The Muscular System

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Introduction

- The human body has more than 600 individual muscles
- Muscles cause bones and supported structures to move by alternating between contraction and relaxation

Functions of Muscles

- Muscle has the ability to contract, permitting muscles to perform various functions

- Functions:
  - Movement
  - Stability
  - Control of body openings and passages
  - Heat production

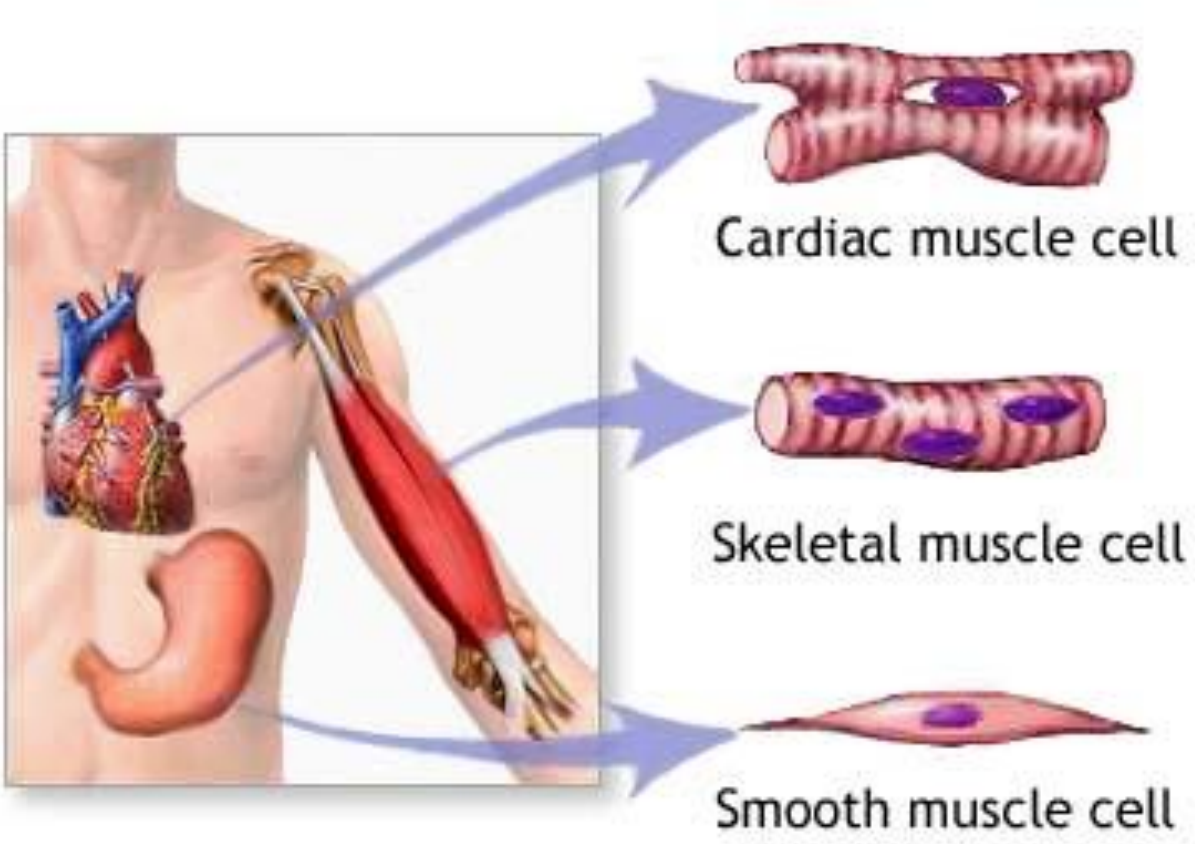
Characteristics of Muscles

- Muscle cells are elongated (muscle cell = muscle fiber)
- Contraction of a muscle is due to movement of ***myofilaments*** (protein fibers)
- All muscles share some terminology
  - Prefix *myo* refers to muscle
  - Prefix *mys* refers to muscle

Types of Muscles

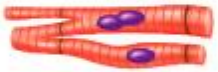
- 3 basic muscle types are found in the body
  - Skeletal muscle
  - Cardiac muscle
  - Smooth muscle

Types of Muscles



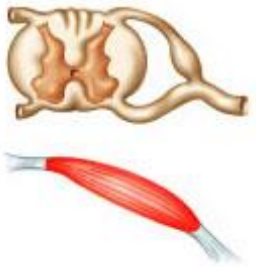
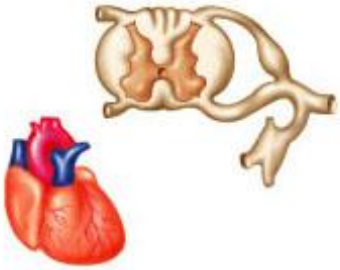
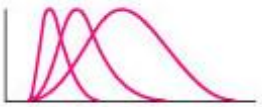
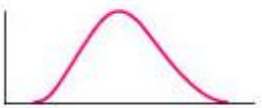
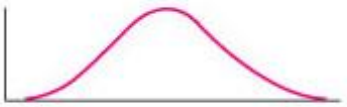
Comparison of Types of Muscle

Table 6.1 Comparison of Skeletal, Cardiac, and Smooth Muscles

Characteristic	Skeletal	Cardiac	Smooth
Body location	 Attached to bones or, for some facial muscles, to skin	 Walls of the heart	 Mostly in walls of hollow visceral organs (other than the heart)
Cell shape and appearance	 Single, very long, cylindrical, multinucleate cells with very obvious striations	 Branching chains of cells; uninucleate, striations	 Single, fusiform, uninucleate; no striations

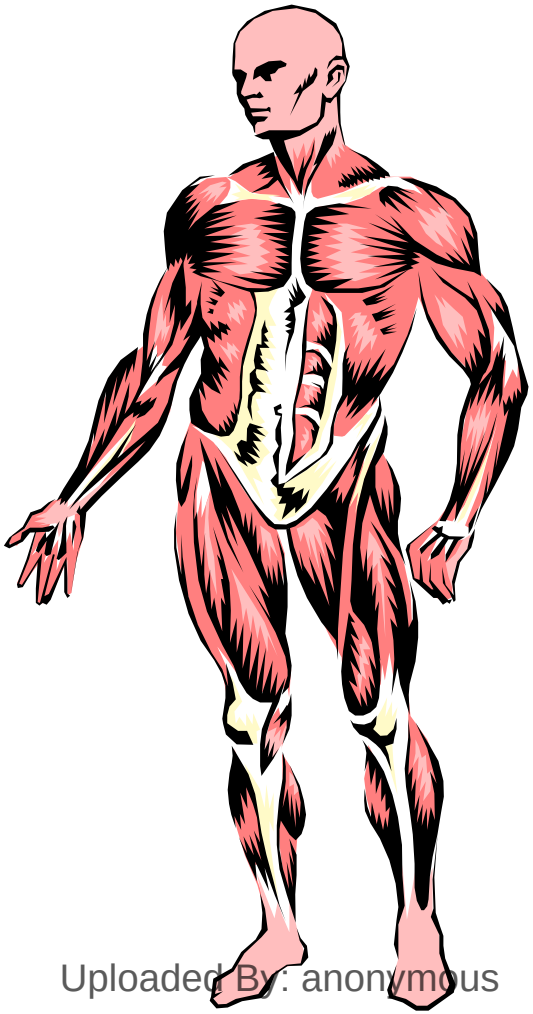
Types of Muscle, cont.

Table 6.1 Comparison of Skeletal, Cardiac, and Smooth Muscles

Characteristic	Skeletal	Cardiac	Smooth
Regulation of contraction			
	Voluntary; via nervous system controls	Involuntory; the heart has a pacemaker; also nervous system controls; hormones	Involuntary; nervous system controls; hormones, chemicals, stretch
Speed of contraction			
	Slow to fast	Slow	Very slow
Rhythmic	No	Yes	Yes in some

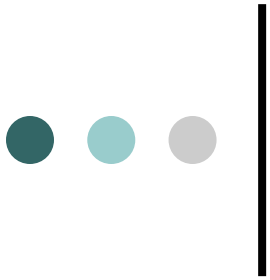
Skeletal Muscles

- The major components of the muscular system

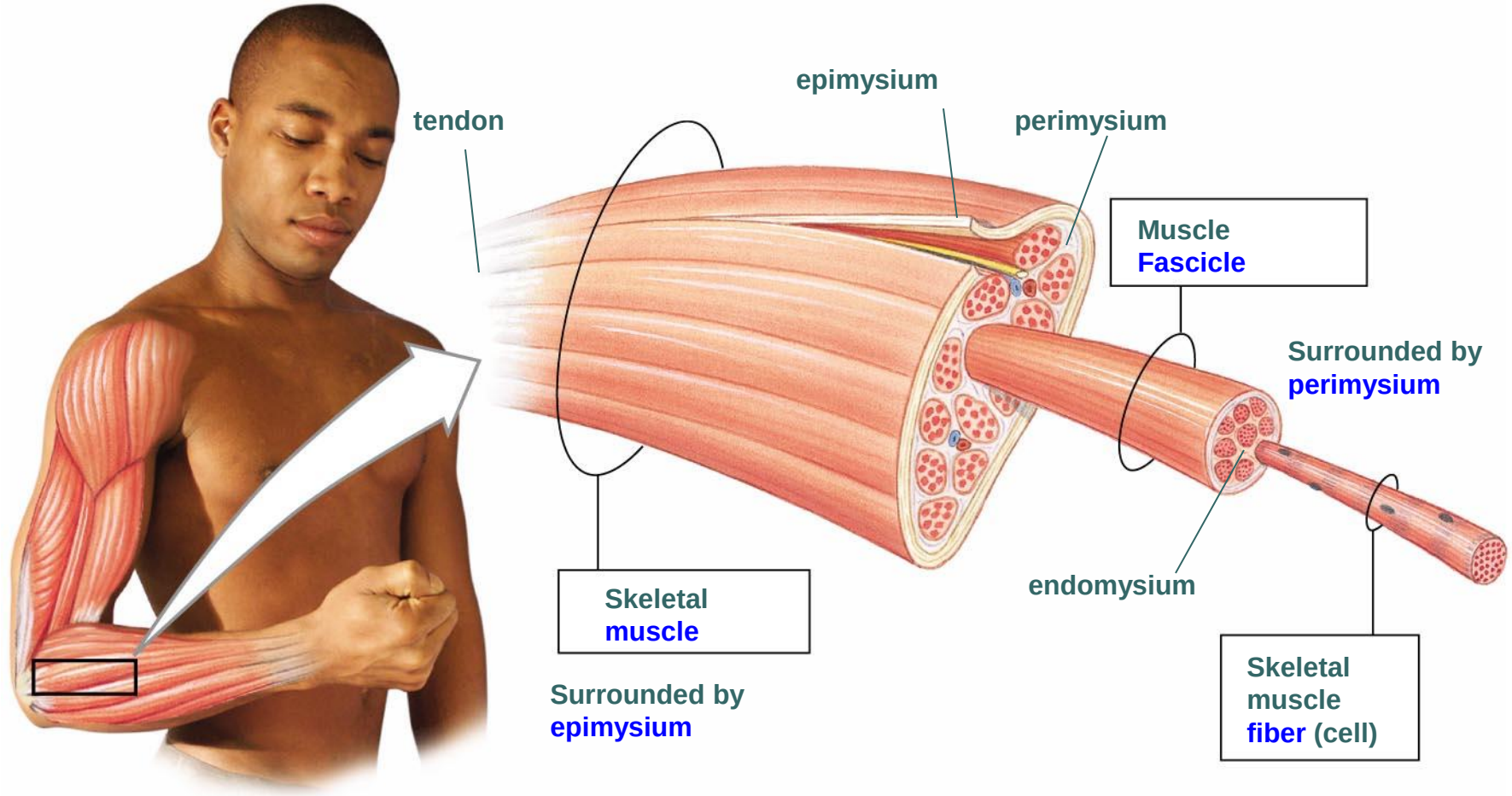


Structure of Skeletal Muscles:
Connective tissue coverings

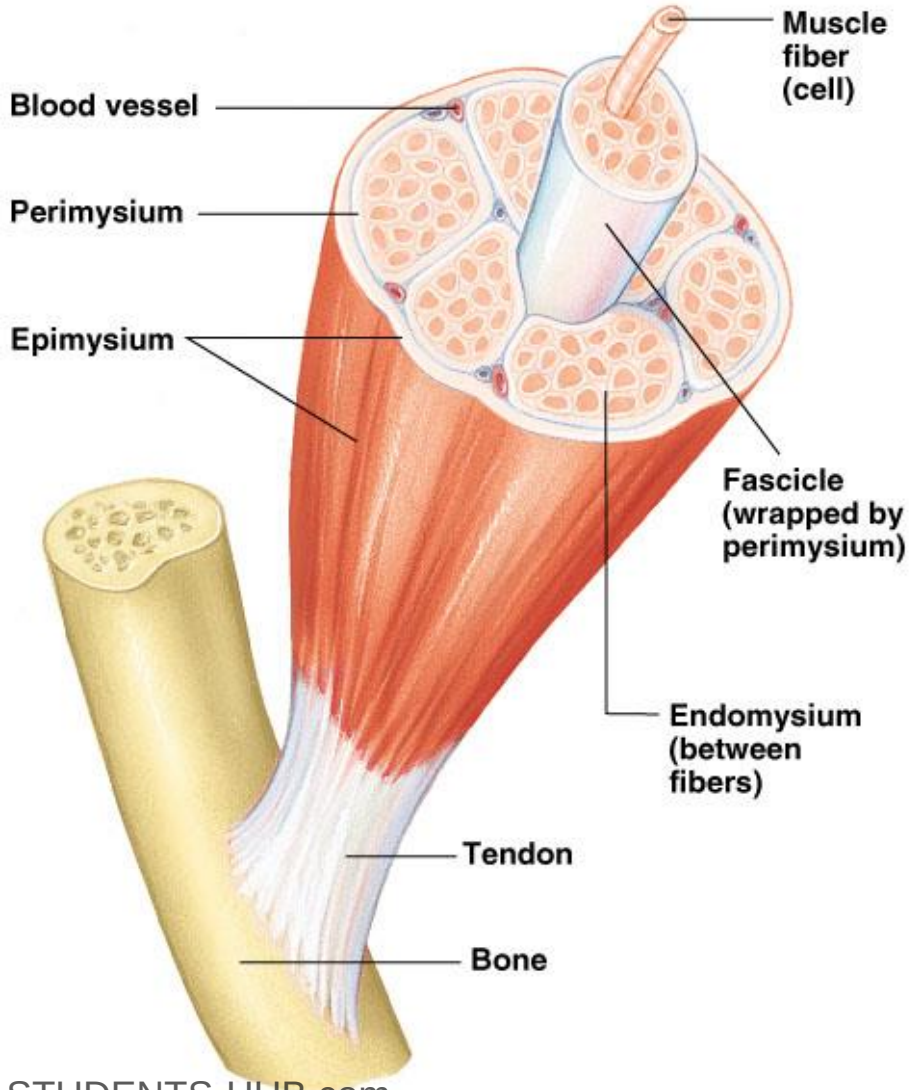
- ***Fascia***
  - Covers entire skeletal muscles
  - Separates them from each other
- ***Tendon***
  - A tough, cord-like structure made of fibrous connective tissue
  - Connects muscles to bones
- ***Aponeurosis***
  - A tough, sheet-like structure made of fibrous connective tissue
  - Attaches muscles to other muscles



Anatomy of skeletal muscles



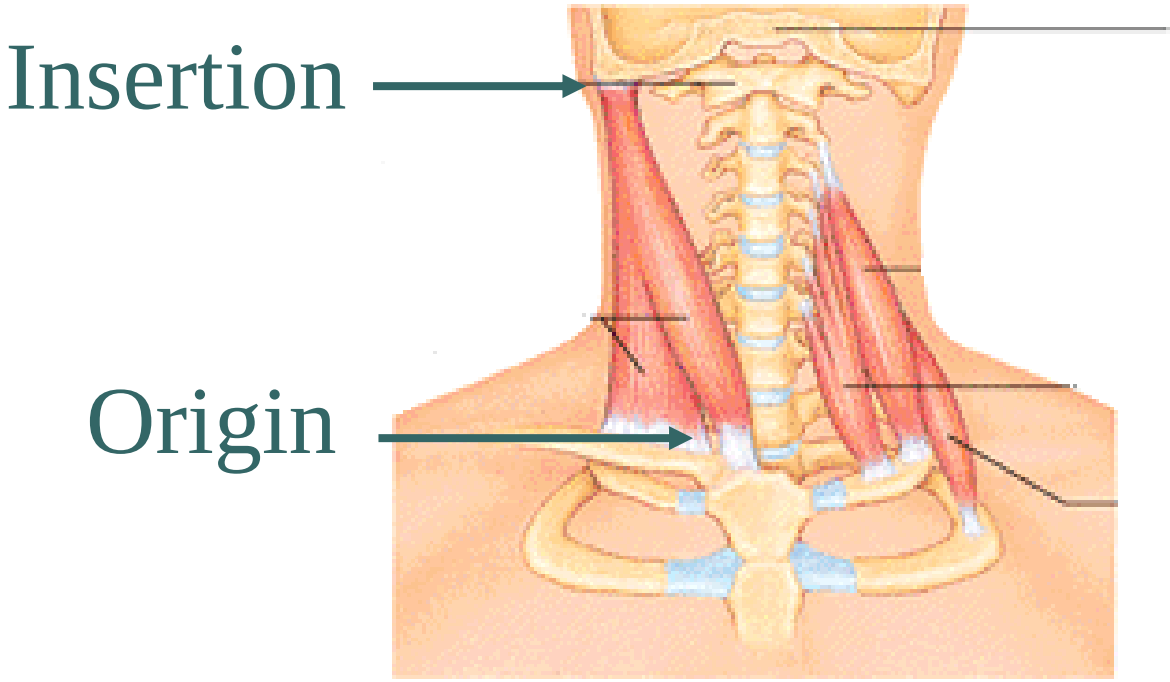
Anatomy of a Muscle Cell



- ***Epimysium***
  - A thin covering that is just below the fascia of a muscle and surrounds the entire muscle
- ***Perimysium***
  - Connective tissue that divides a muscle into sections called ***fascicles***
- ***Endomysium***
  - Covering of connective tissue that surrounds individual muscle cells

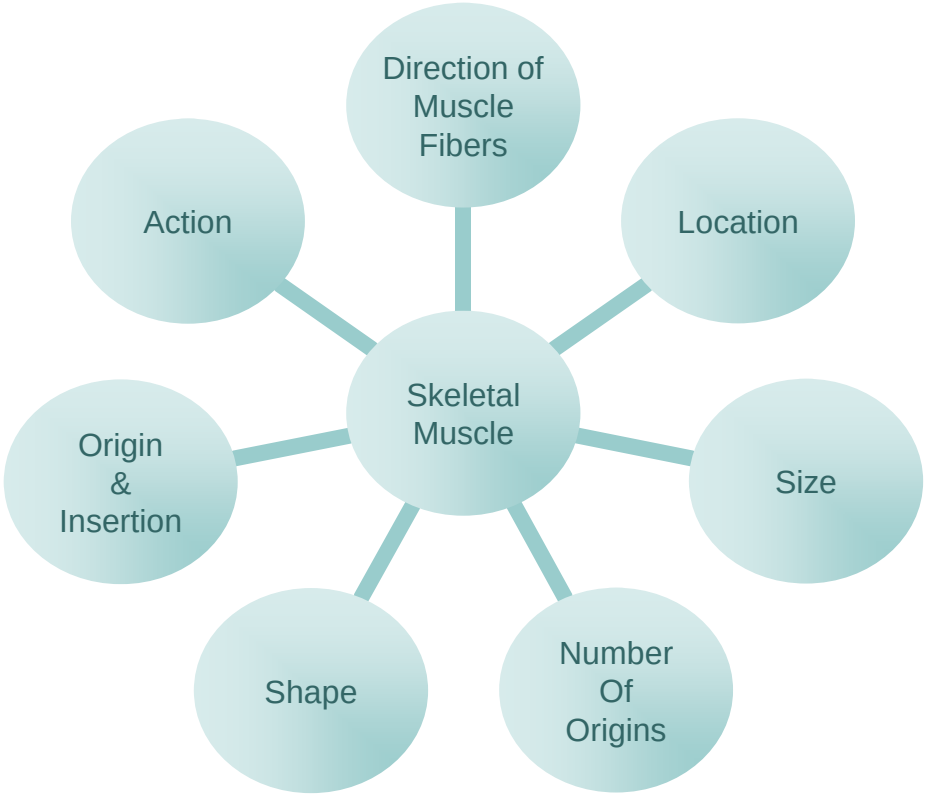
How are muscles attached to bone?

- ***Origin -***
  attachment site that doesn't move during muscle contraction
- ***Insertion -***
  attachment site that moves



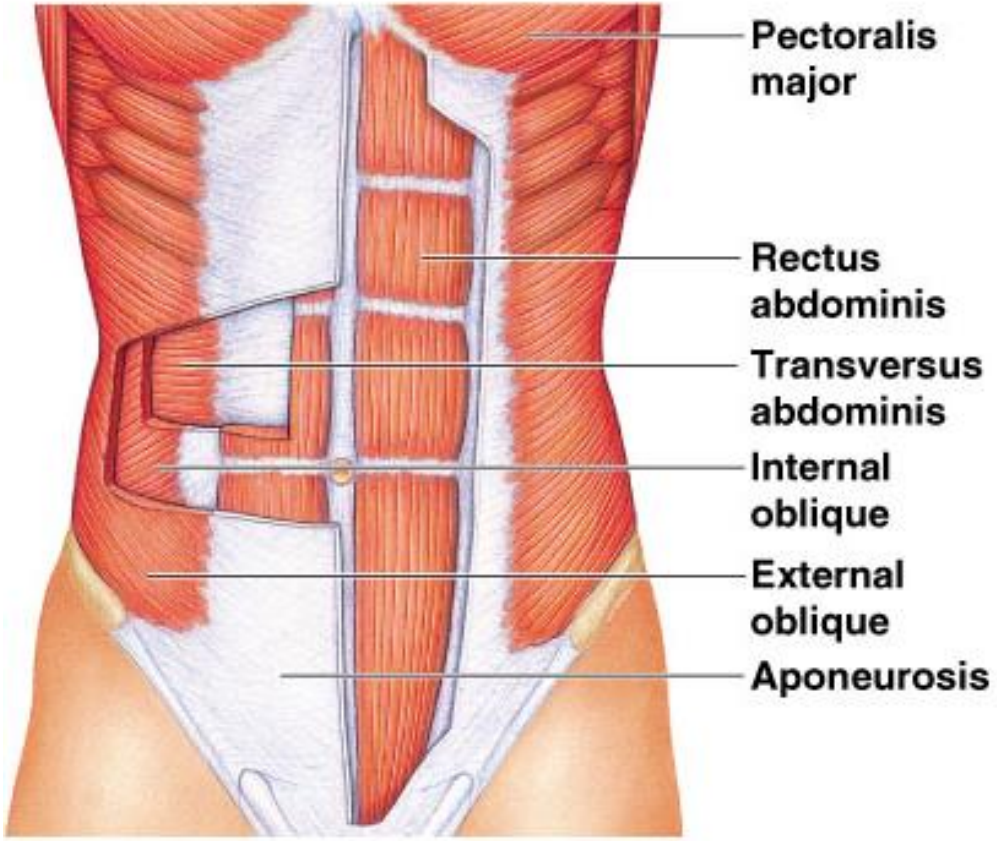
- Muscles are always attached to at least 2 points

Naming Skeletal Muscles



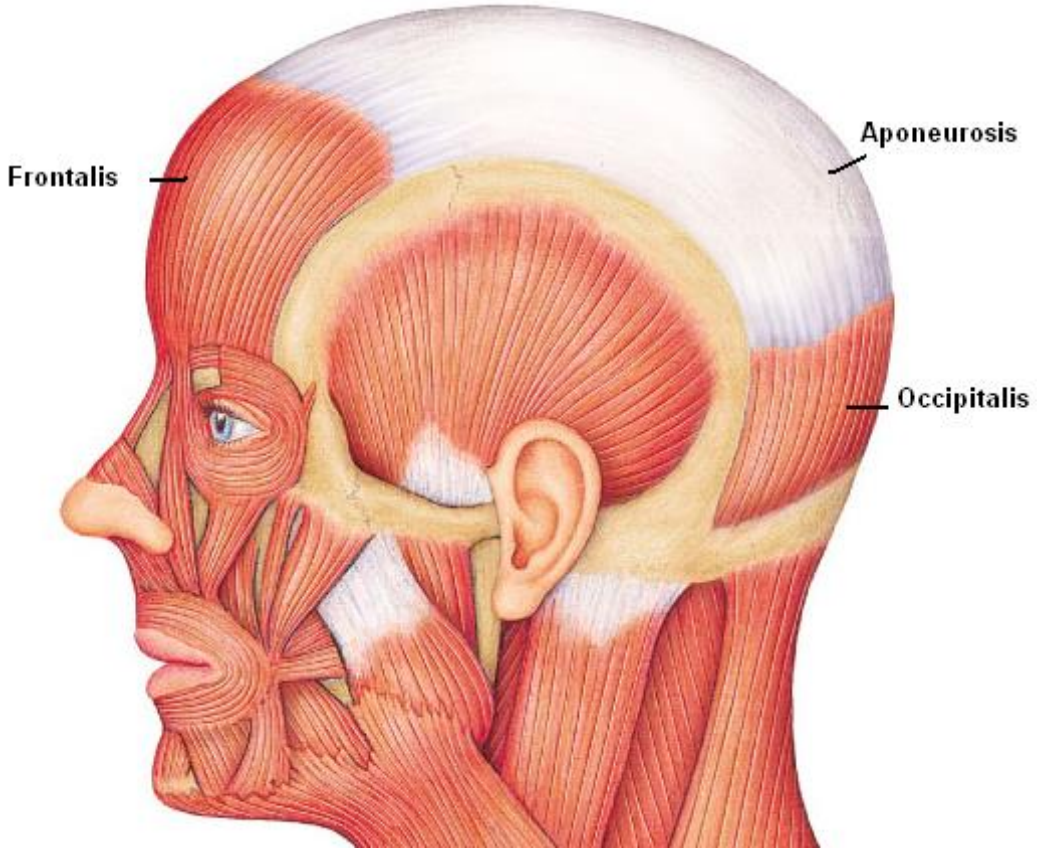
Direction of Muscle Fibers

- Relative to the Midline
- **RECTUS** = parallel to the midline
  - ***Rectus*** *Abdominus*
- **TRANSVERSE** = perpendicular to midline
  - ***Transversus*** *Abdominus*
- **OBLIQUE** = diagonal to midline
  - *External* ***Oblique***



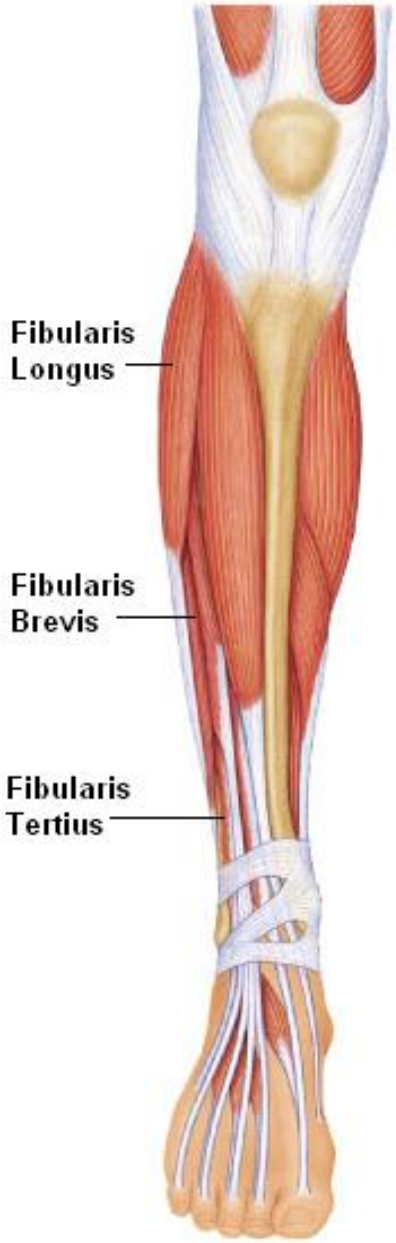
Location

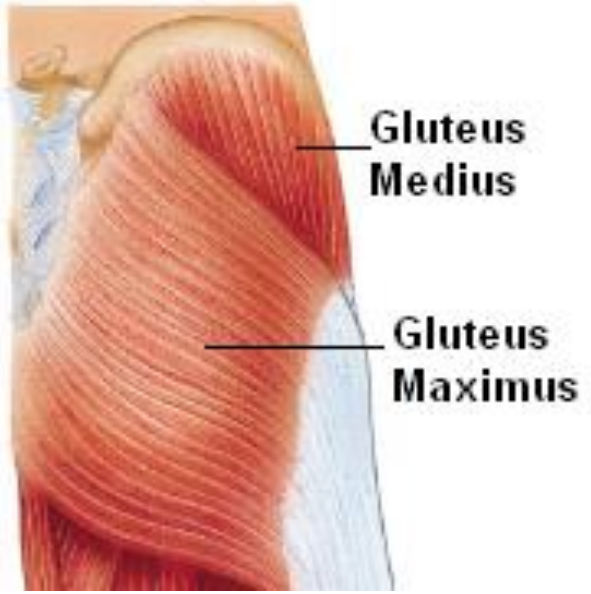
- Structure near which muscle is found
  - ***FRONTALIS*** = near FRONTAL bone
  - ***OCCIPITALIS*** = near OCCIPITAL bone

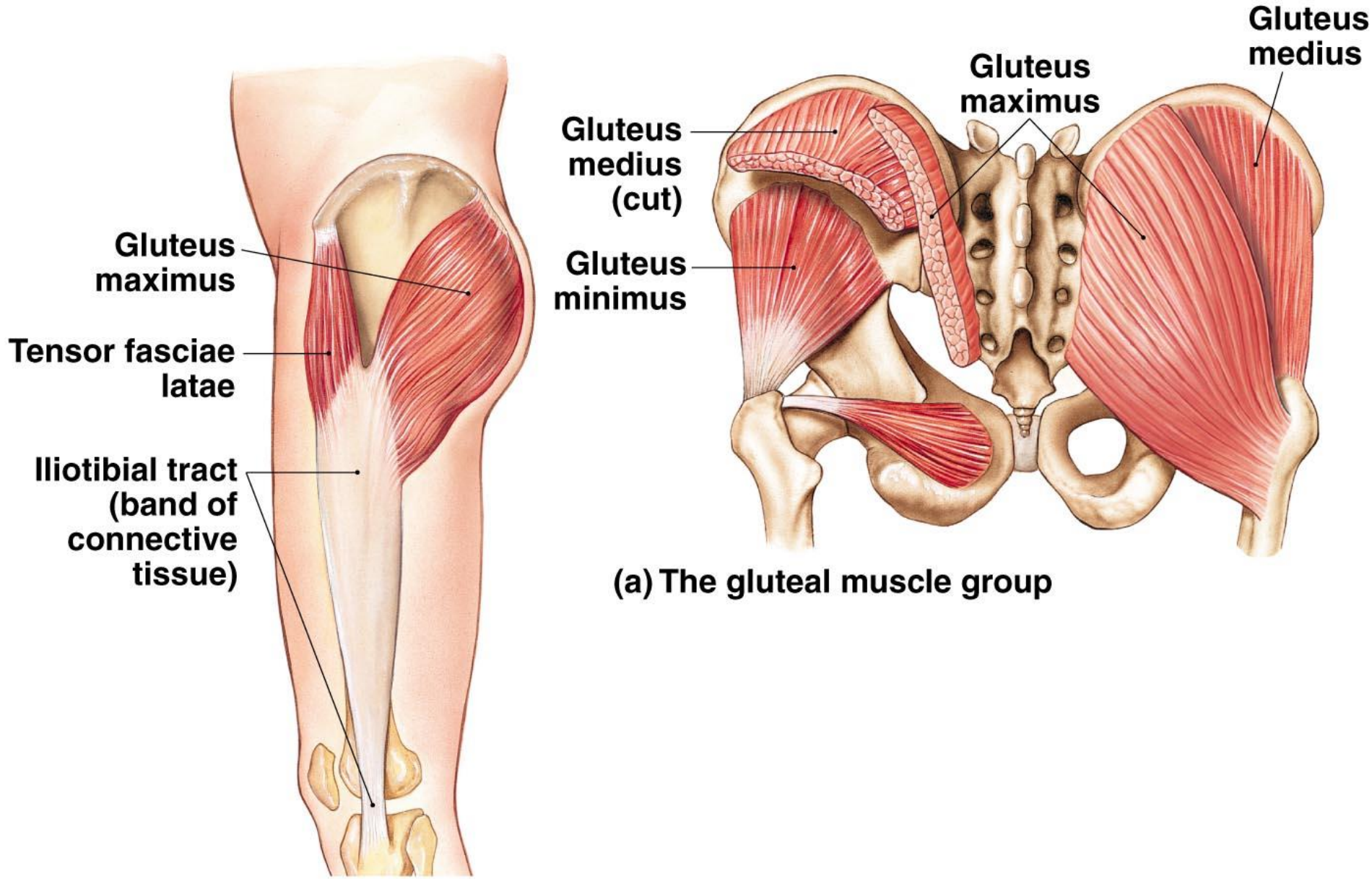


Size

- Relative Size of Muscle
- **MAXIMUS** = largest
  - *Gluteus **Maximus***
- **MEDIUS** = middle
  - *Gluteus **Medius***
- **MINIMUS** = smallest
  - *Gluteus **Minimus***
- **LONGUS** = longest
  - *Fibularis **Longus***
- **BREVIS** = short
  - *Fibularis **Brevis***
- **TERTIUS** = shortest
  - *Fibularis **Tertius***

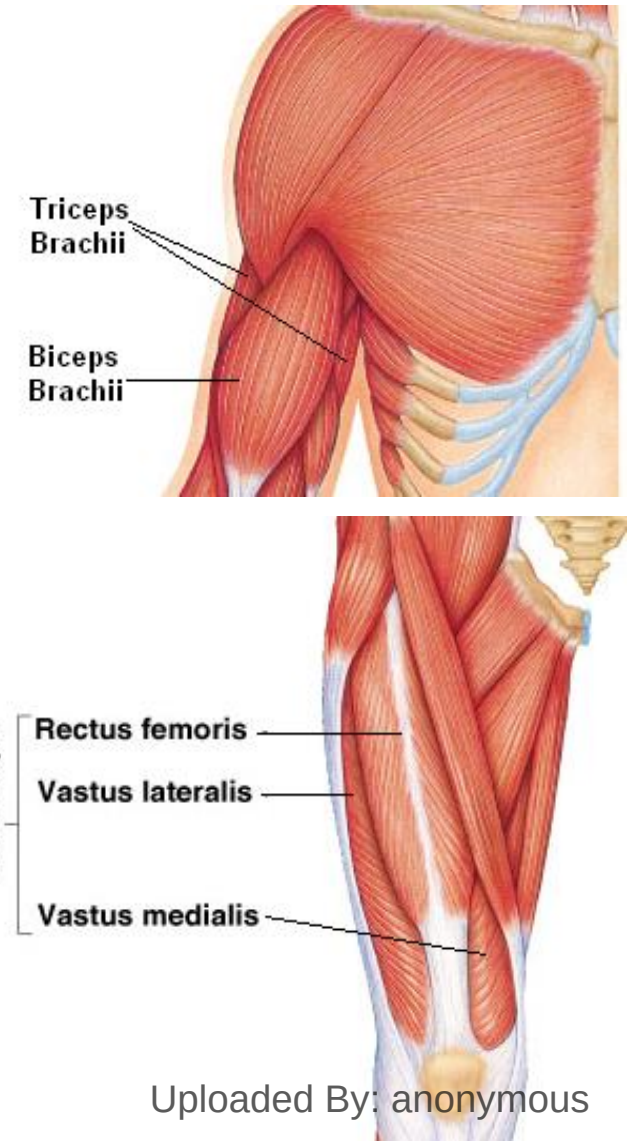






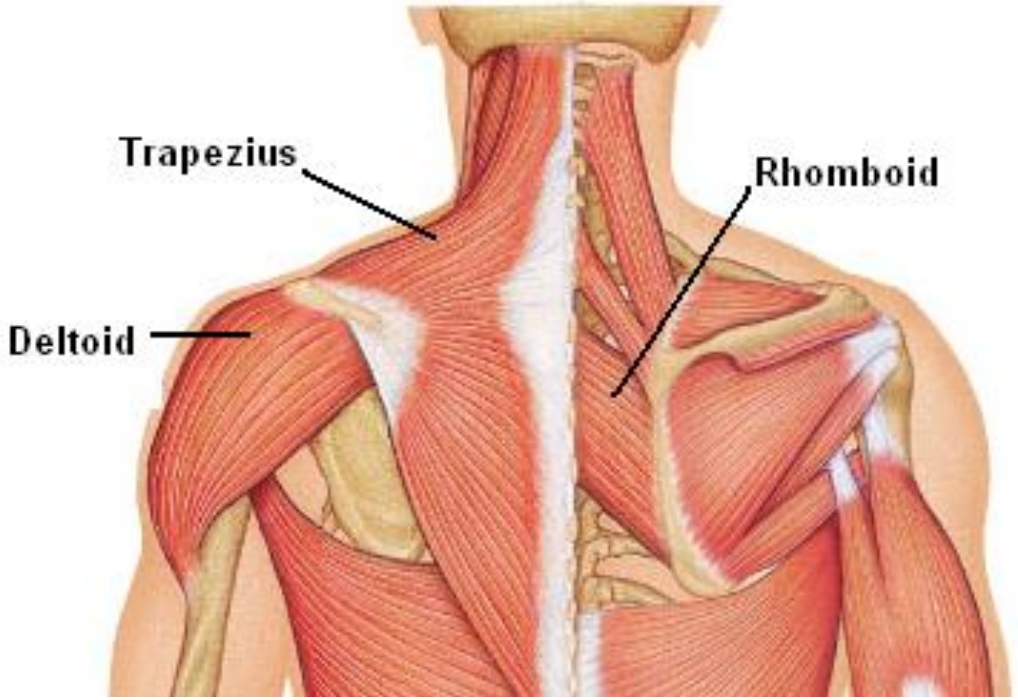
Number of Origins

- Number of tendons of origin
- **BICEPS** = Two
  - ***Biceps*** *Brachii*
  - ***Biceps*** *Femoris*
- **TRICEPS** = Three
  - ***Triceps*** *Brachii*
- **QUADRICEPS** = Four
  - ***Quadriceps*** *Femoris*



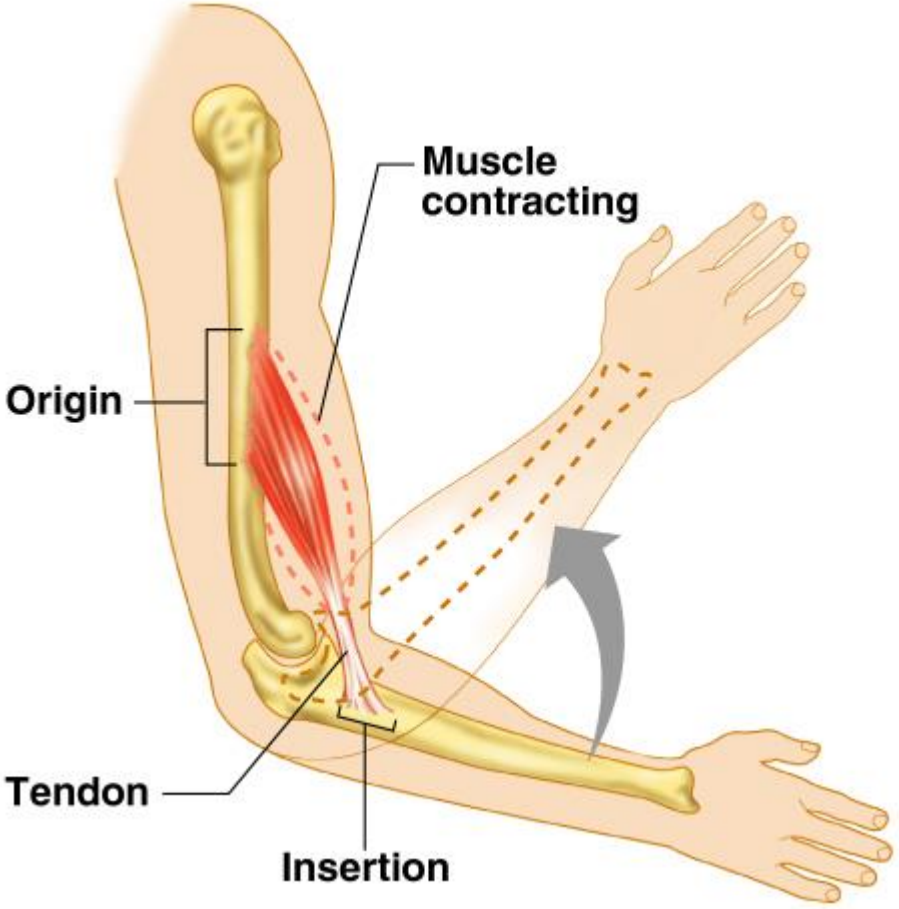
Shape

- Relative Shape of the Muscle
- **DELTOID** = triangular shape Δ
- **TRAPEZIUS** = trapezoid shape ◊



Origin & Insertion

- Origin – attachment to an immoveable bone
- Insertion – attachment to a movable bone
- During contraction, the muscle insertion moves toward the origin



Actions of Skeletal Muscles

Flexion – bending a body part

Extension – straightening a body part

Hyperextension – extending a body part past the normal anatomical position

Dorsiflexion – pointing the toes up

Plantar flexion – pointing the toes down

Abduction – moving a body part away from the anatomical position

Adduction – moving a body part toward the anatomical position

Actions of Skeletal Muscles

Circumduction – moving a body part in a circle

Pronation – turning the palm of the hand down

Supination – turning the palm of the hand up

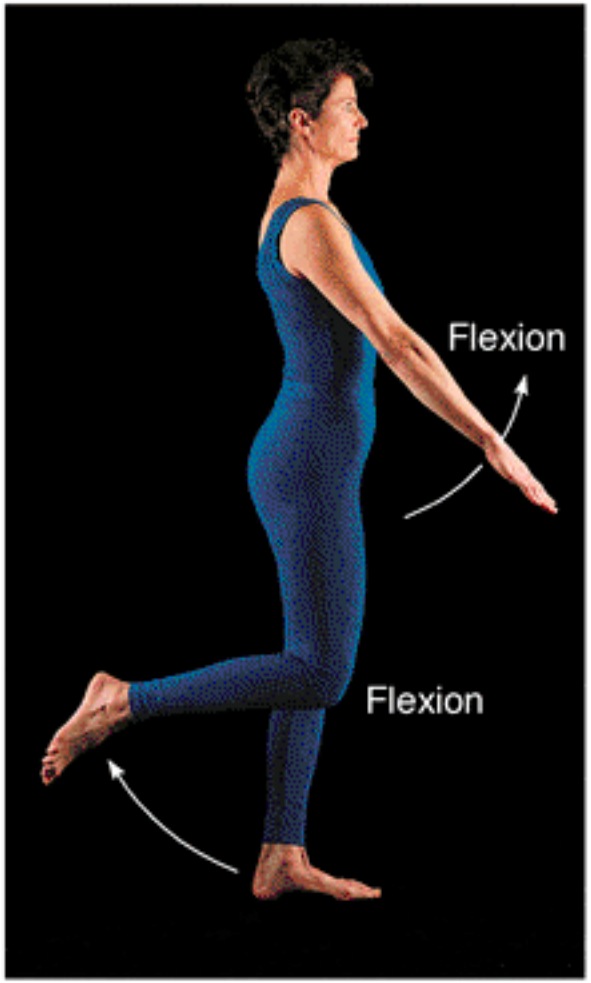
Inversion – turning the sole of the foot medially

Eversion – turning the sole of the foot laterally

Retraction – moving a body part posteriorly

Protraction – moving a body part anteriorly

Flexion



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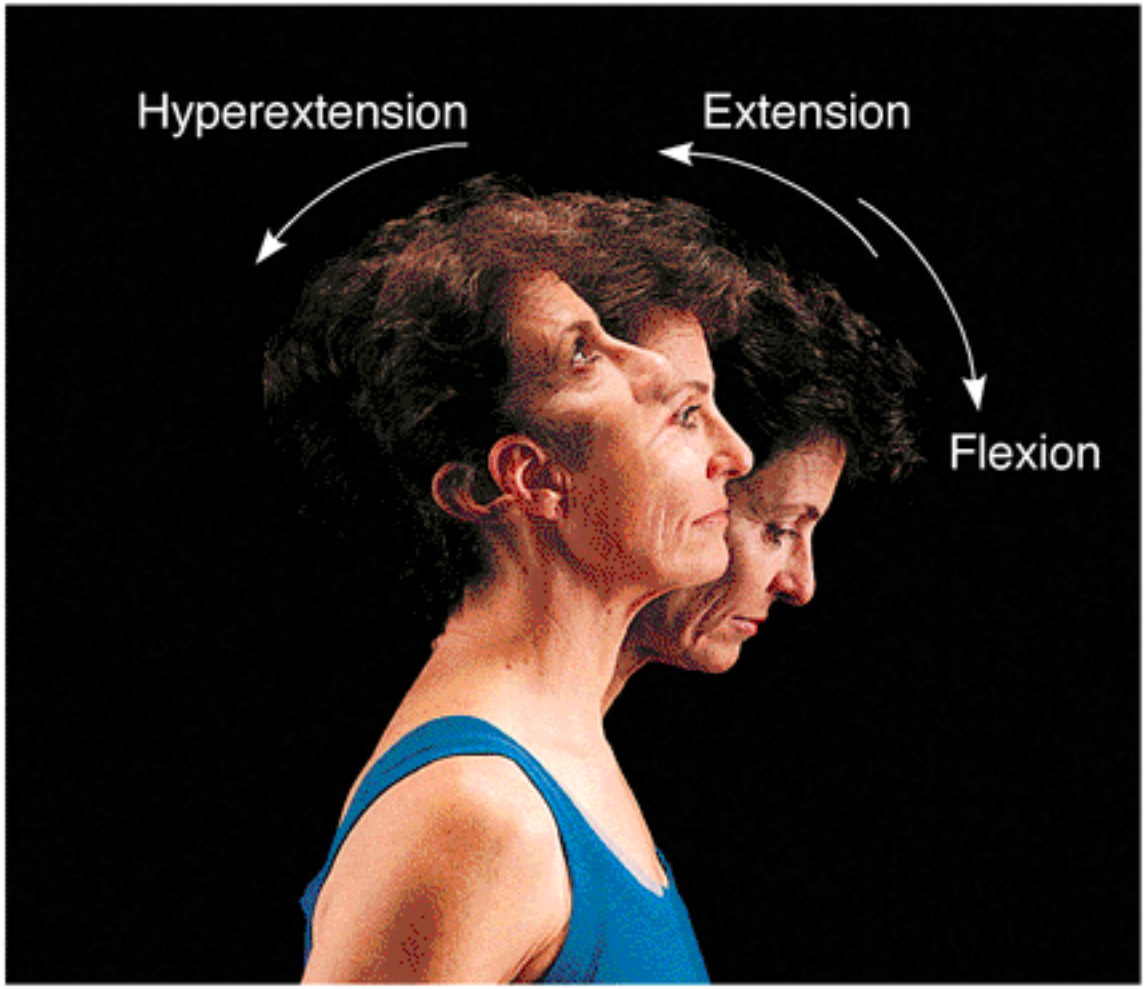
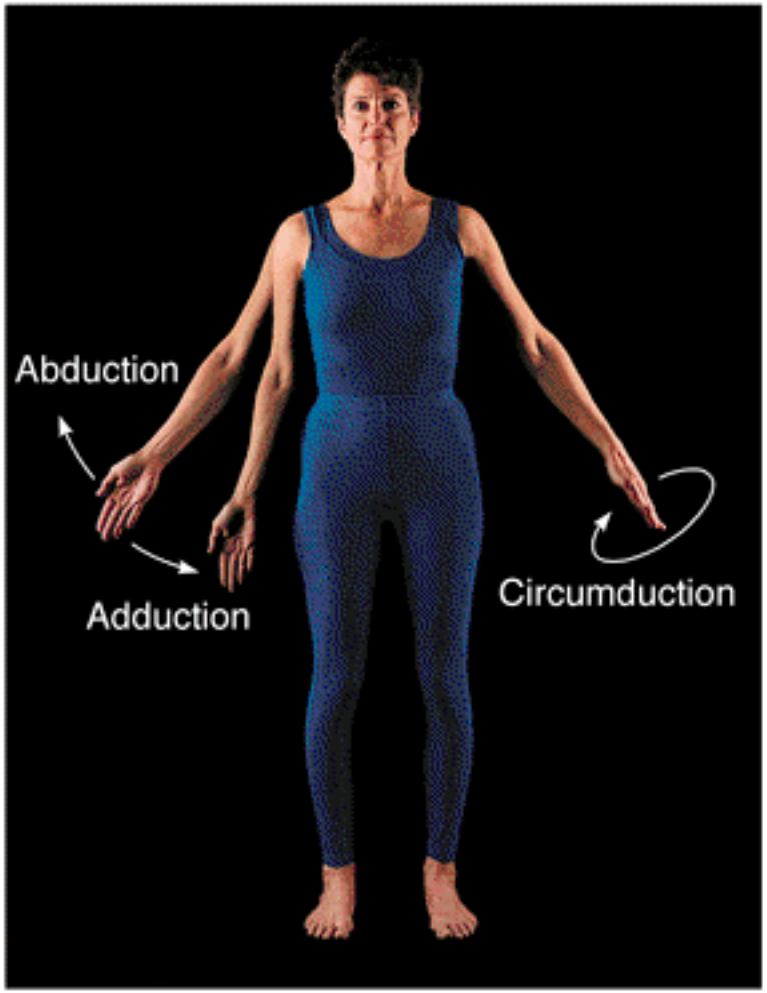
Extension

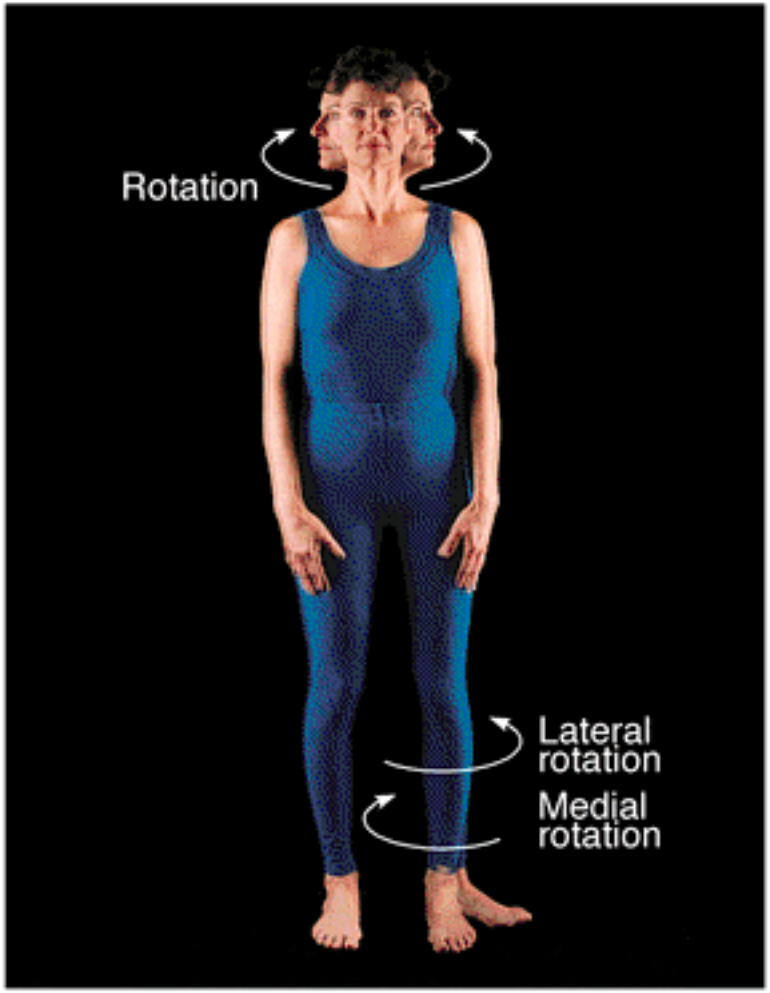
Hyperextension

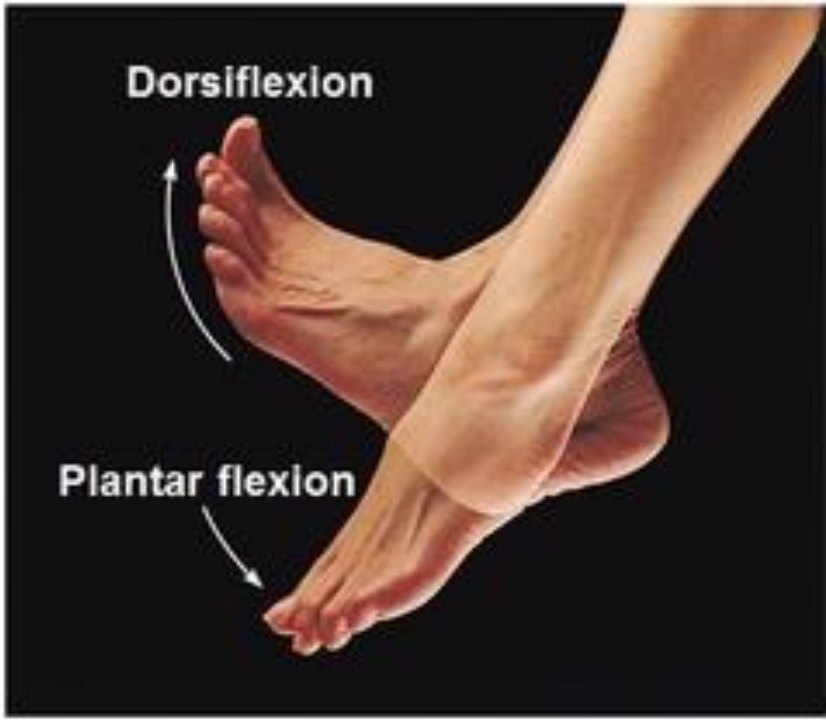


Abduction, Adduction & Circumduction



Rotation





(b) Inversion

(c) Eversion

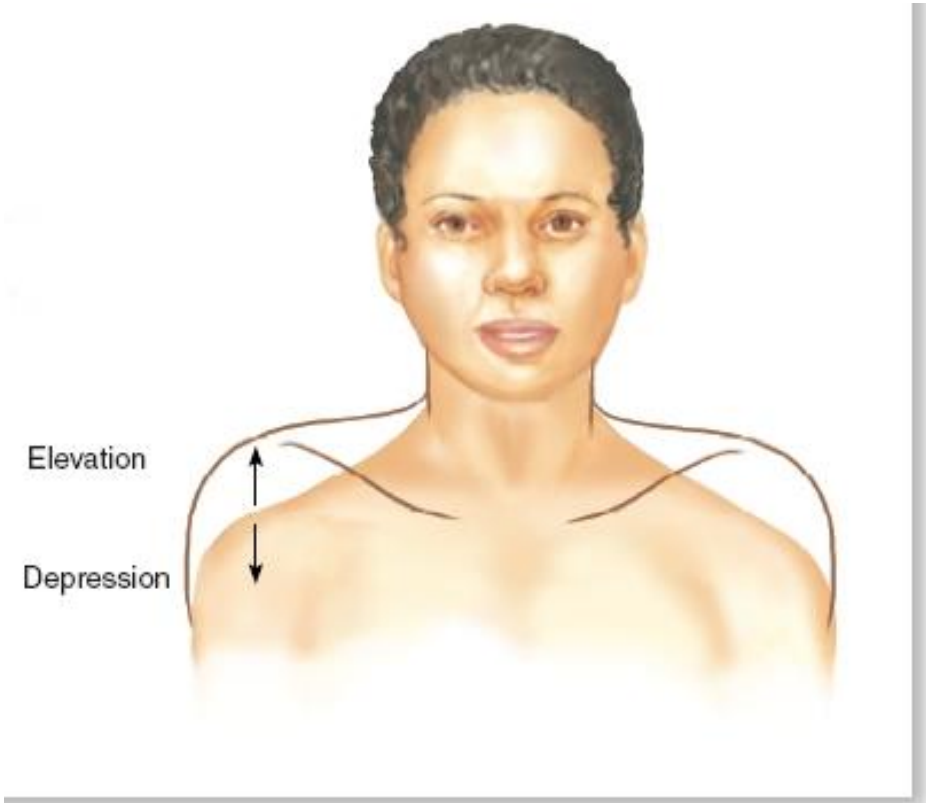
Actions of Skeletal Muscles

Elevation – lifting a body part

- elevating the shoulders

Depression – lowering a body part

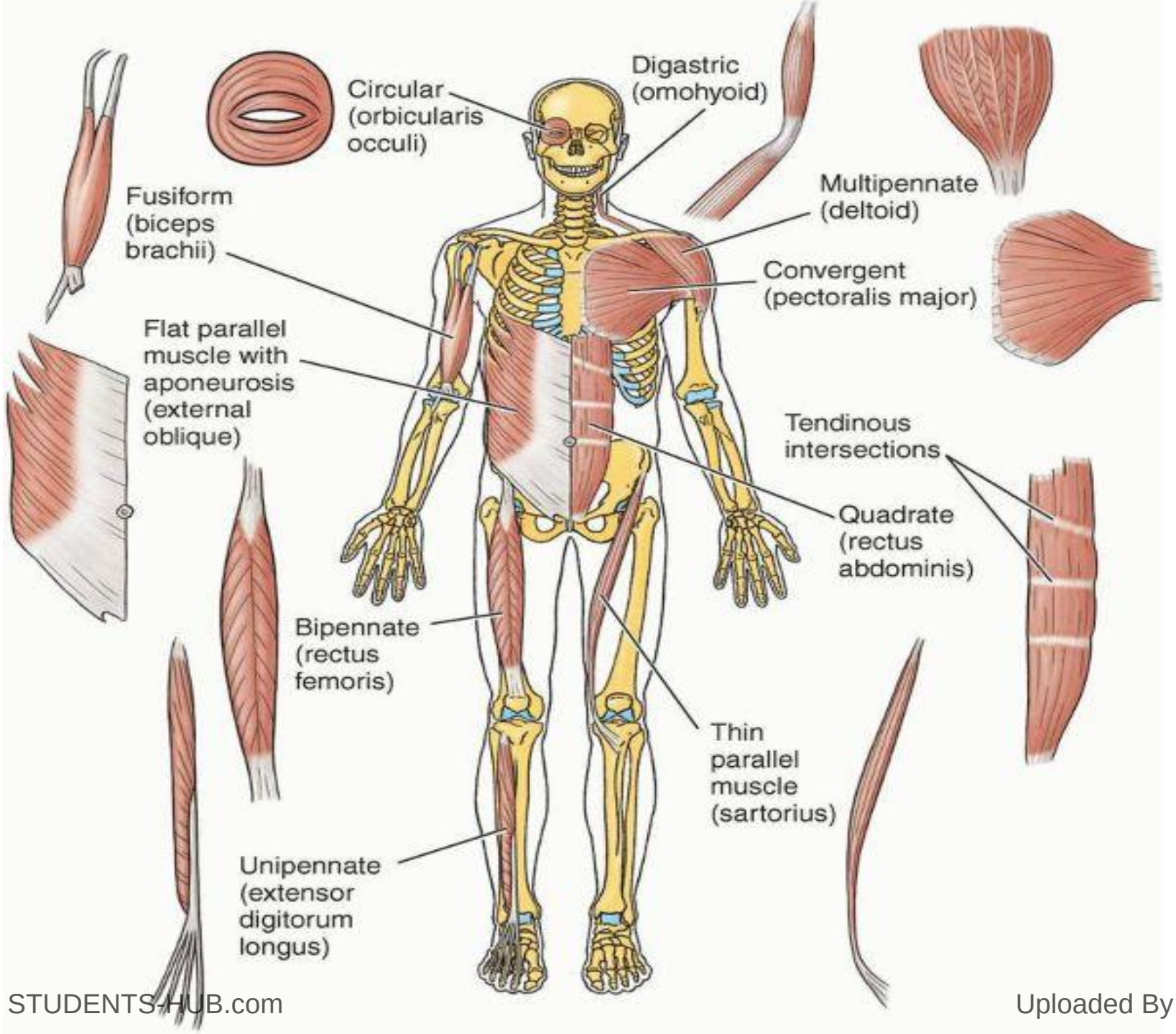
- lowering the shoulders



Arrangements of Muscle Fibers

1. Circular –fibers arranged in circle around an opening sphincters
2. Convergent- base is much wider than insertion
   triangular shape
3. Parallel – fibers arranged parallel to long axis of muscle
4. Fusiform – modified parallel, spindle shaped muscle
5. Pennate – fasciculi arranged like barbs of feather

   Unipennate, Bipennate, Multipennate



End of Muscular System