

Lecture 2

SKELETAL MUSCLES



Color Index:

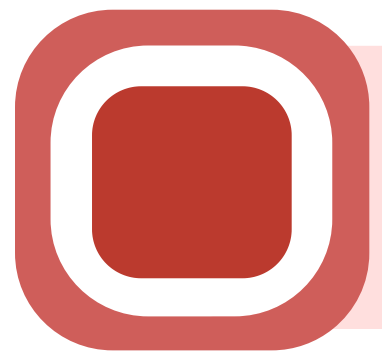
- Main text
- Boys' Slides
- Girls' Slides
- Important
- Dr's Notes
- Extra

 [Editing File](#)

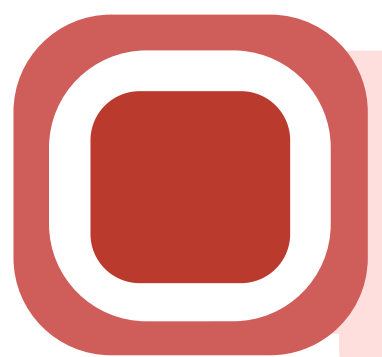
OBJECTIVES

- Describe the **main criteria** of skeletal muscles.
- Describe the **attachments** of skeletal muscles.
- Describe the **different directions** of skeletal muscle fibers.
- Describe the **mode of action** of skeletal muscles.
- Describe briefly the **naming** of skeletal muscles.
- Describe briefly the **nerve supply** of skeletal muscles.

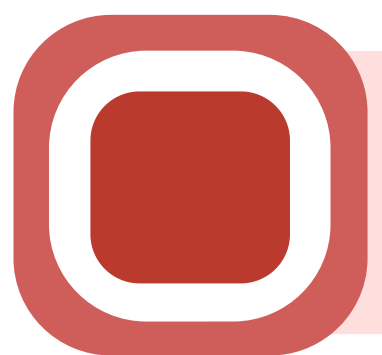
Introduction



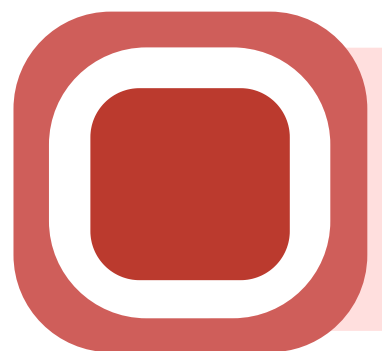
Musculoskeletal is a general term which is defined as relating to muscles and bones of the skeleton.



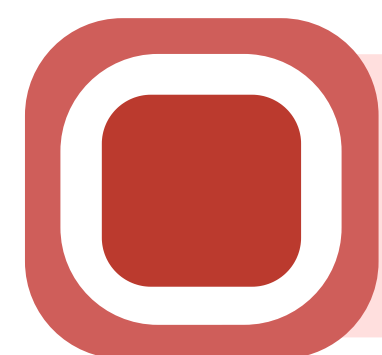
The **musculoskeletal system** comprises (composed of) **bones, joints, cartilage, bursae, tendons, muscles and ligaments.**



It is the system that **moves** the body and **maintains** its form.



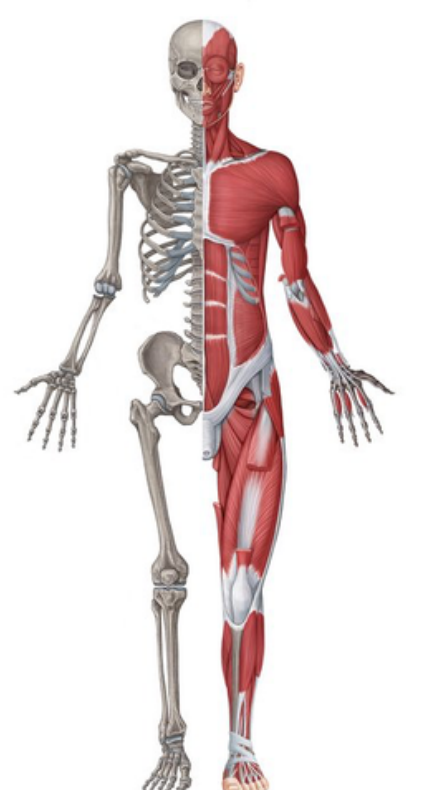
Study of this system consists of **osteology** (the study of bones), **arthrology** (the study of joints), and **myology** (the study of muscles).



The musculoskeletal system **does not** work in isolation.



It is **closely linked with many other systems** in the body, including the nervous system, genitourinary system, circulatory system, immune system, respiratory system, digestive system and endocrine system.





Muscle Tissues

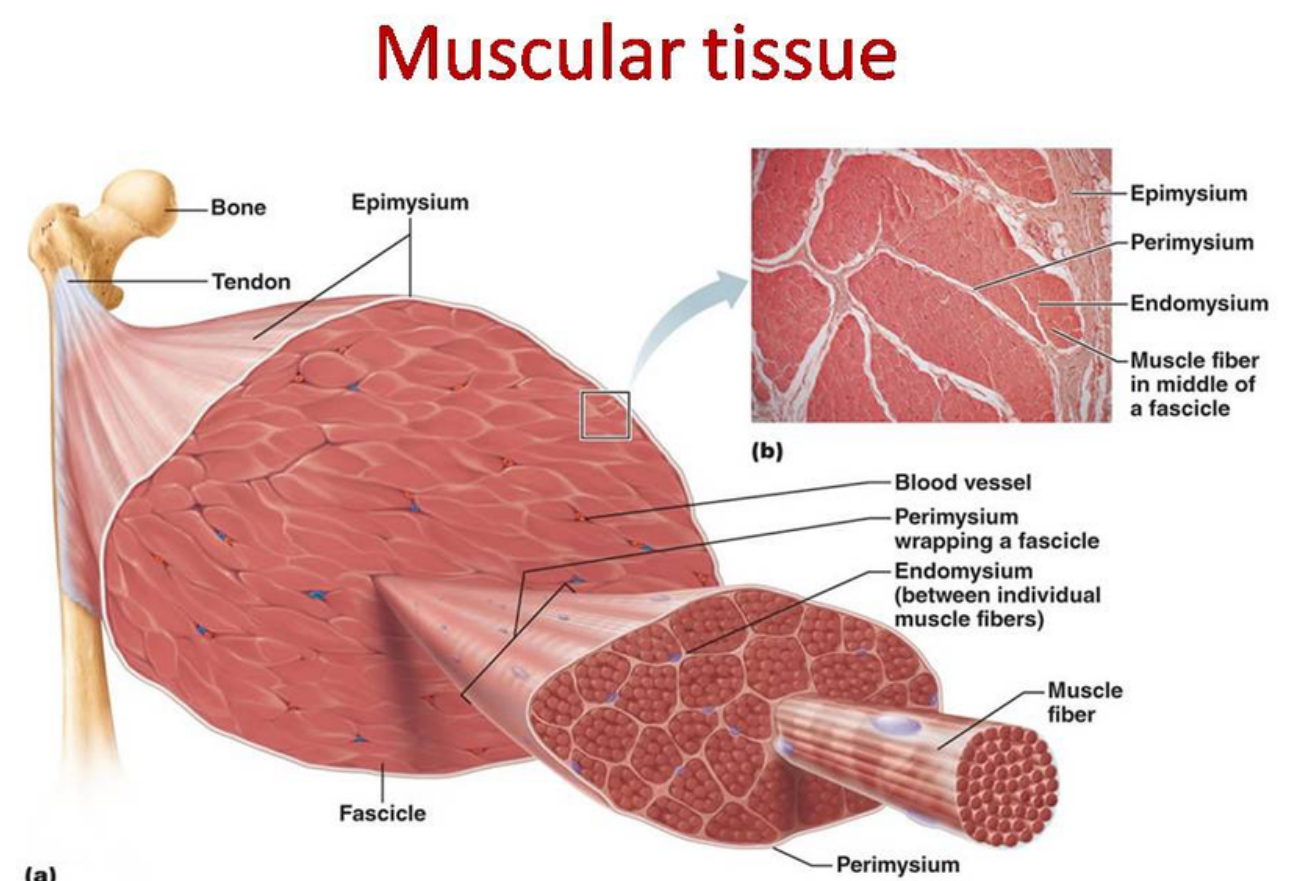
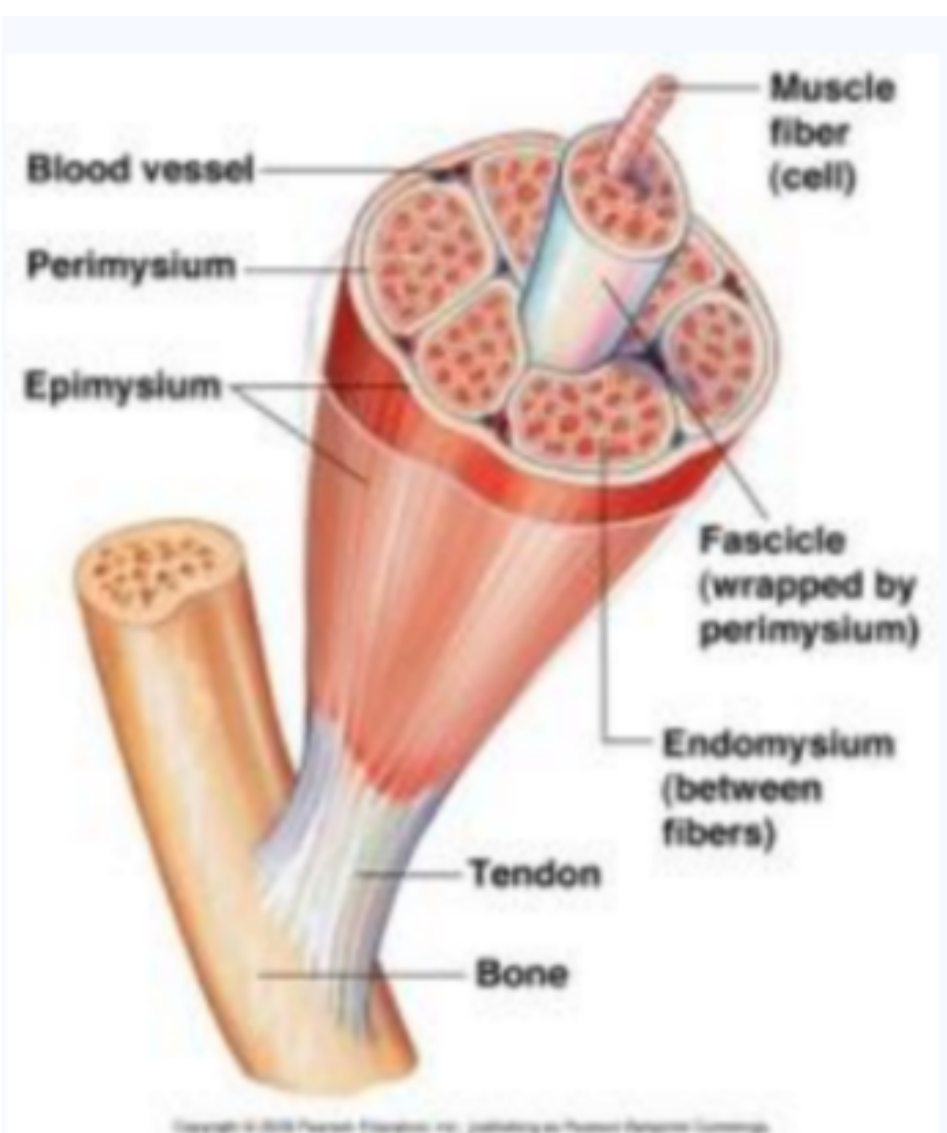
Muscle tissue is a unique tissue which has the **ability to contract**.

As a result of this ability, muscles are **responsible for all the body movements**.

The structural and functional unit of muscle tissue is **"muscle cell"**.

All muscle cells are elongated and are called **"muscle fibers"**.

The ability of muscle to **contract (or to shorten)**, depends on two types of myofilaments:
1- actin
2- myosin
 in the muscle fibers.



Extra image for further clarification



Myofilaments are the three protein filaments of myofibrils in muscle cells. The main proteins involved are myosin, actin, and titin. Myosin and actin are the contractile proteins and titin is an elastic protein.

IMPORTANT!

Classification of Muscles

Muscles are classified **based on** the following:

Action

Voluntary muscles

◆ Subject to conscious control.

example:
Muscles attached to skeleton

Involuntary muscles

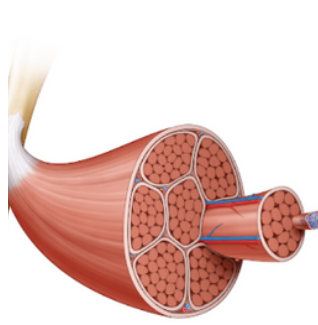
◆ Not under conscious control.

example:
Muscles of the heart & other organs

Location

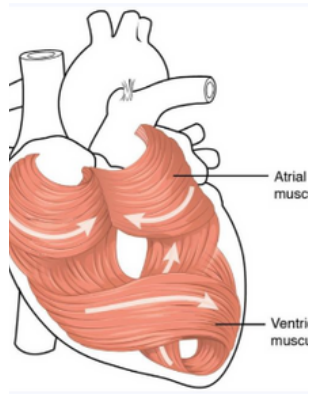
Skeletal Muscles

◆ Attached to bones & produce Movement



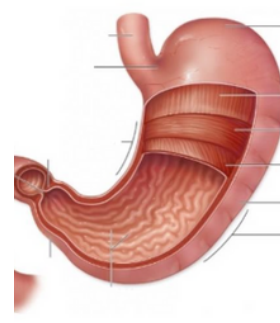
Cardiac Muscles

◆ Walls of the Heart



Visceral or Smooth Muscles

◆ Walls of visceral organs



Microscopic structure

Striated

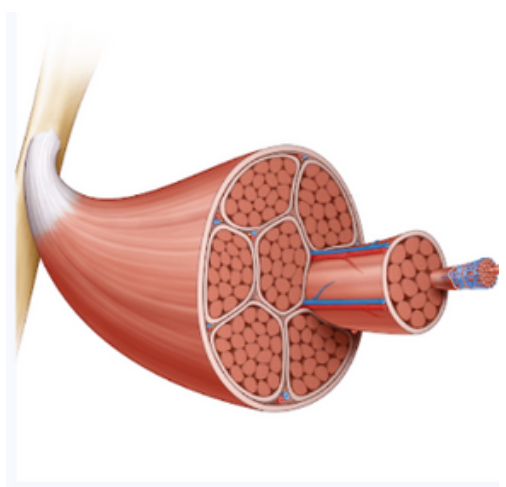
◆ The muscle fibers show transverse striations

example:
skeletal & cardiac muscles

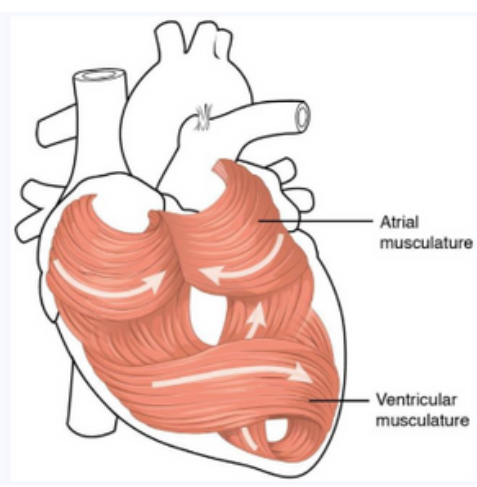
Non Striated (Smooth)

◆ No striations

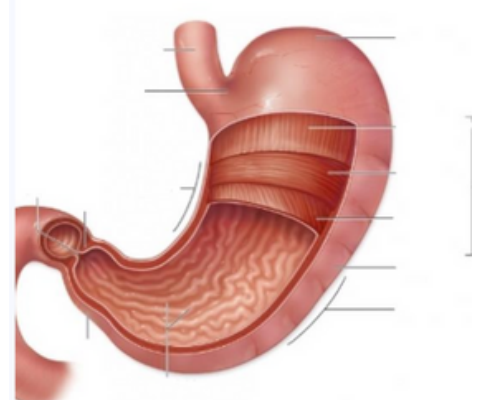
example:
visceral muscles



Voluntary
(Muscle tissue)

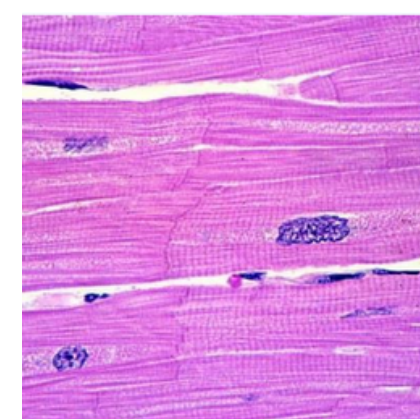


Involuntary (Heart)

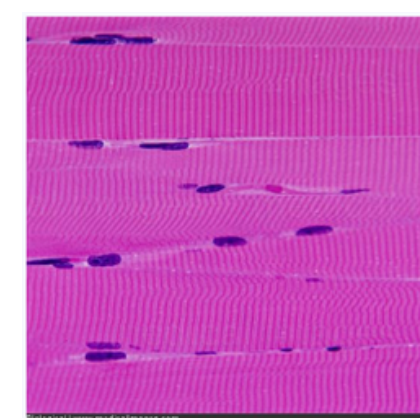


Involuntary (Stomach)

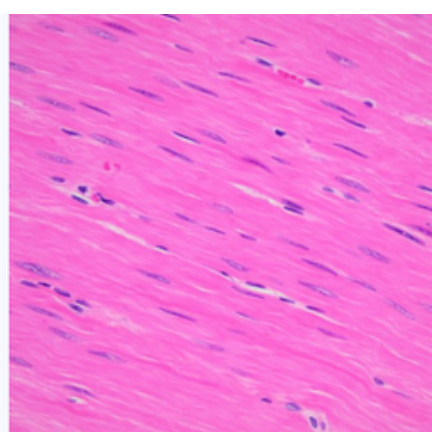
examples of visceral organs:
stomach, liver, pancreas,
small intestine, large intestine



CARDIAC (STRIATED)



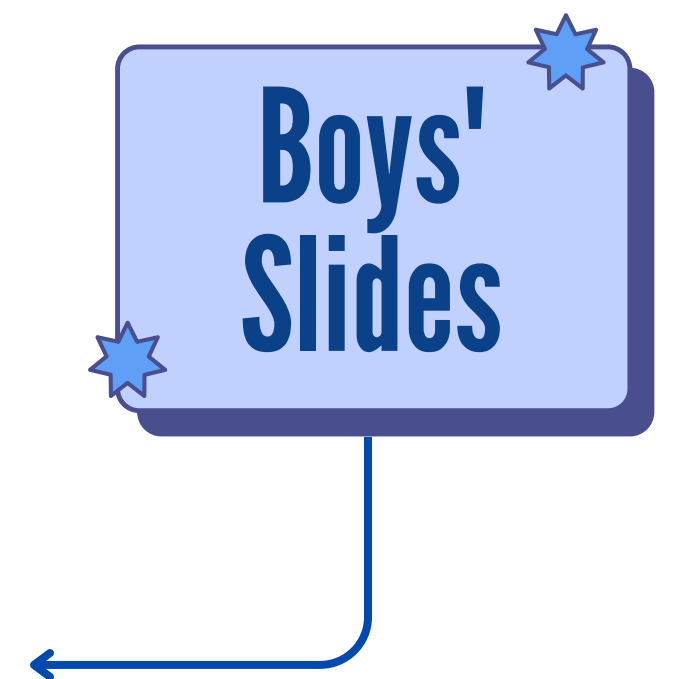
SKELETAL (STRIATED)



SMOOTH (NONSTRIATED)

Classification Overview

Skeletal Muscle	Cardiac Muscle	Smooth Muscle
Voluntary	Involuntary	Involuntary
Striated	Striated	Non Striated



Skeletal Muscles

Main Criteria

- Striated
- Attached to skeleton
- Produce movement of skeleton
- Voluntary
- Supplied by **Somatic Nerves**

Functions

- Body Movement
- Maintain Posture
- Generate Heat
- Stabilizing Joints

Attachments

IMPORTANT!

▪ The skeletal muscles are attached to bones at **not less than two points**:

Origin

Insertion

Attached to **less mobile** or **immovable bone**

Attached to the **movable** bones

Least movable

Most movable

Mostly **fleshy**

Mostly **fibrous**

Proximal end

Distal end

- When the muscle **contracts**, the **insertion moves toward the origin**.
- **At insertion**, the **muscles** are **attached by** means of strong **cord-like tendons** or by **sheet-like aponeurosis**.

Types of Attachments

IMPORTANT!

Types of Attachments

Muscles are attached to bones, cartilage or ligaments by:

1) Tendons

A **tough cord of fibrous connective tissue** that usually connects muscle to bone and is capable of withstanding tension.

2) Aponeurosis

A **thin broad and strong sheet of fibrous tissue**. (scalp)

3) Raphe

An **interdigitation of the tendinous ends of the flat muscles**.

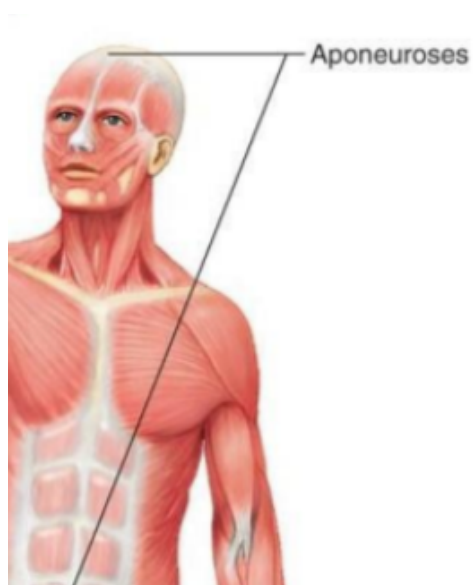
example: **Mylohyoid Raphe**



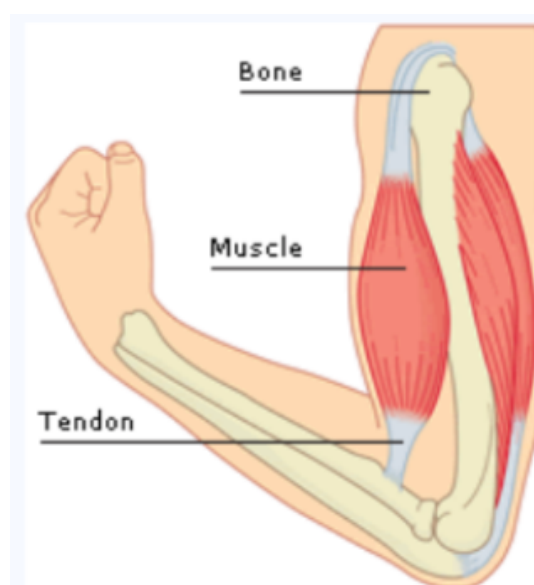
Interdigitate: to become interlocked like the fingers of folded hands.

Boys' Slides

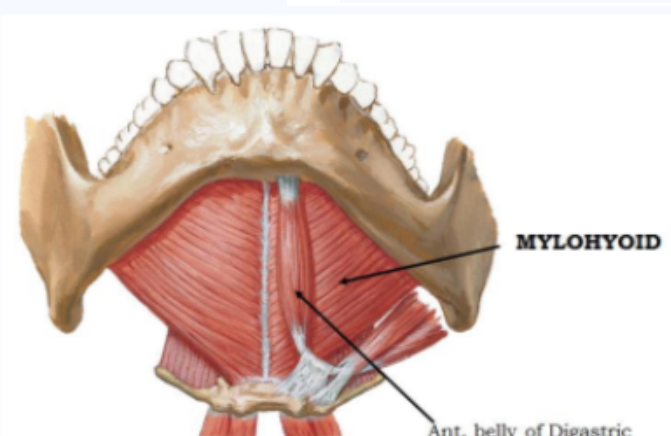
Girls' Slides



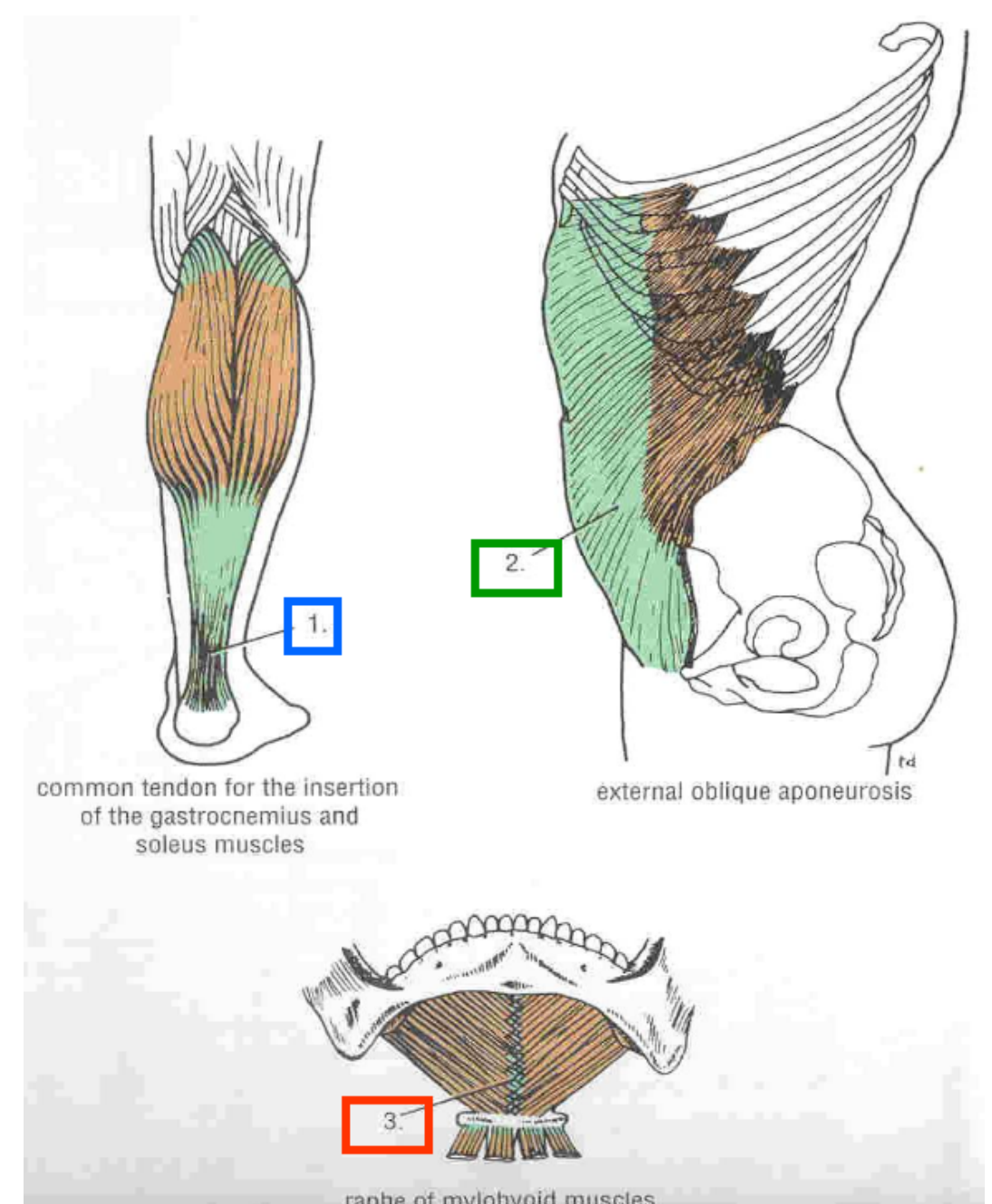
APONEUROSIS



TENDONS



RAPHE



common tendon for the insertion of the gastrocnemius and soleus muscles

external oblique aponeurosis

raphe of mylohyoid muscles

Directions of Muscles

✦ The range of motion and the power of a muscle depends on the arrangement of its fascicles (a group of muscle fibers "bundled" as a unit within the whole muscle is called a fascicle).

✦ The fiber arrangement can be:

1

Fusiform

Spindle-shaped (round, thick belly, & tapered ends).

2

Circular

Surround a body opening or orifice, constricting it when contracted.

3

Convergent

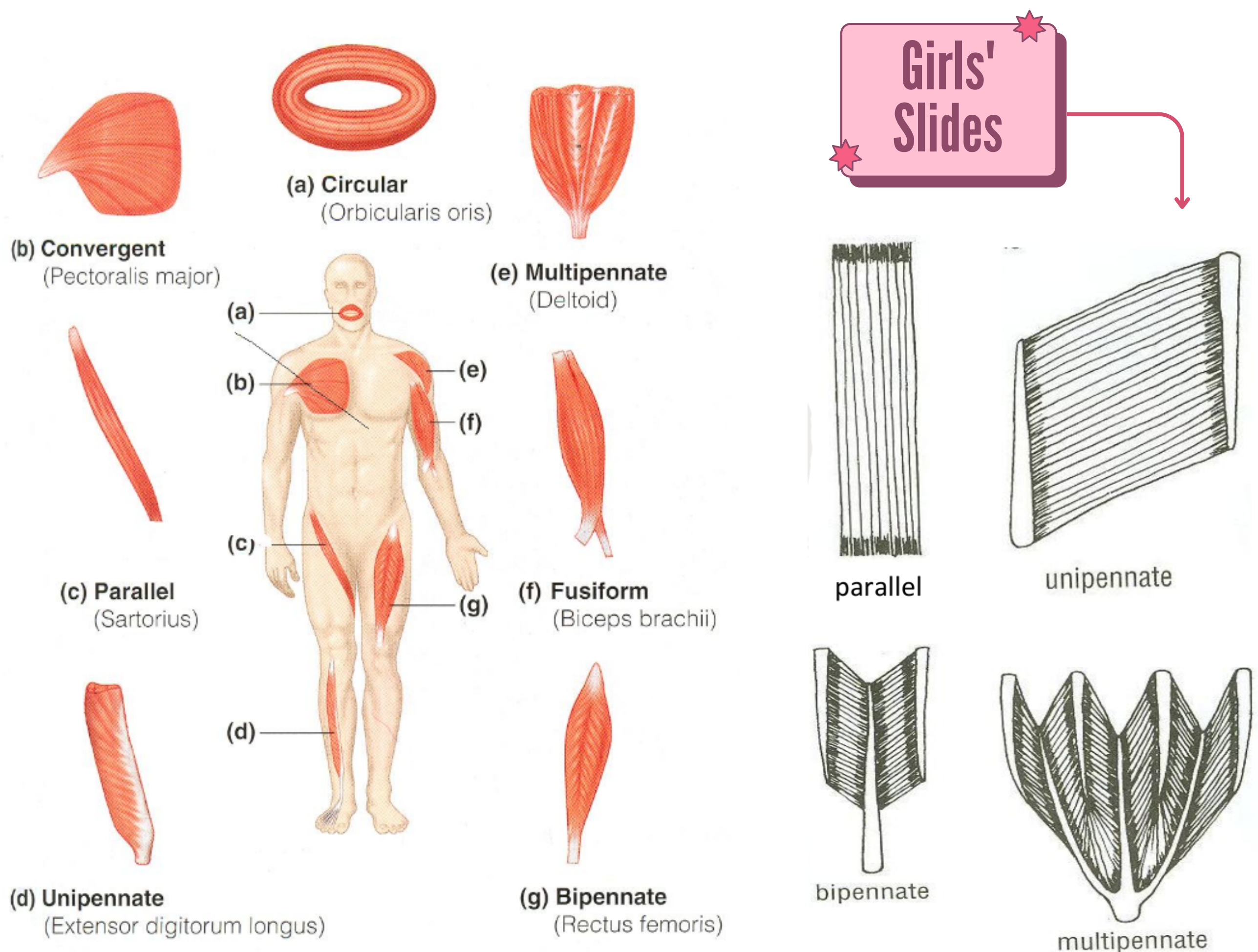
When a muscle has a widespread expansion over a sizable area and the fascicles come to a single, common attachment point.

4 Parallel

- **More range of movement , less powerful.**
- The long parallel arrangement gives more range of motion but is not usually very powerful.

5 Pennate

- **More powerful, less range of movement.**
- **Unipennate(Uni=1)/Bipennate(Bi=2)/Multipennate(Multi=3,4,5....)**
- The pennate muscles shorten very little but are very powerful.



Mode of Actions

IMPORTANT!

- It is the **chief** (main) **muscle** responsible for a particular movement.

- Muscles that assist the prime mover in a particular movement.

Extra images for further clarification

Prime Mover (Agonist)

Antagonist

Synergist

Fixator

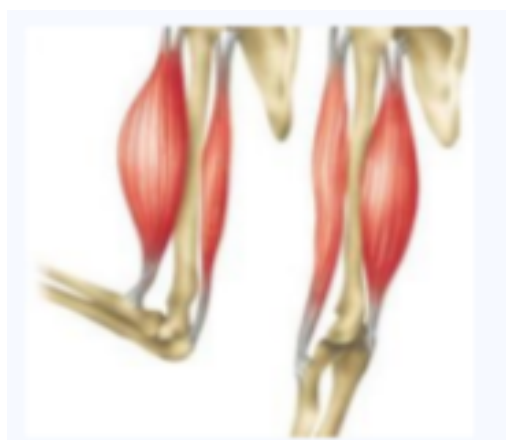


- It **opposes** the action of the prime mover.
- Before the contraction of the prime mover, the antagonist must be relaxed.

- Its contraction does not produce movement by itself, but it stabilizes the origin of the prime mover so that it can act efficiently.



PRIME MOVER



ANTAGONIST



SYNERGIST



FIXATOR

PRIME MOVER (AGONIST)

It is the **chief muscle** responsible for a particular movement.

Examples:

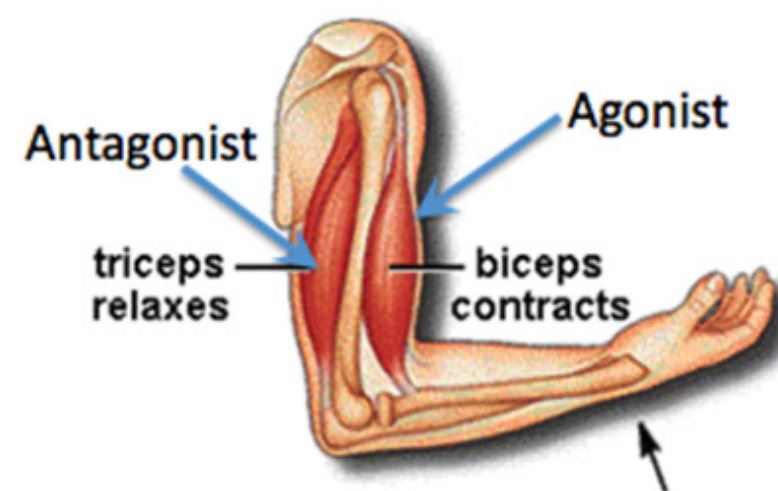
- **Quadriceps Femoris** is the prime mover for **extension** of the knee joint.

Extra image for further clarification →



- **Biceps Brachii** is the prime mover for **flexion** of the elbow joint and forearm.

Extra image for further clarification →



ANTAGONIST

- It **opposes** the action of the prime mover.
- Before contraction of prime mover, antagonist must be relaxed.
- ex:
 - **Triceps Brachii** is the antagonist for prime mover for flexion of the elbow joint and forearm.
 - **Biceps Femoris** (Flexor of knee).
 - It opposes the action of quadriceps when the knee joint is extended.



SYNRGIST

- Muscles that assist the prime mover in a particular movement.
crossed by the Prime Mover.
- Helps prime movers by adding a little extra force to the same movement OR By reducing undesirable or unnecessary movement.

Brachialis muscle for Biceps prime

- Synergists are sometimes called **neutralizers** because they help cancel out, or neutralize, extra motion from the agonists to make sure that the force generated works within the desired plane of motion.

- **Example:**

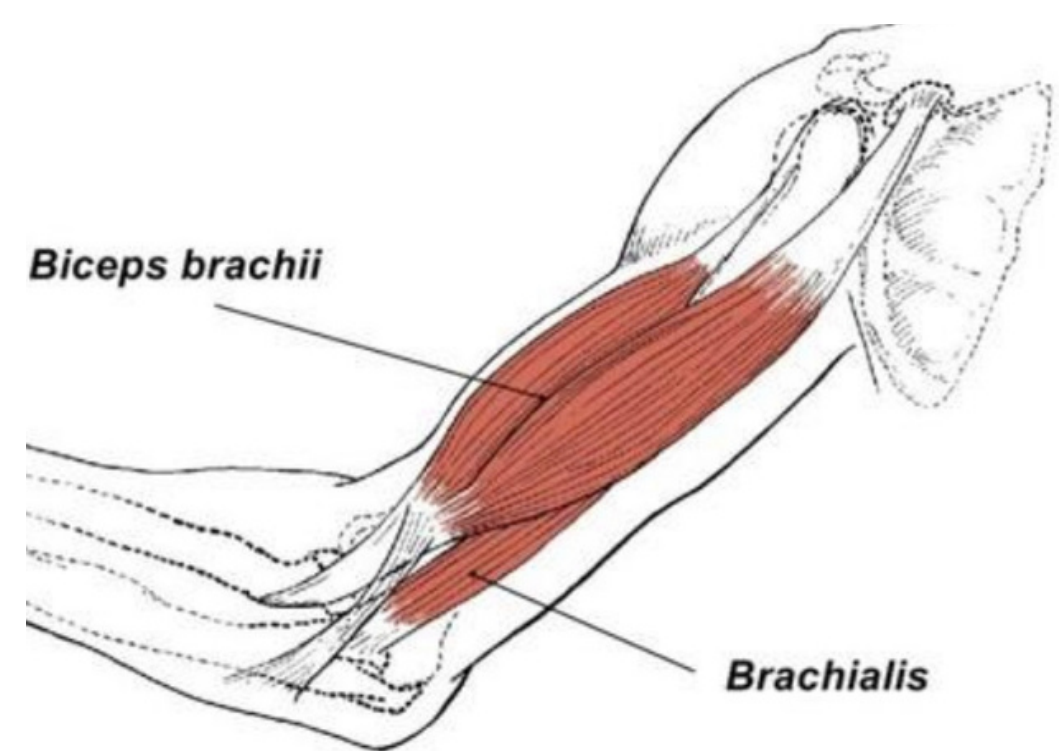
- o **Brachialis muscle** for Biceps prime mover muscle.

another Example :

The biceps is the prime mover in the elbow joint.

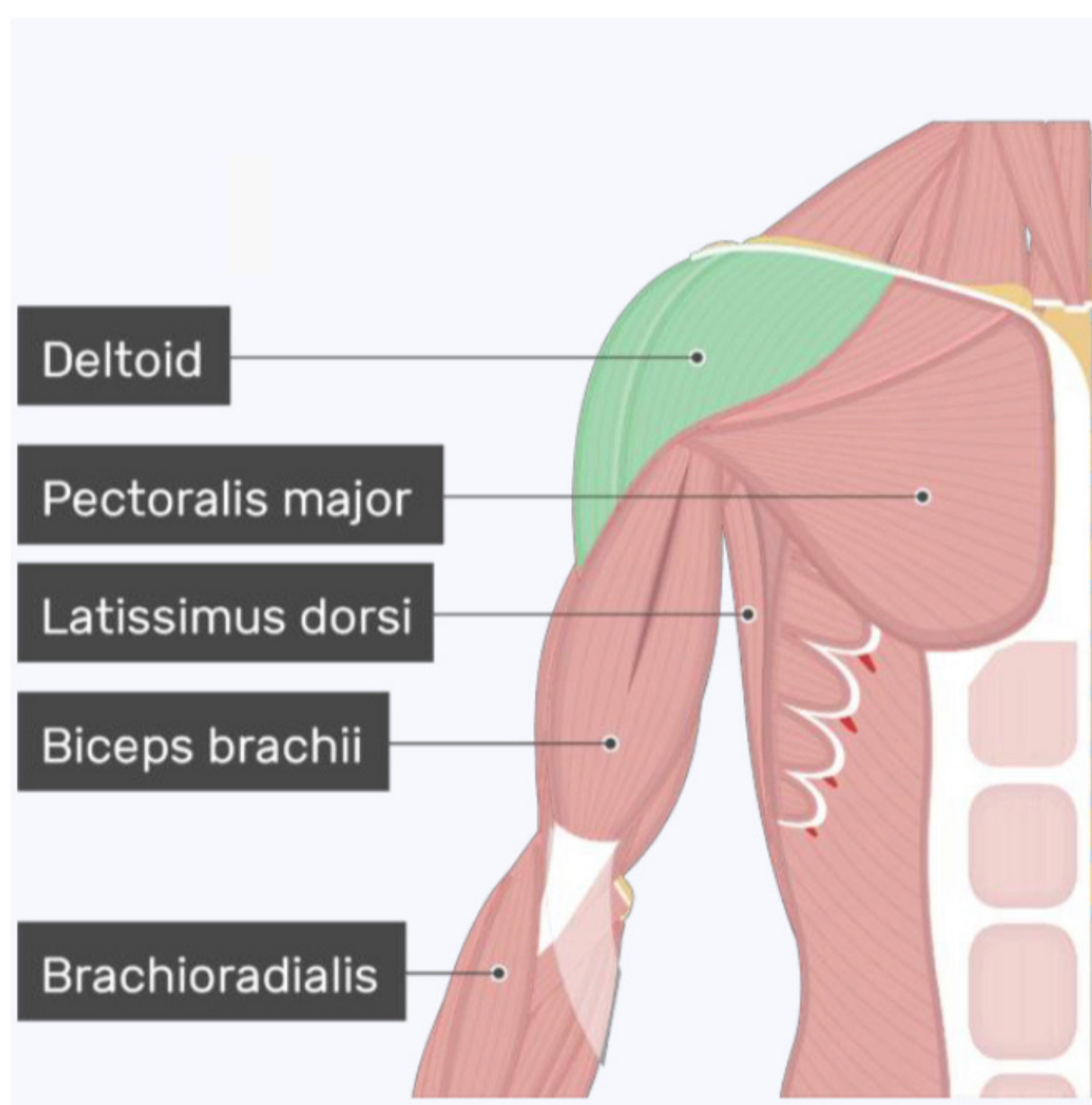
Bracioradialis acts as a synergistic muscle to stabilize the joint thus aiding in the motion.

- o Flexors and Extensors of wrist joint: they contract to fix wrist joint in order that flexors and extensors of fingers work efficiently.



FIXATOR

- Its contraction does not produce movement by itself but it **stabilizes** the origin of the prime mover so that it can act efficiently.
- Example:
 - o **Deltoid muscle** for Biceps prime mover muscle.
 - o **Muscles attaching the shoulder girdle** to the trunk contract to fix shoulder girdle, allowing deltoid muscle (taking origin from shoulder girdle) to move shoulder joint (humerus).



- Major or Maximus (large)
- o Minor or minimus (small)
- o Latissimus (broad)
- o Longus (long)
- o Brevis (short)

- o Superficialis (superficial)
- o Profundus (deep)
- o Externus (external)

Size

Position

Depth

Shape

Pectoralis (pectoral region)

- o Deltoid (triangular)
- o Teres (rounded)
- o Rectus (straight)

NAMING OF MUSCLES

- o Coracobrachialis
from coracoid process to arm

- o Biceps (2 heads)
- o Triceps (3 heads)
- o Quadriceps (4 heads)

Attachments

Action

Number of heads

Flexor digitorum:
flexion of digits

TYPES OF BODY MOVEMENTS

1

Flexion

Movement that brings the two bones closer to each other (decreases the angle of joint).

2

Extension

Movement that increases the angle, or the distance between the two bones.

3

Adduction (Adding)

Movement of the limb toward the midline of the body.

4

Abduction

Movement of the limb away from the midline of the body.

5

Rotation

Movement of a bone around a vertical axis

6

Circumduciton

Combination of all the above movements.

MUSCLE EXERCISE

- The amount of work done by a muscle is reflected in changes in the muscle itself.
- Muscle inactivity leads to muscle weakness and wasting.
- Regular exercise increases muscle size, strength and endurance.

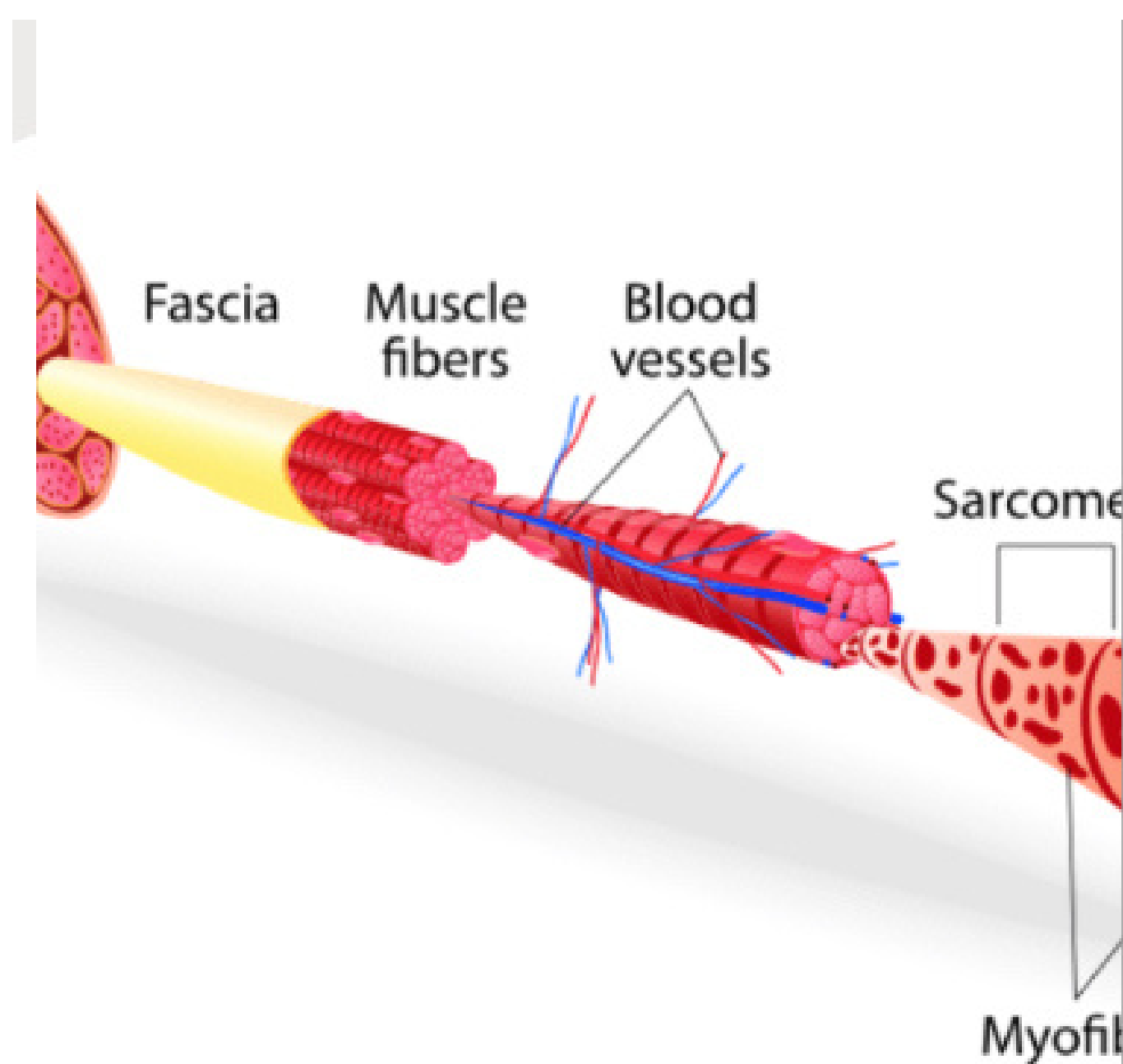
MUSCLES INNERVATION

- The somatic nervous system (is the part of the peripheral nervous system) associated with skeletal muscle voluntary control of body movements.
- The nerve enters the muscle at about the middle point of its deep surface.
- The nerves supplying the skeletal muscles are **Mixed**.
 - 60% are **Motor**
 - 40% are **Sensory**
- It contains some Autonomic fibers (sympathetic)

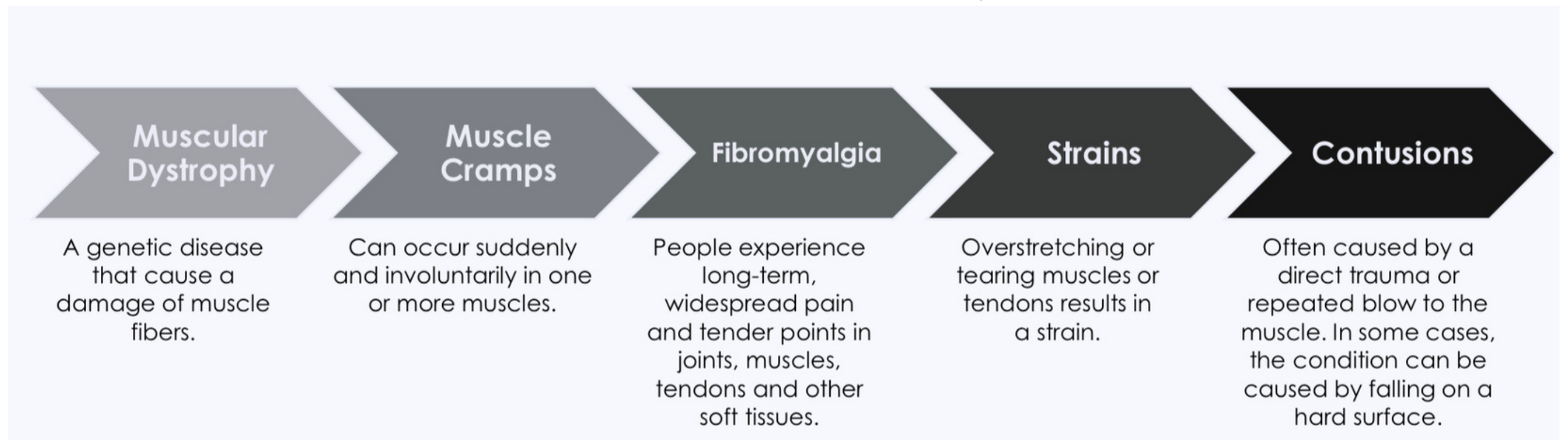
BLOOD SUPPLY

Girls'
Slides

- During extreme physical exertion, more than 80% of cardiac output can be directed to contracting muscles.
- The vascular inflow to skeletal muscles is provided by primary arteries, which represent the last branches of the arterial supply that arise before entry into the tissue.
 - The primary arteries are appropriately distributed along the long axis of the muscle and give rise to feed arteries that course toward the epimysium of the muscle at right or oblique angles to the primary arteries.



Clinical Anatomy



MUSCLE DISEASES

- Muscle diseases and injuries are common, especially in sports activities. A severe muscle injury can keep you from participating in the activities that you love and enjoy for living.
- Muscle diseases and injuries could be one of the major factors that threaten someone's professional career(s).



FIBROMYALGIA

- Fibromyalgia is a term used to describe a common syndrome in which people experience long-term, widespread pain and tender points in joints, muscles, tendons and other soft tissues.
 - It also results in disturbed sleep and exhaustion.
- The cause is unknown but possible triggers include viral infection, physical and emotional stress.
 - It tends to be more common in people with pre-existing lupus, rheumatoid arthritis, or ankylosing spondylitis.
 - There is no cure but symptomatic treatment can help some patients.

MUSCLE CRAMP

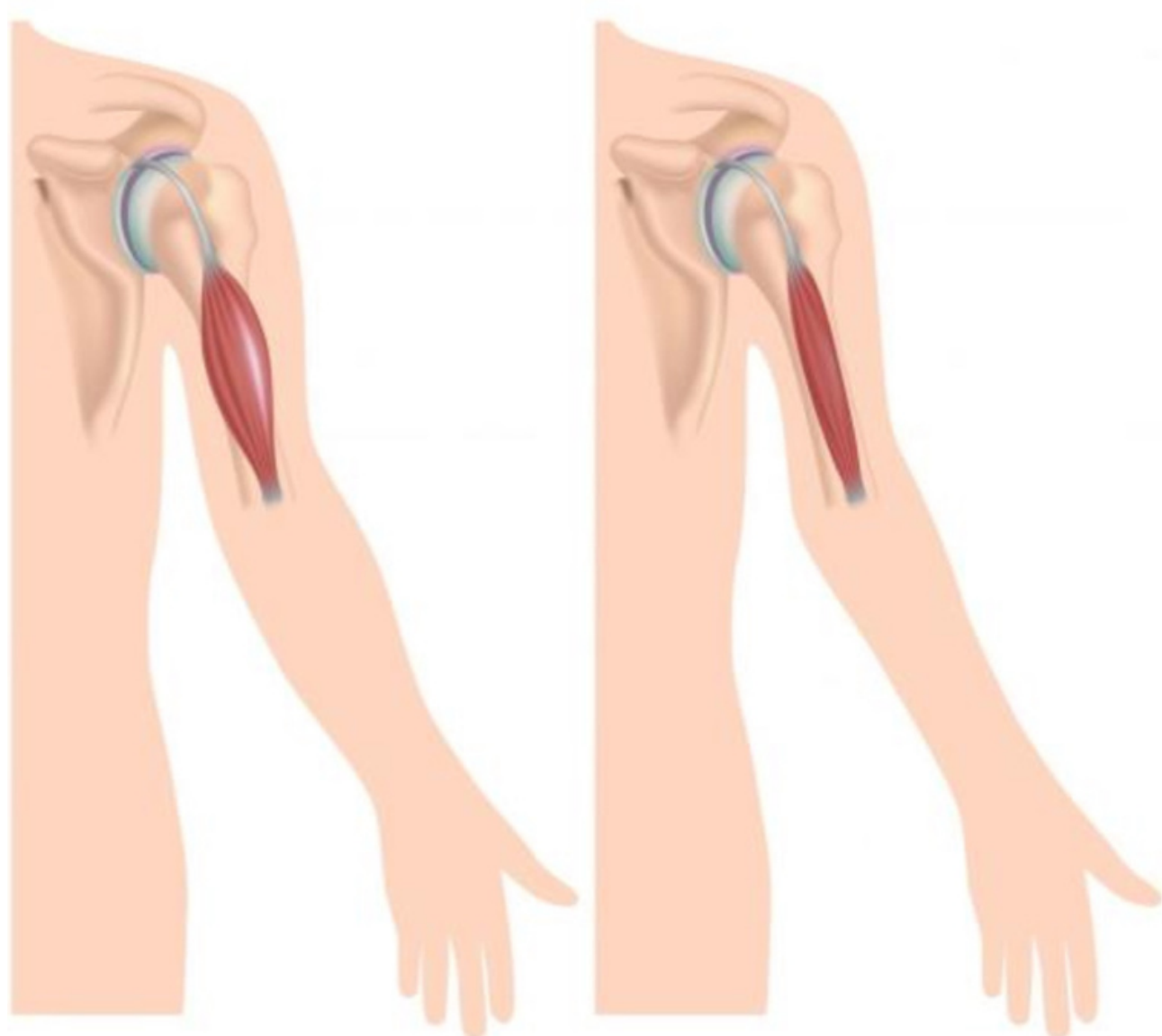
- The muscle cramp is a sudden and involuntary contraction of one or more of your muscles.
- If you've ever been awakened in the night or stopped in your tracks, you know that muscle cramps can cause severe pain.
- Muscle cramps can make it temporarily impossible to use the affected muscle.
- Long periods of exercise or physical labor, particularly in hot weather, can lead to muscle cramps.
- Some medications and certain medical conditions also may cause muscle cramps.
- Overuse of a muscle, dehydration, muscle strain or simply holding a position for a prolonged period can cause a muscle cramp.
- You might be at higher risk of muscle cramps if you have diabetes, or nerve, liver or thyroid disorders.



MUSCLE DYSTROPHY

Muscular dystrophy (MD) refers to a group of hereditary diseases that weaken different muscle groups in various ways.

- A person affected with MD has a genetic mutation that prevents the repair of muscle tissue.
- This muscle weakening occurs gradually over time.
- Symptoms may start at any time from infancy through to adulthood.
- By age 10 to 12 years children will often be in a wheelchair.
- This disease also affects other body systems so patients need regular respiratory and cardiac assessment.
- It is likely that these patients will eventually need a ventilator to breathe.
 - People with DMD usually do not survive beyond their late teens or early adulthood.



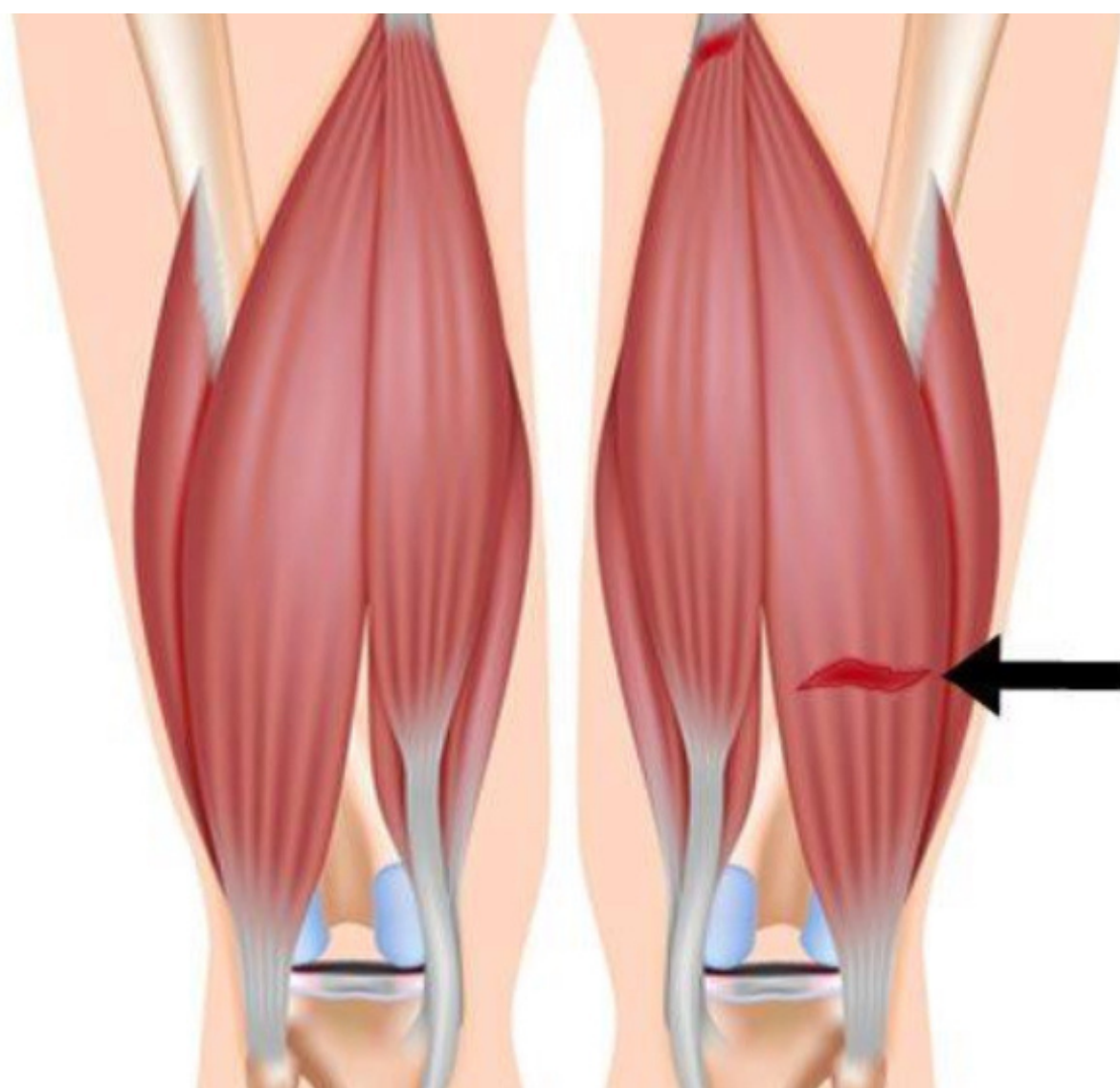
Normal biceps

Muscular dystrophy

STRAIN

A strain occurs when a muscle and/or tendon is overstretched or torn.

- There is no fracture or dislocation present.
 - Pain, weakness and muscle spasms are common symptoms experienced after a strain occurs.
- Rest, application of ice and a compression bandage are effective treatments.



MCQs

1

The pennate muscles shorten very little and are very weak.

A) True

B) False

2

Quadriceps Femoris is the _____ for extension of the knee joint.

A) Synergist

B) Fixator

C) Agonist

D) Antagonist

3

Somatic Nerves supply?

A) Cardiac Muscles

B) Skeletal Muscles

C) Visceral Muscles

D) All of the above

4

It opposes the action of the prime mover

A) Fixator

B) Antagonist

C) Agonist

D) Synergist

5

The amount of work done by a muscle is reflected in changes in the muscle itself:

A) Muscles exercise

B) muscles innovation

C) tendons

D) Action

Answer Key:

1) B (but are very powerful)

2) C or "Prime mover"

3) B

4) B

5) A



LEADERS

Nisreen Alotaibi

Omar Alattas

MEMBERS

- Shaden Alotaibi
- Danah Khallaf
- Elaf Alshamlan
- Jana Alahaideb
- Dana Alotaibi
- Noorah Alkhilaiwi
- Orjwan Alharthi
- Lana Alfouzan
- Abdulhadi Alqahtani
- Turki Alanzi
- Talal Alrobaian
- Abdulmalik Aldafas
- Ahmad Addas
- Salman Al Hakeem
- Ziyad Bukhari

