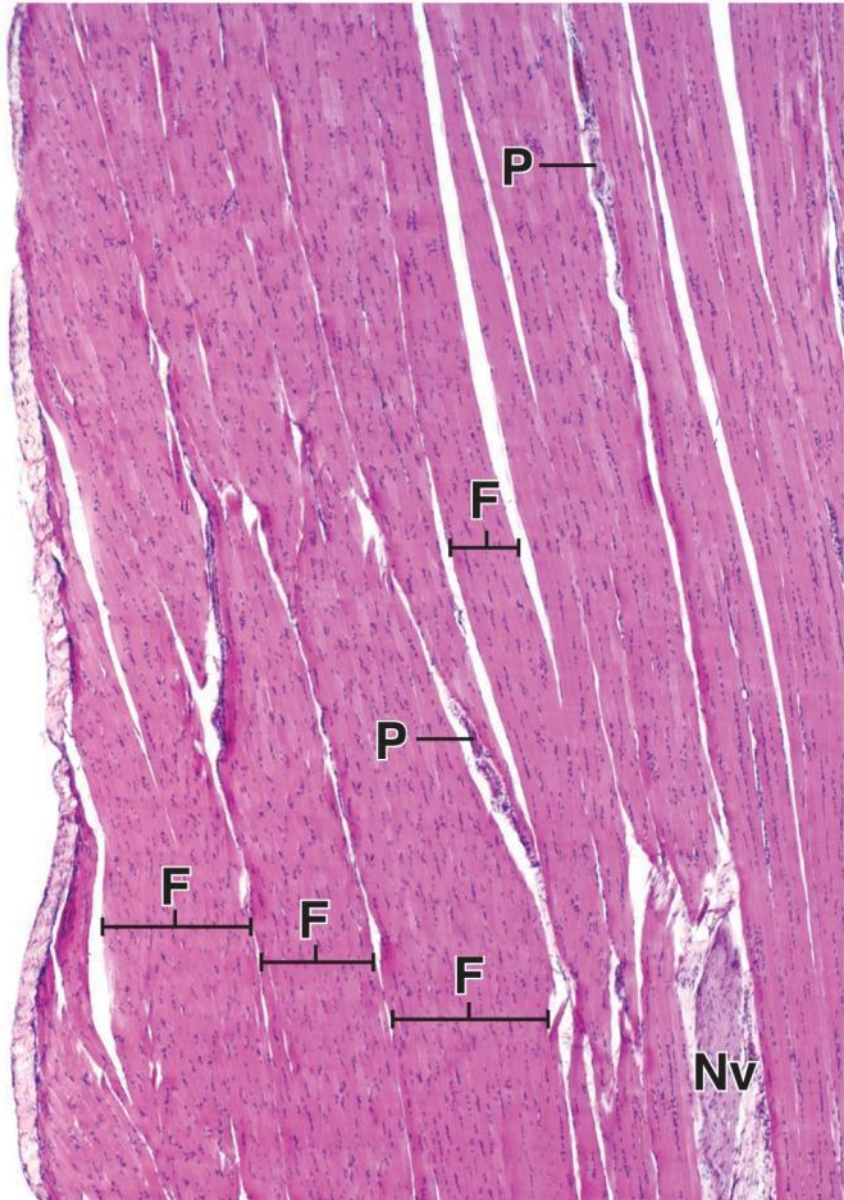


# Skeletal Muscle



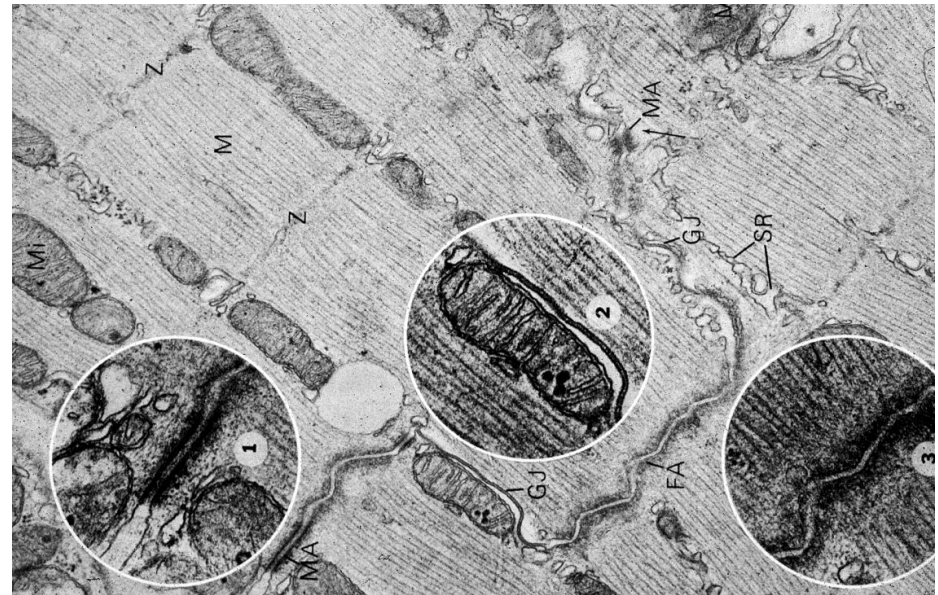


# Skeletal Muscle



# Cardiac muscle

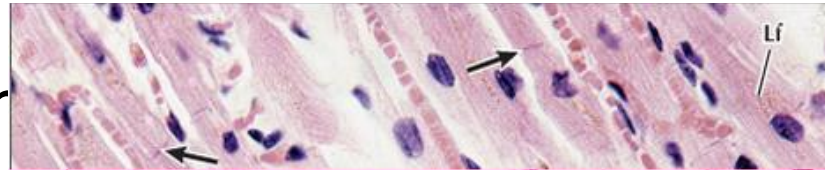
- Striated
- Involuntary
- Uninucleate (usually)
- Interconnected cells
- Arranged in branches
- Connected by specialized junctions called intercalated discs
- Location
  - The walls of the heart





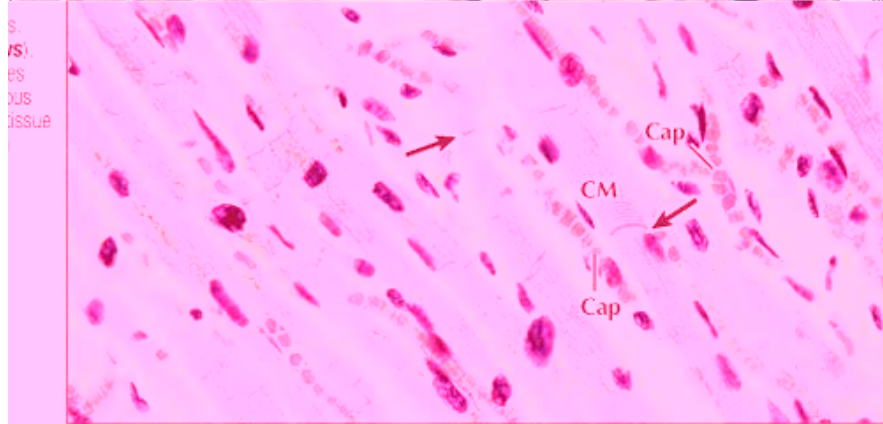
# The cardiac muscle nucleus lies in the center of the cell.

## - Rich in mitochondria



### ◀ Longitudinal section of cardiac muscle

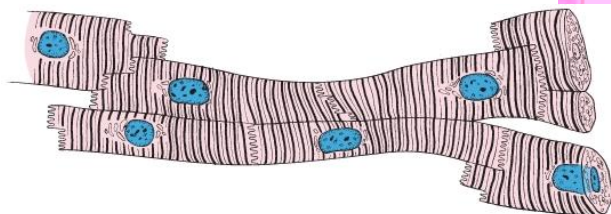
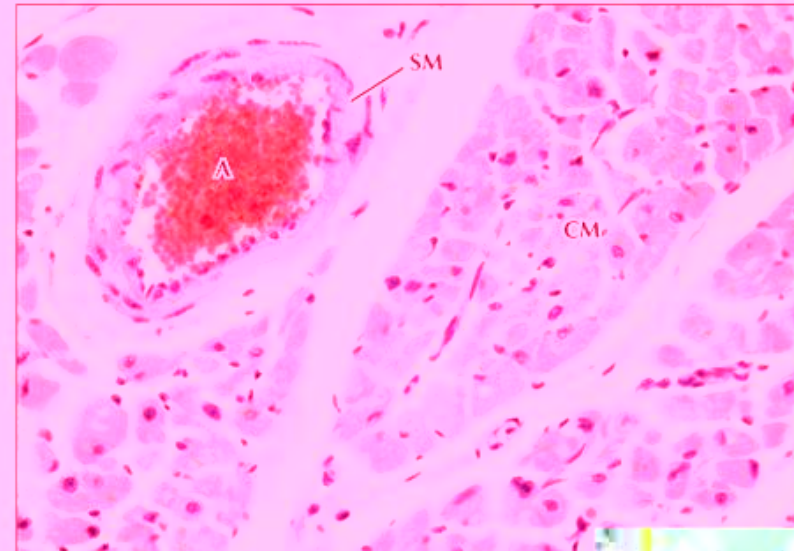
Cardiac muscle fibers (CM) are branched and contain a single, centrally placed nucleus. In some cells, lipofuscin (Lf) pigment is concentrated at the nuclear poles. The cells are eosinophilic and contain striations.



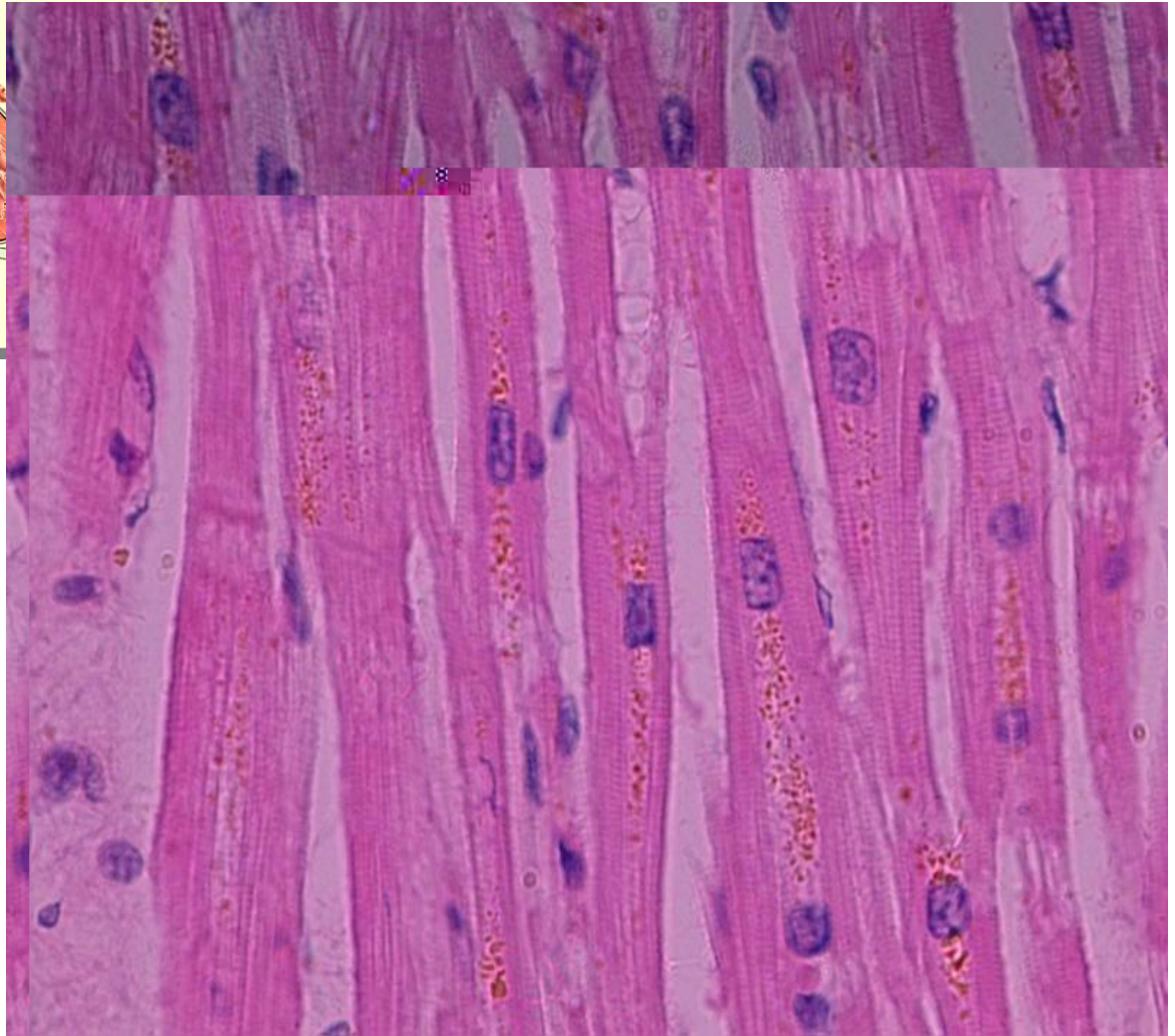
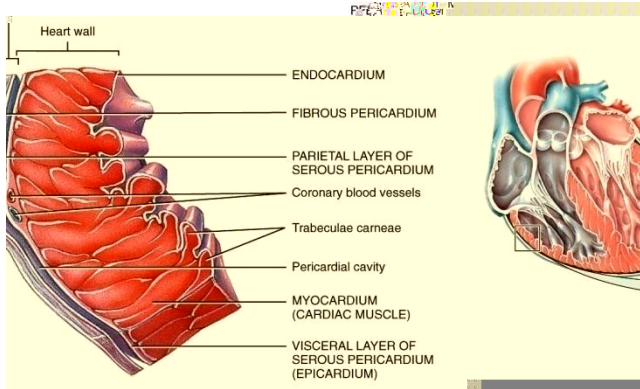
Cells are linked by intercalated discs (arrows) which appear as dark, jagged transverse lines between the cells or their branches. Numerous capillaries (Cap) in surrounding connective tissue form an extensive, branching network. Located close to the muscle fibers, many capillaries can be identified by erythrocyte content. 475x. H&E

### ▶ Transverse section of cardiac muscle.

The irregularly shaped cardiac muscle cells (CM) are grouped in bundles and surrounded by richly vascularized connective tissue. When in the plane of section, nuclei occupy a central position in the cells. An arteriole (A) filled with erythrocytes occupies the interstitial connective tissue. Smooth muscle (SM) is seen in the wall of the arteriole. 440x. H&E.

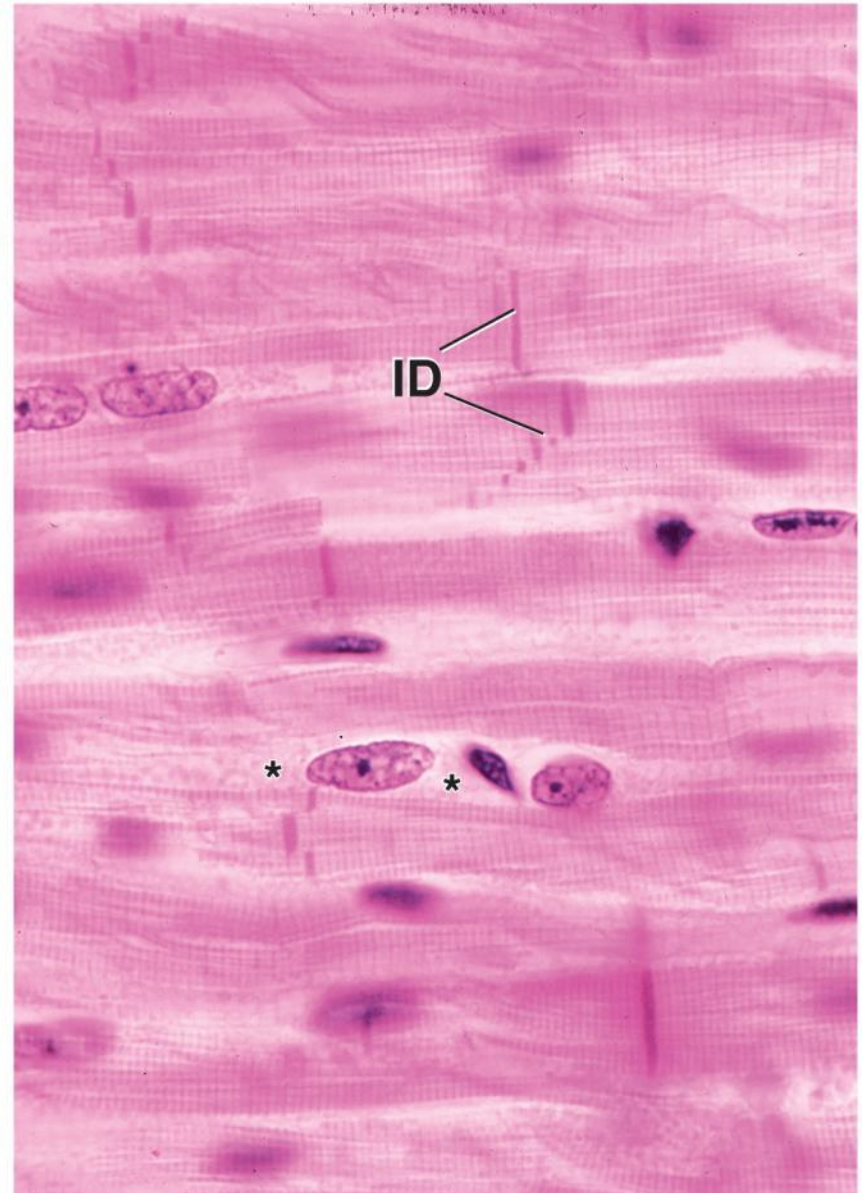
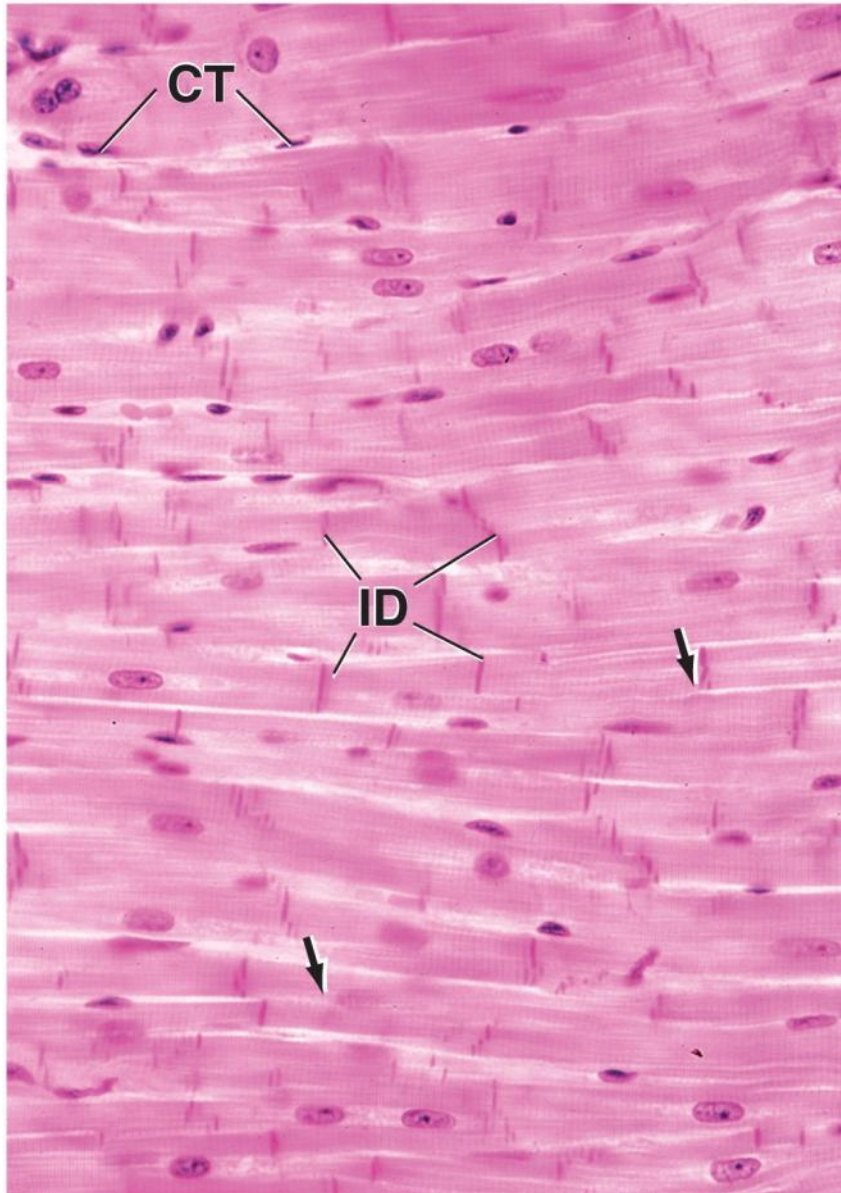


# Internal Anatomy - Myocardium

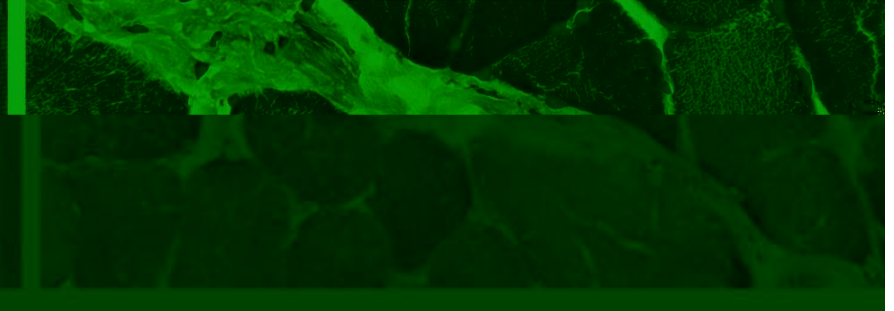
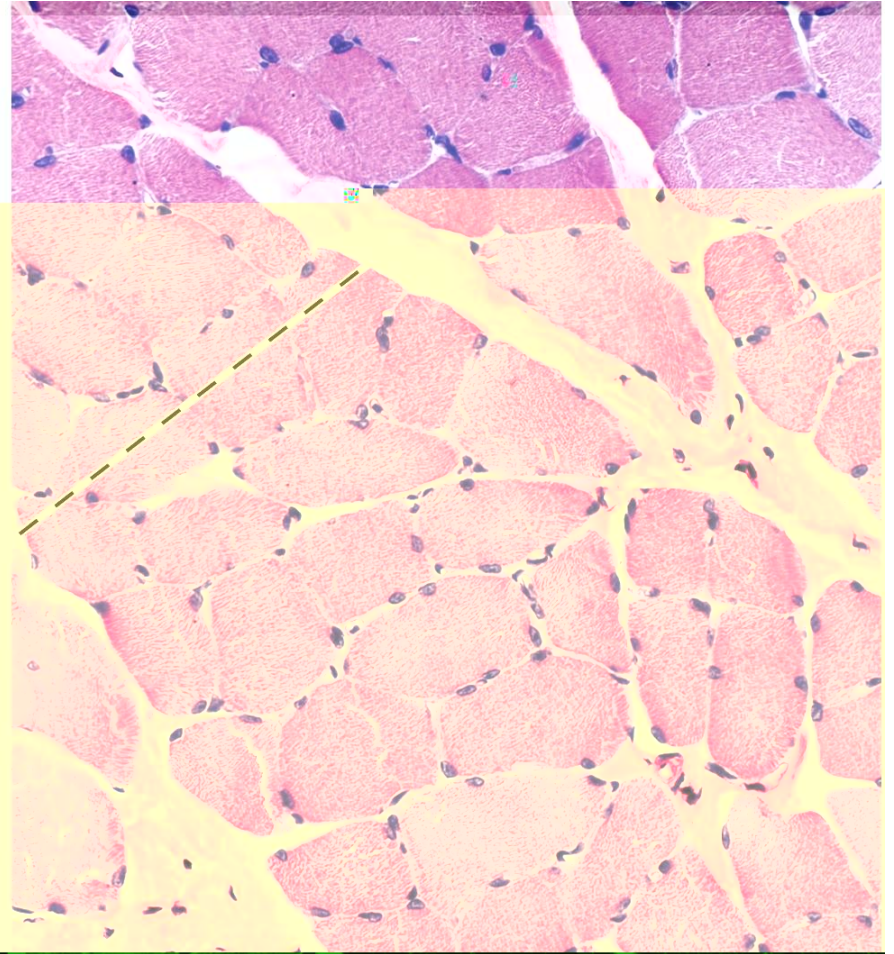
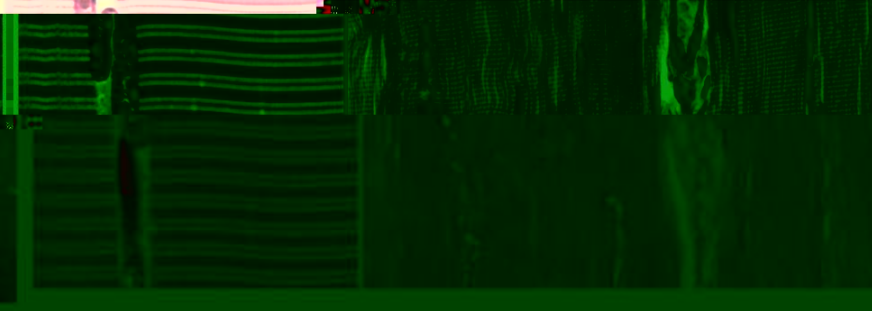
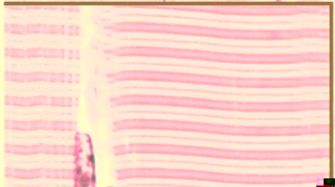
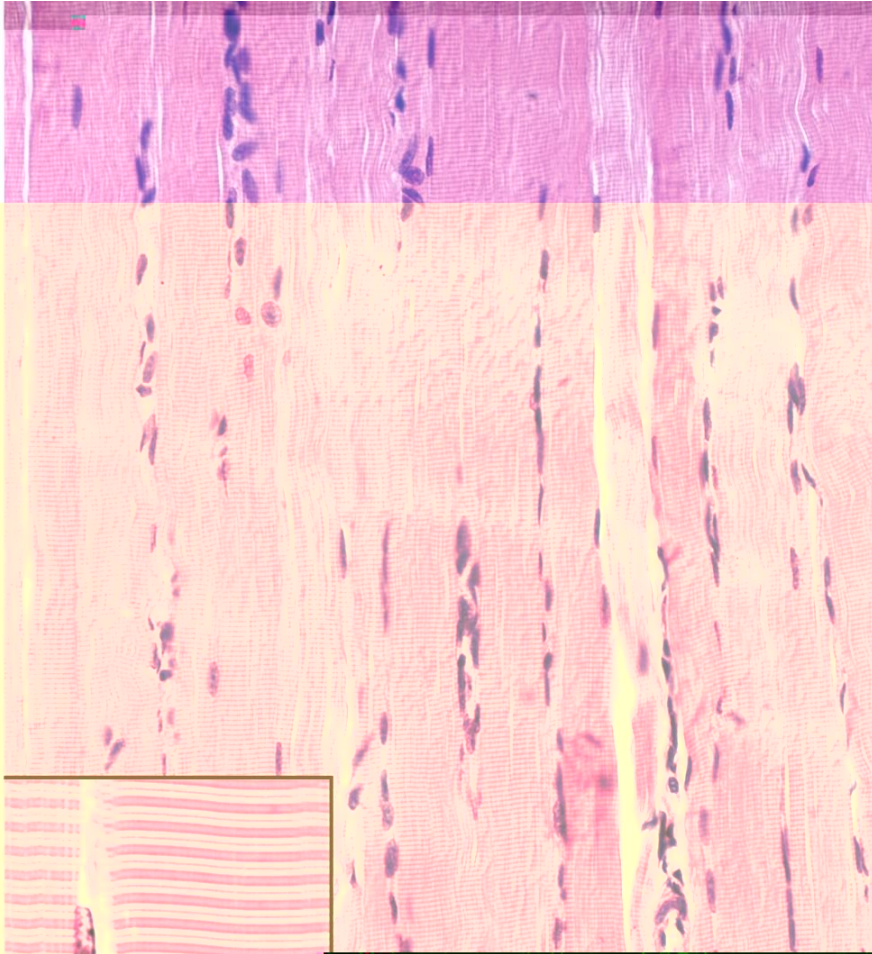




# Cardiac Muscle

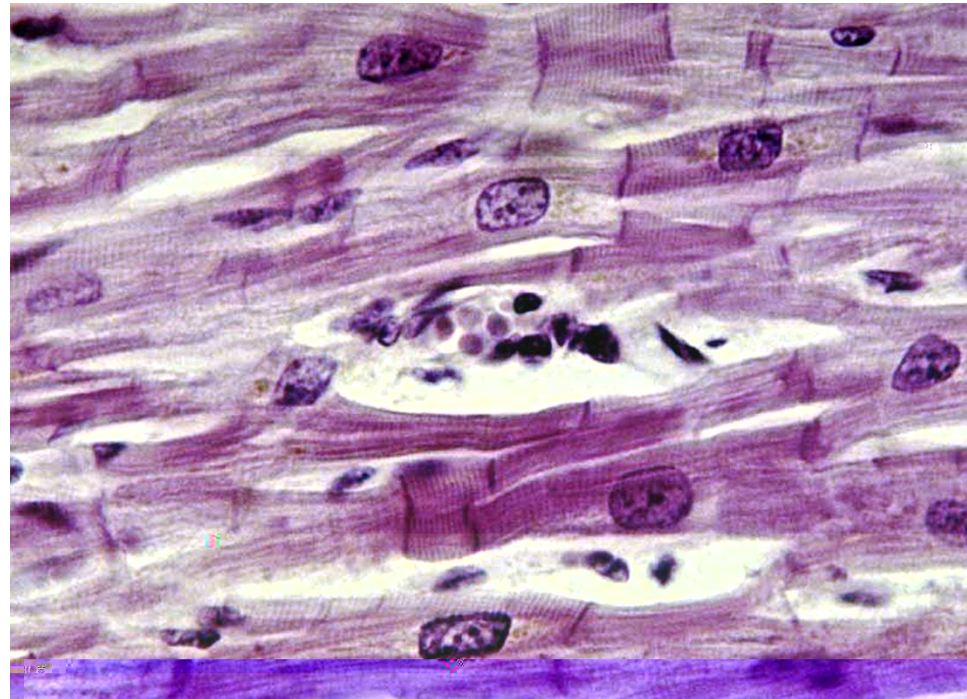
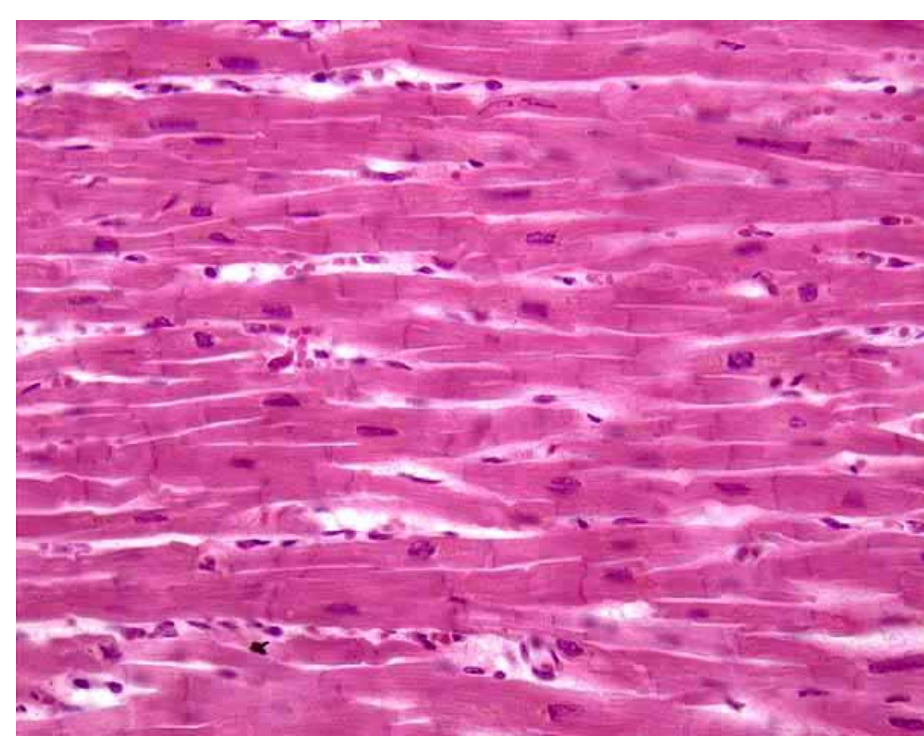






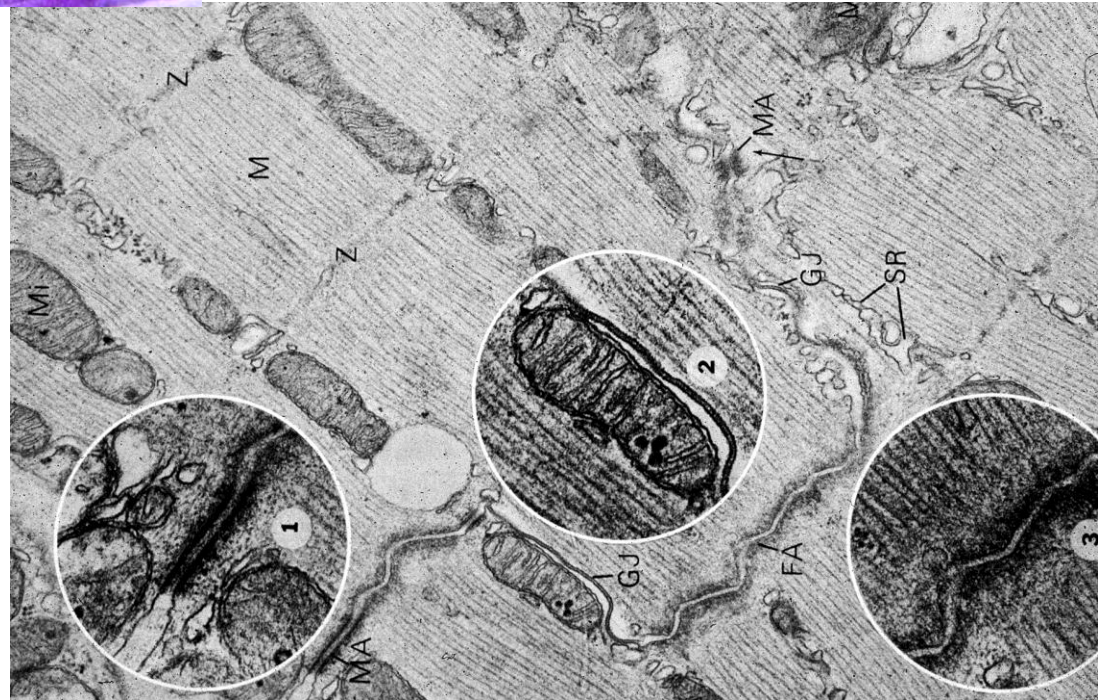
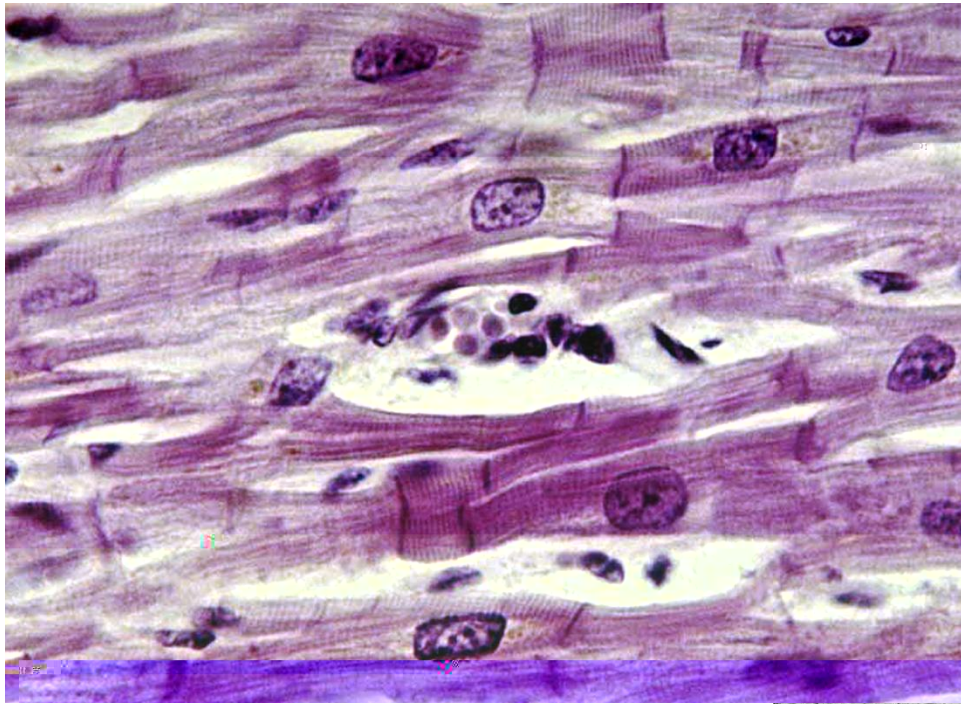


# Cardiac Muscle





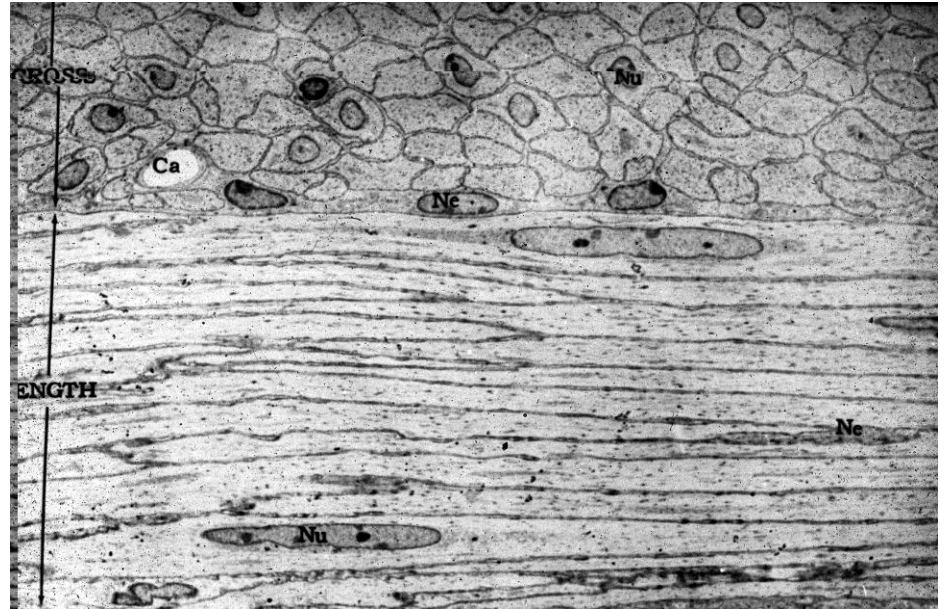
# Cardiac Muscle





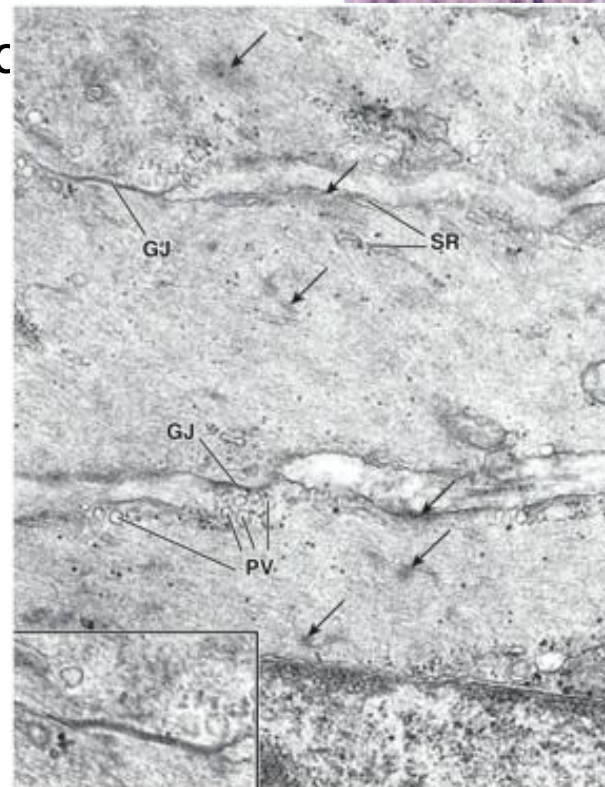
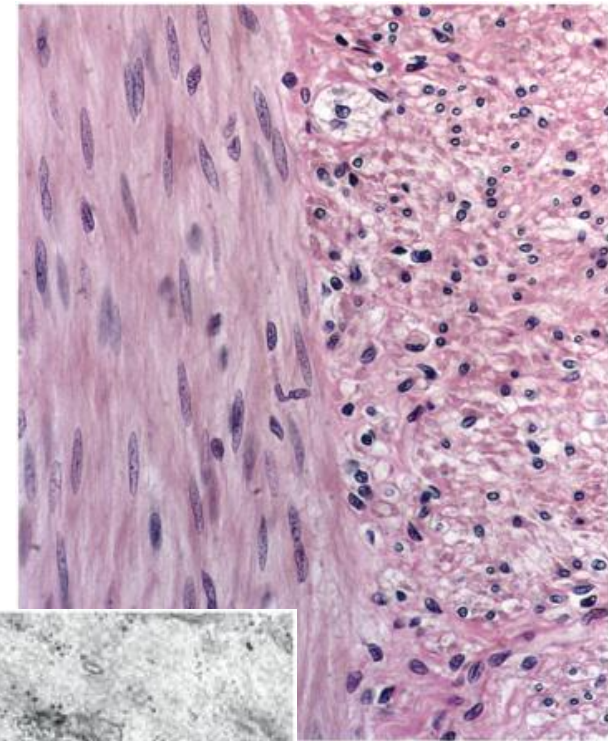
# Smooth muscle

- Nonstriated
- Involuntary
- Uninucleated
- Spindle-shaped cells
- Location
  - Mostly in the walls of hollow organs

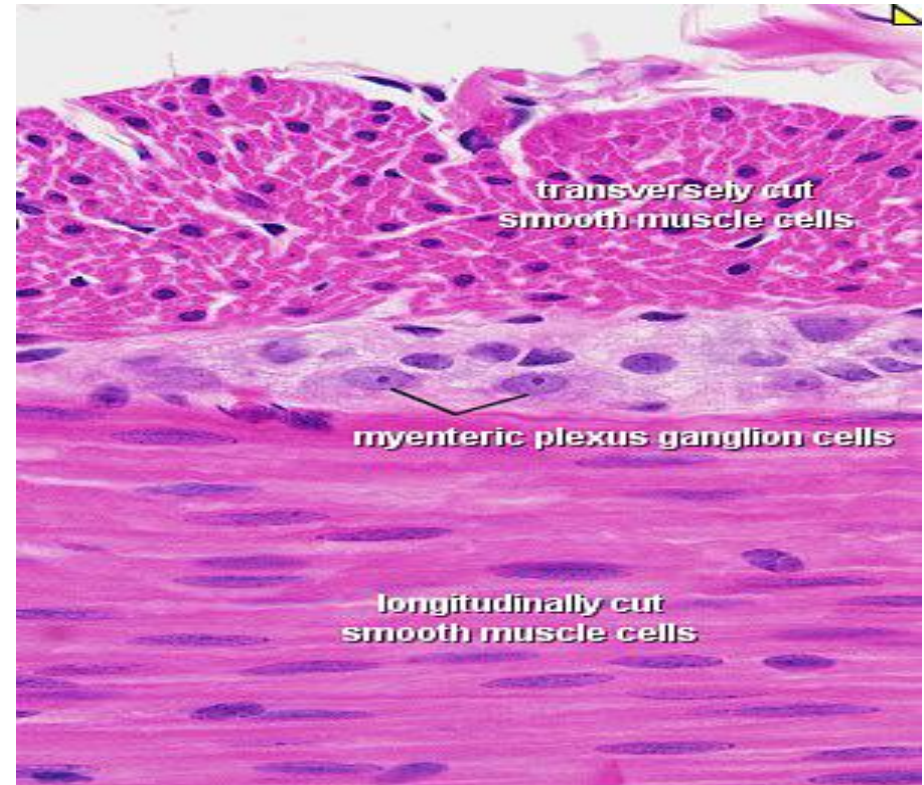
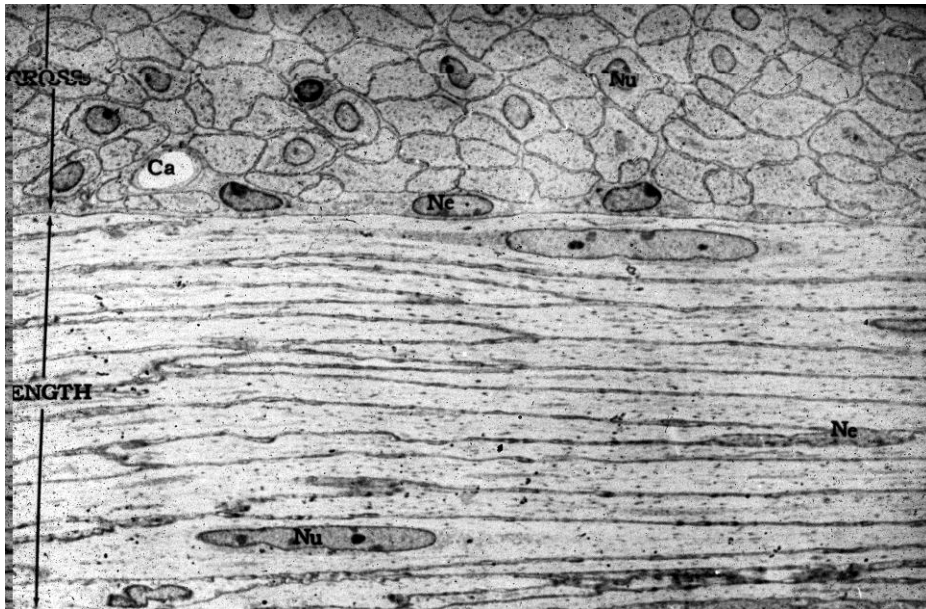


## Smooth Muscle

- Bundles or sheets of elongated cells that taper at the ends
- Fibers
  - Walls of small blood vessels
  - Wall of intestine
  - Wall of uterus during pregnancy
- Gap junctions
- Nuclei in center of cell
- Myofilaments
- Sarcoplasmic reticulum
- Pinocytotic vesicles



# Smooth muscle





# Smooth Muscle



# Lecture Objectives

- Muscles
  - What are muscles?
  - How can we classify/Name them?
  - What is their function?
- Musculoskeletal system
  - Components?
  - How does this system work?
- Histological slides