Muscular system



Muscular System

LEARNING OBJECTIVES:

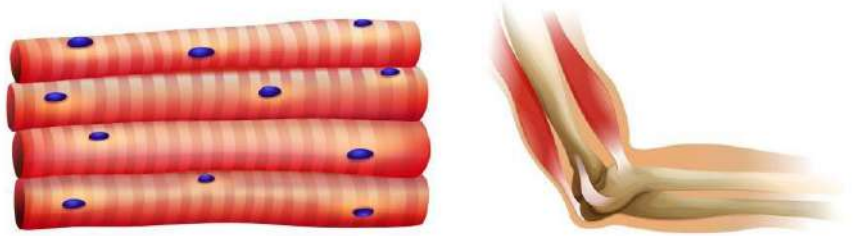
1. STRUCTURE AND FUNCTION OF MUSCLE TISSUE
2. HOW MUSCLES WORK
3. LOCATION AND ACTION OF MAIN MUSCLES
4. DISORDERS OF THE MUSCULAR SYSTEM

Functions of the muscular system

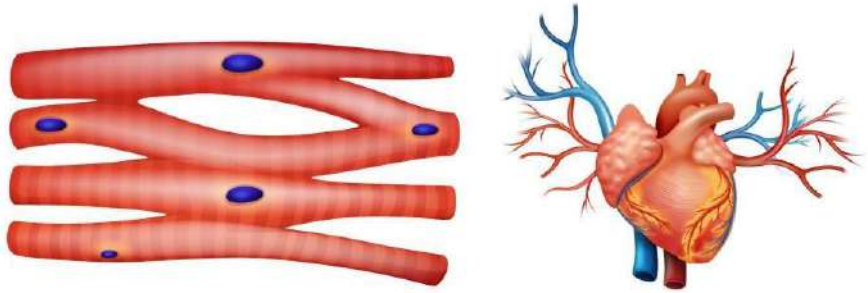
- Movement
- Stability of joints
- Maintain posture
- Circulation of blood and lymph
- Body temperature regulation



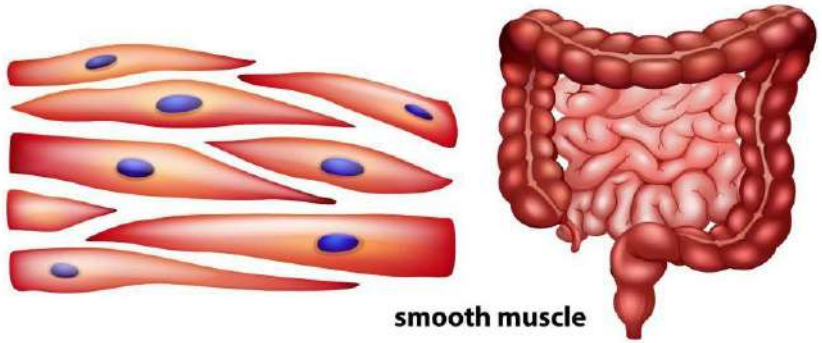
Types of Muscle Cells



skeletal muscle



cardiac muscle



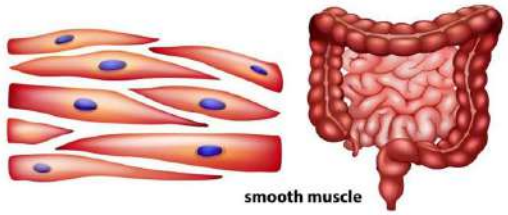
smooth muscle

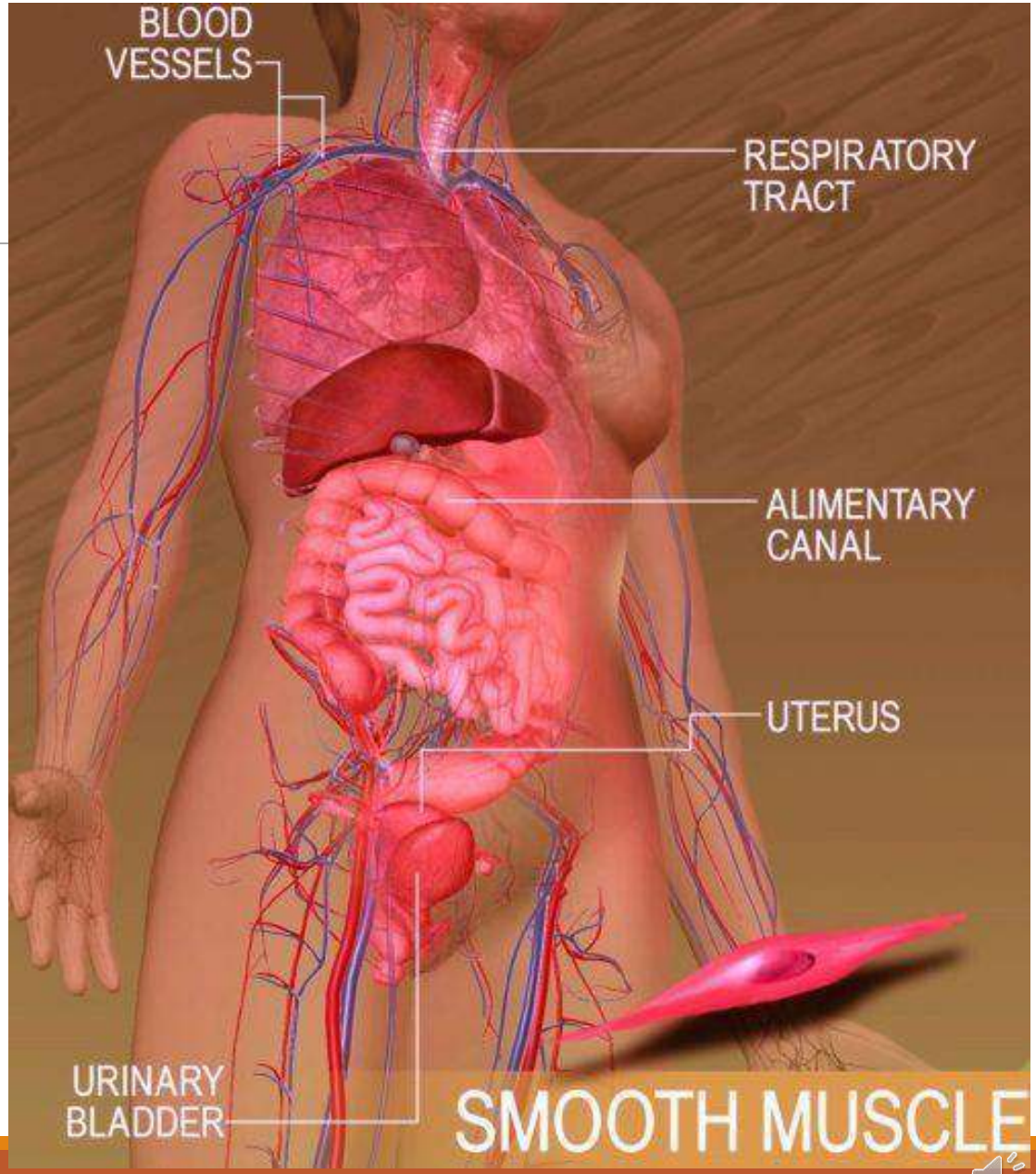
Types of muscle:
1. Smooth muscle

- Found in the lining of organs ('Visceral' muscle)
- Involuntary
- Controlled by nerves and hormones

- **Function:**
  - Allows blood and fluids to move through the organs

- **Structure:**
  - One nucleus
  - Non-striated

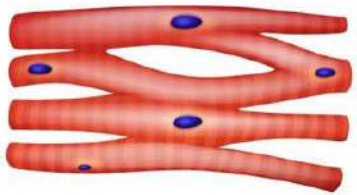




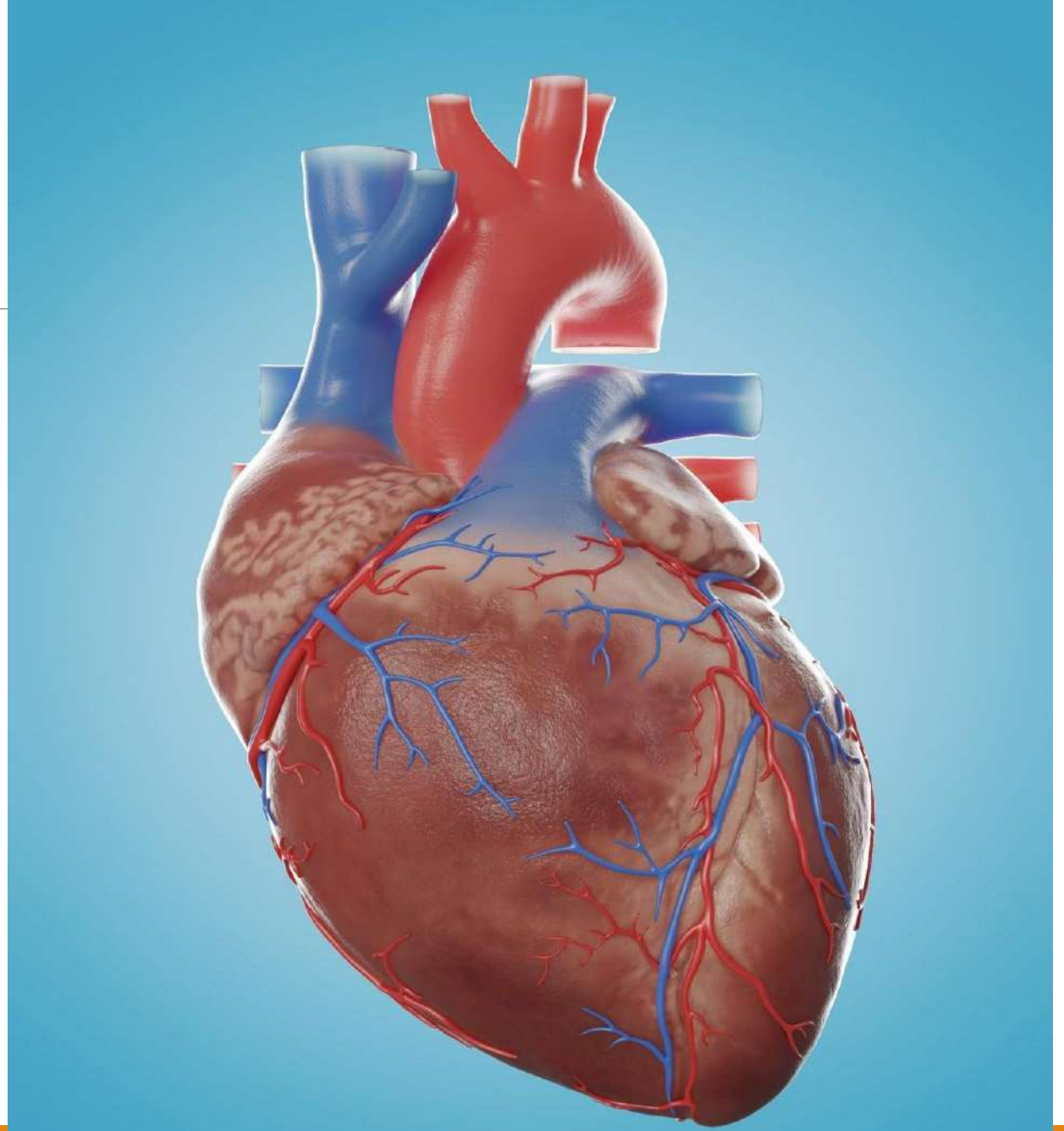
Types of muscle:
2. Cardiac muscle

- Only exists in the heart
- Involuntary
- Controlled by neurotransmitters and hormones
- Does not fatigue

- **Structure:**
  - Mono-nucleated
  - Striated



cardiac muscle

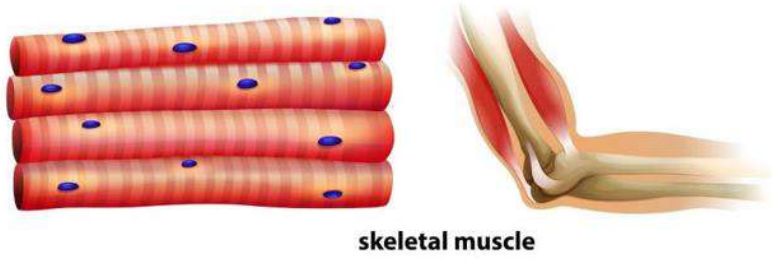


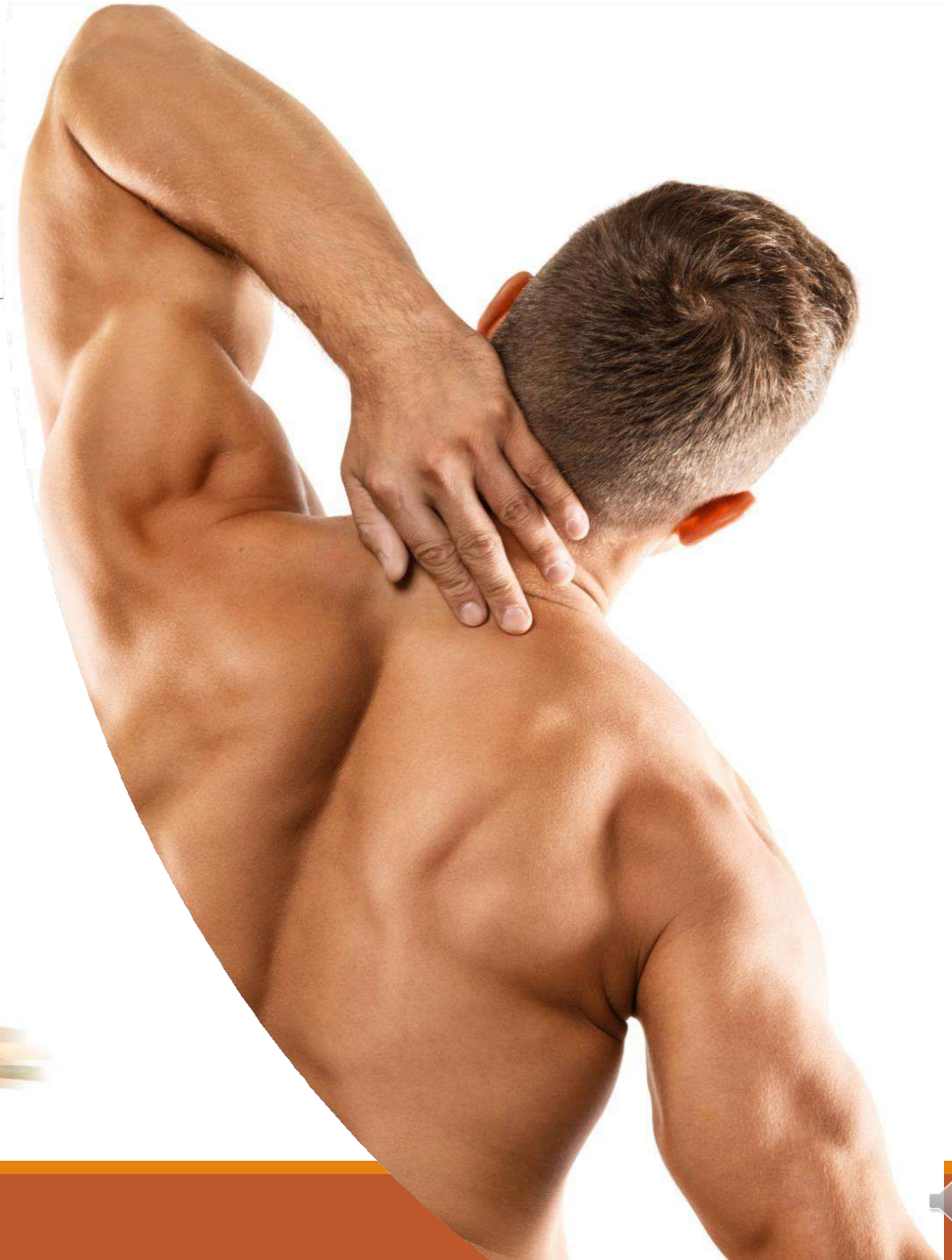
Types of muscle:
3. Skeletal muscle

- Voluntary, consciously controlled
- Located under the skin and fat
- Attach to bones by tendons
- Approx. 45% of body weight

- **Function:**
  - Movement, Posture, Heat regulation

- **Structure:**
  - Striated
  - Multinucleated

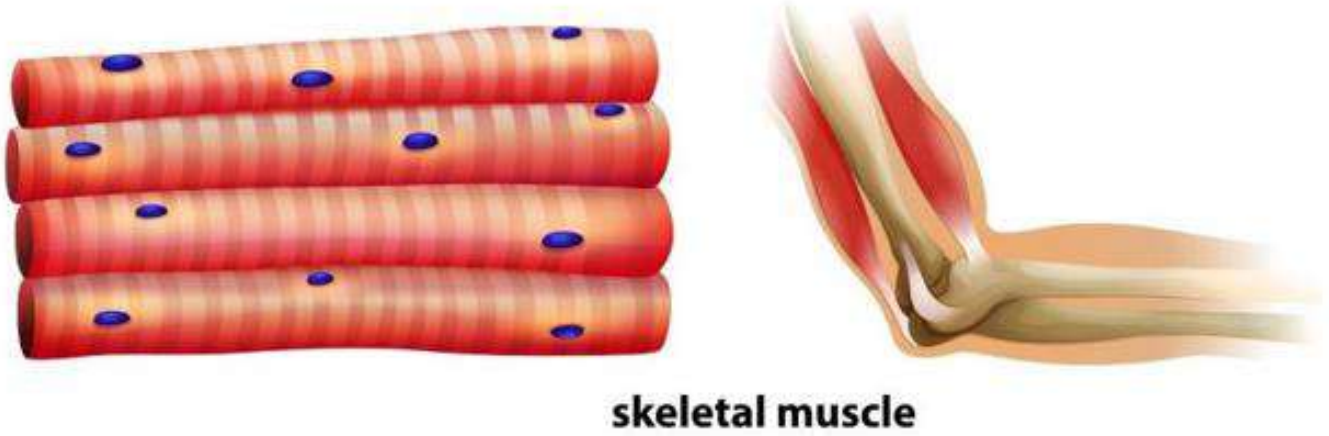




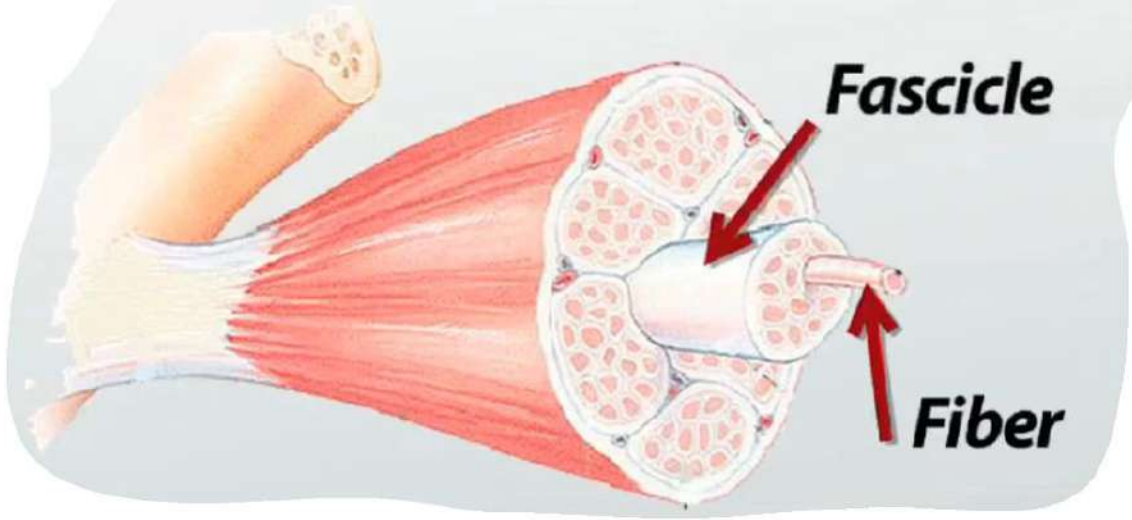
Muscle	Location	Striated / non-striated	Nucleus	Voluntary / involuntary	Function
Skeletal	Between bones	Striated	Multinucleated	Voluntary	Movement
Smooth	Inner walls of organs	Non-striated	Single nucleus	Involuntary	Lines cavities to push food and fluids through the organs
Cardiac	Heart	Striated	Single nucleus	Involuntary	Pumps heart

Skeletal muscle in more detail

- Structure of skeletal muscle
- Movement
- Characteristics
- Shapes / types of skeletal muscle
- How muscle contracts - sliding filament theory



Many muscle fibers = 1 fascicle
Many fascicles = 1 muscle

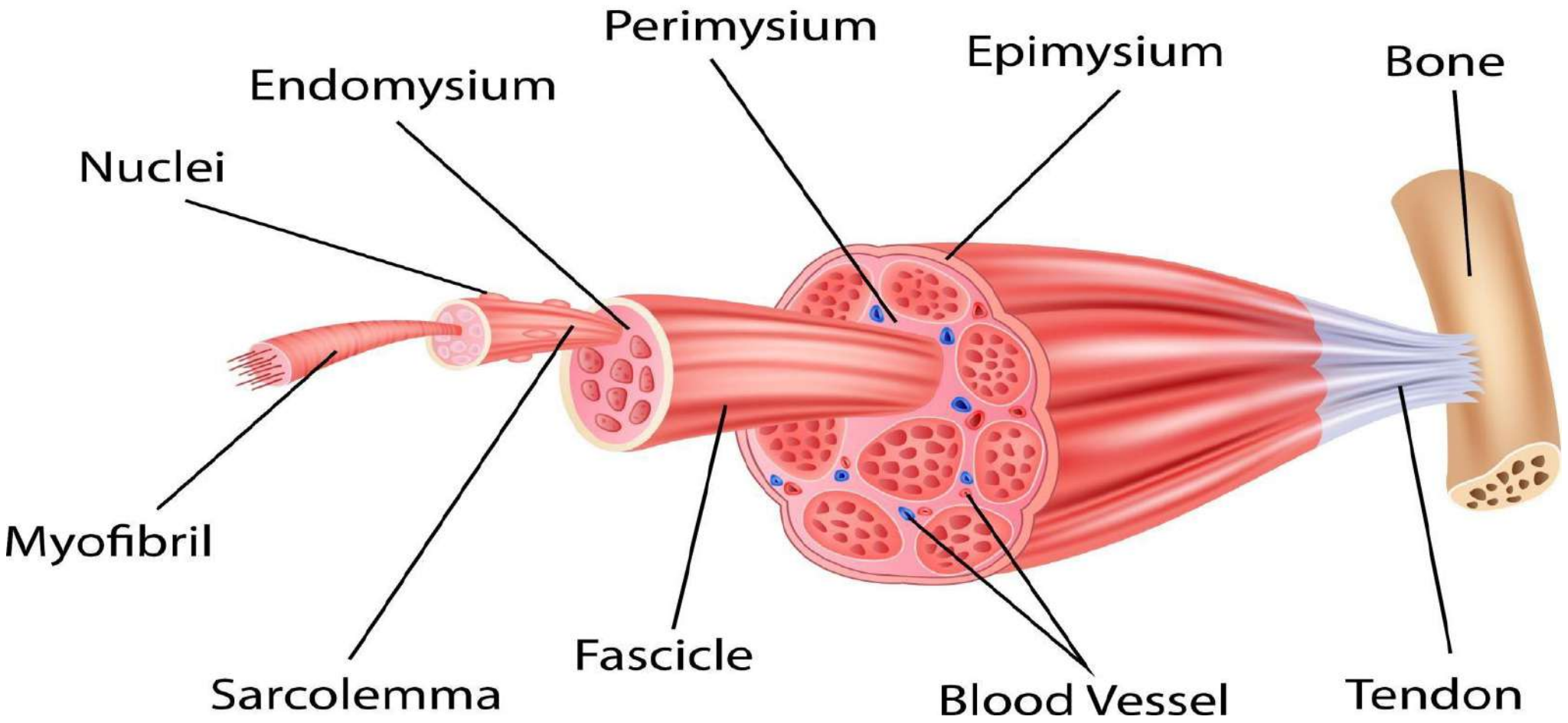


Muscles

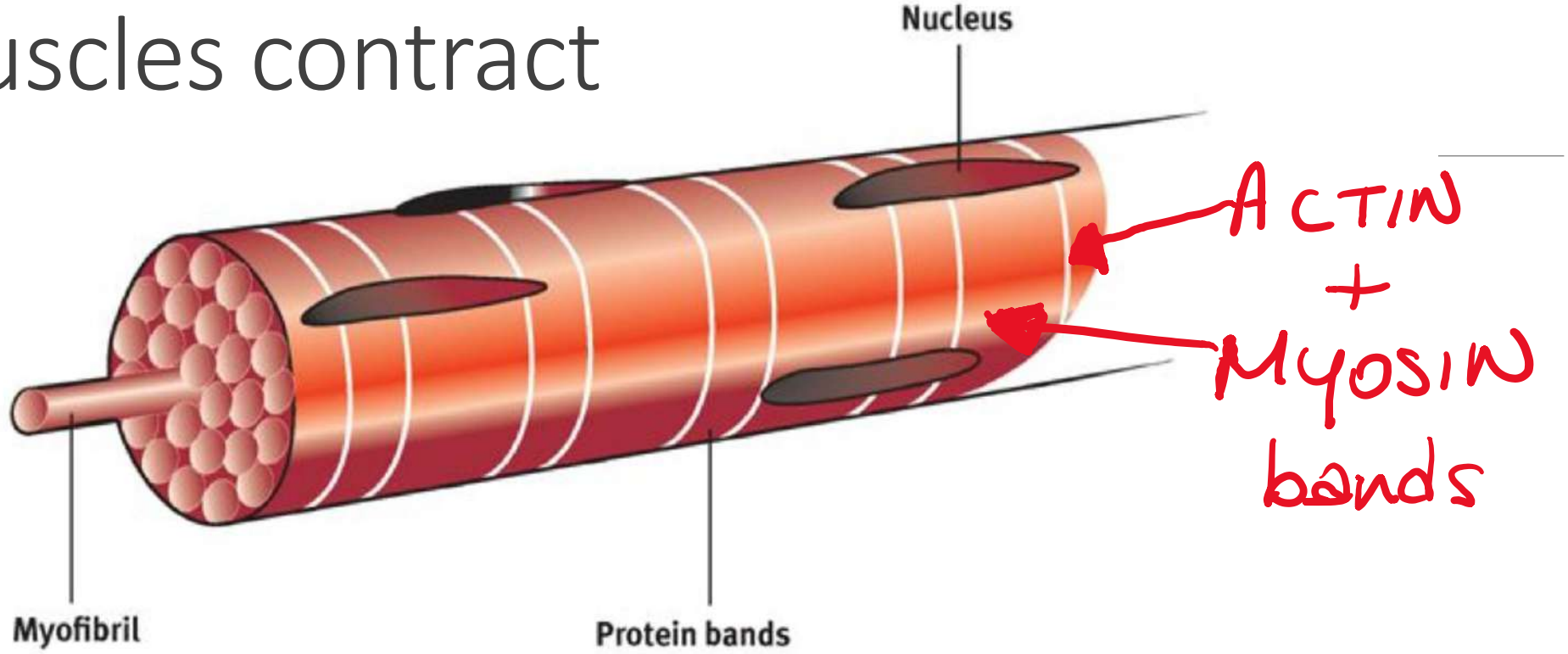
are made up of groups of fascicles

when stimulated they contract to produce motion

Structure of Skeletal Muscle



Sliding filament theory – how muscles contract

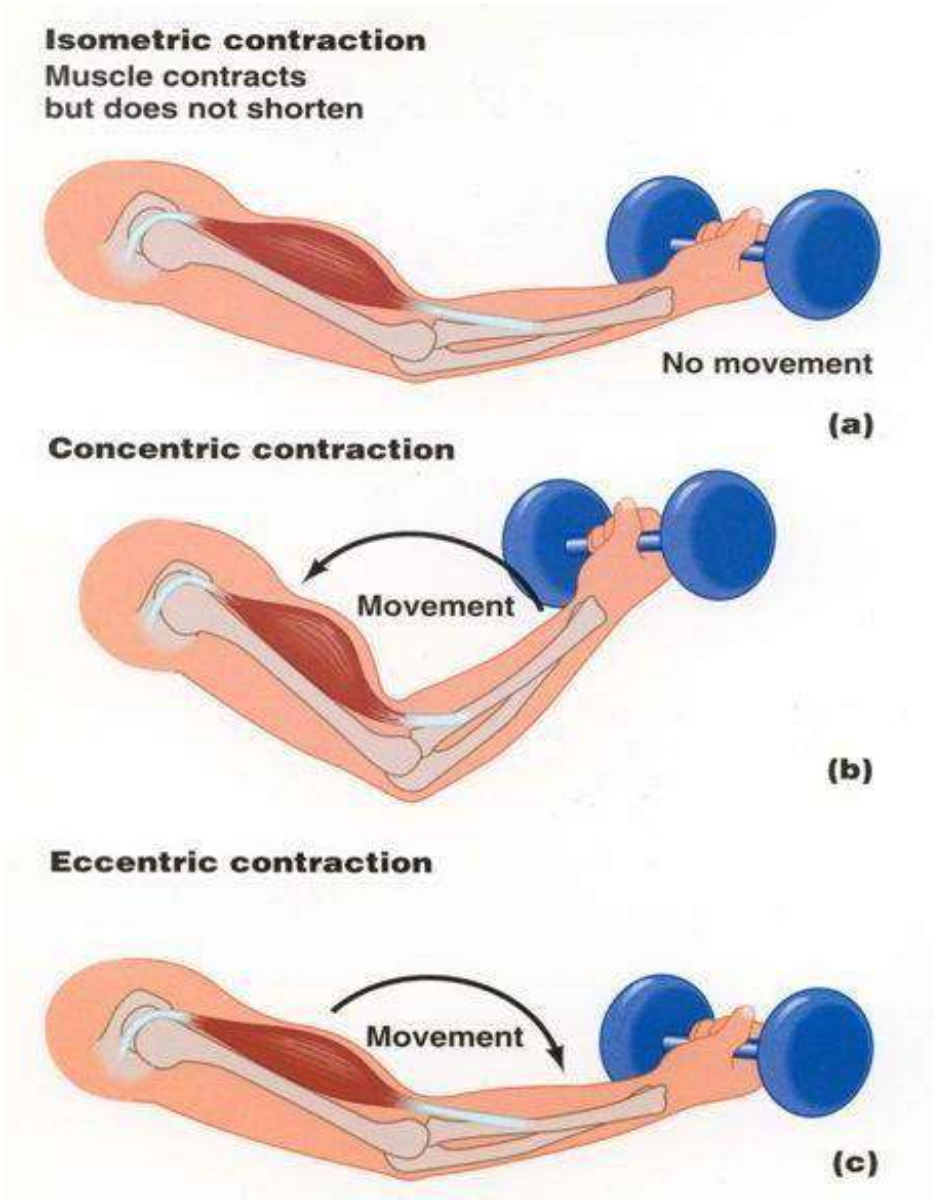


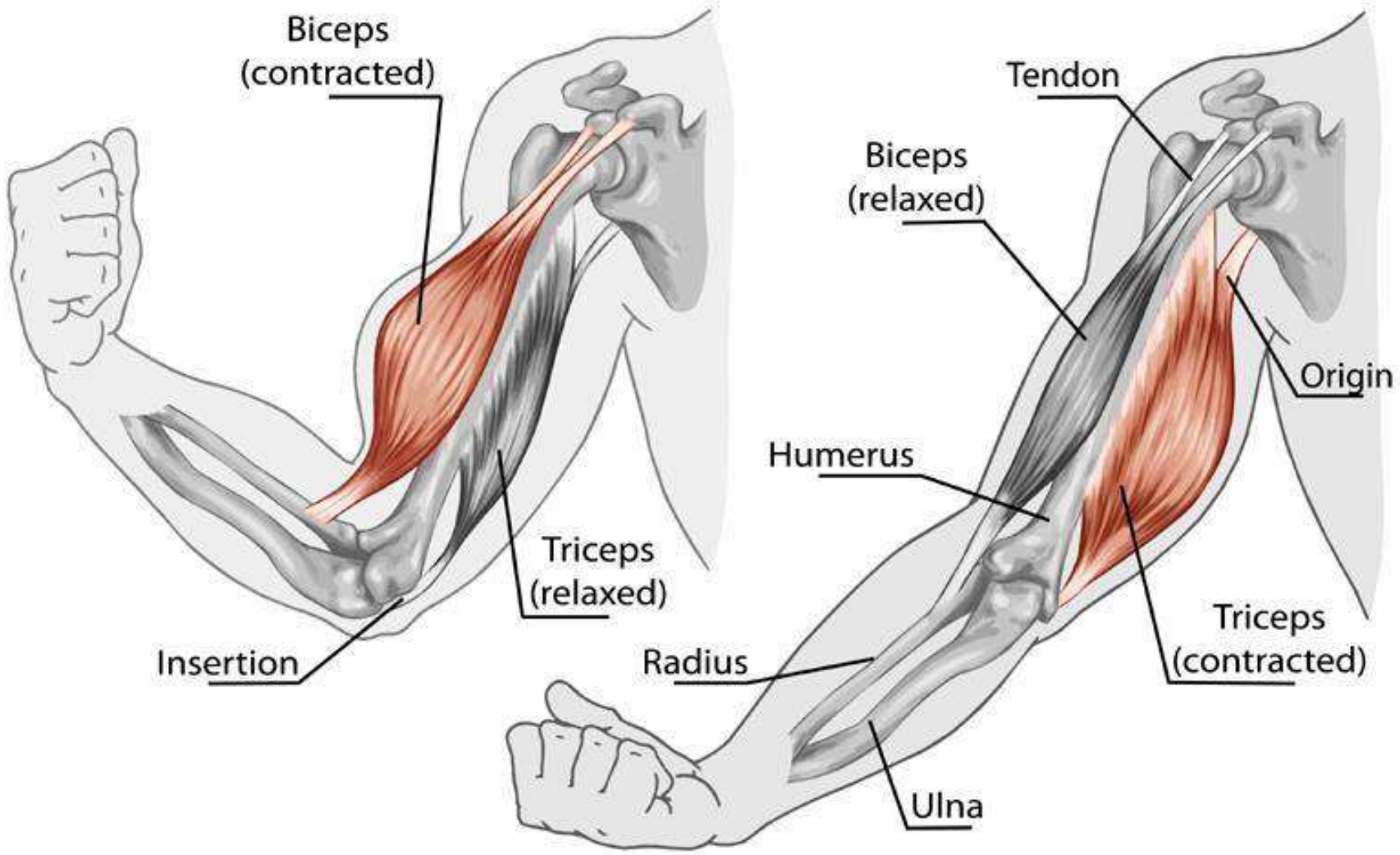
Skeletal muscle fibre

Types of Muscle contractions

- Isotonic –muscle shortens and movement occurs.

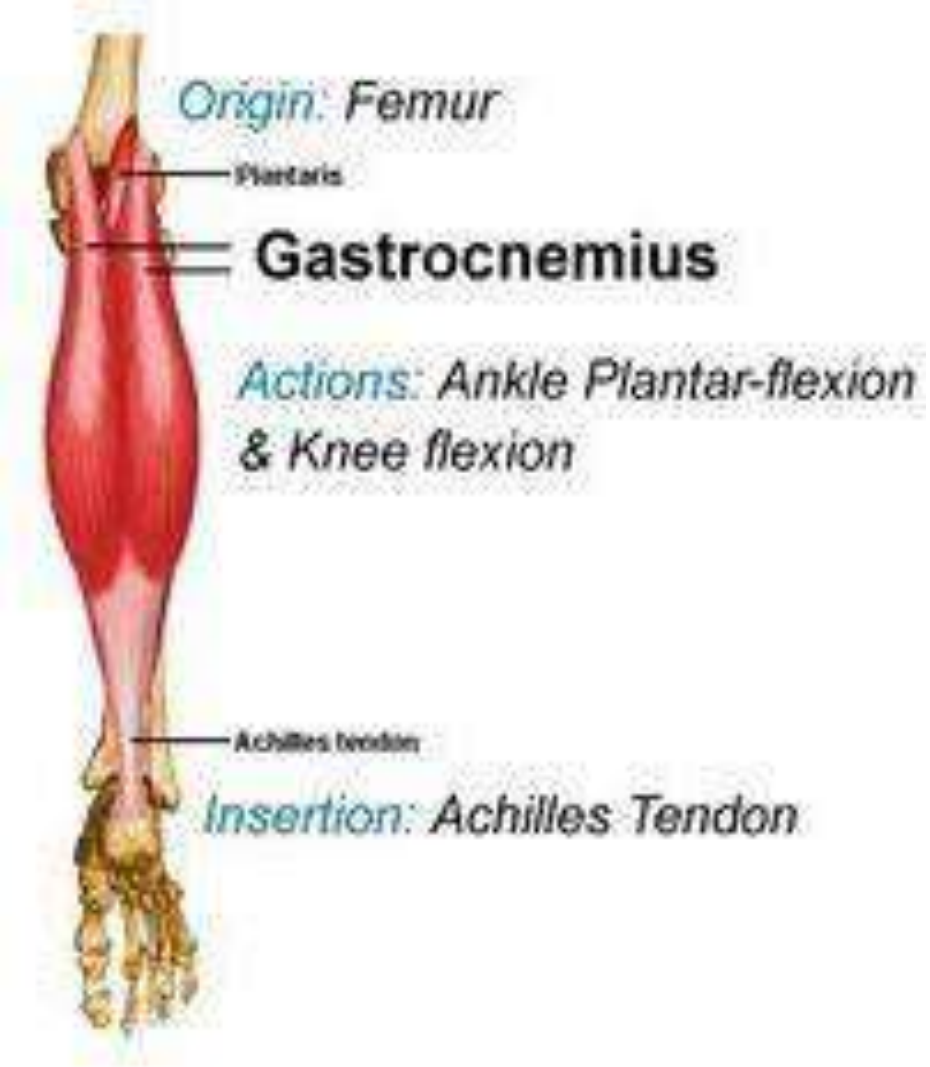
- Isometric- muscle does not shorten but tension increases.




Biceps
(contracted)
Triceps
(relaxed)
Insertion
Tendon
Biceps
(relaxed)
Origin
Humerus
Triceps
(contracted)
Radius
Ulna

Features

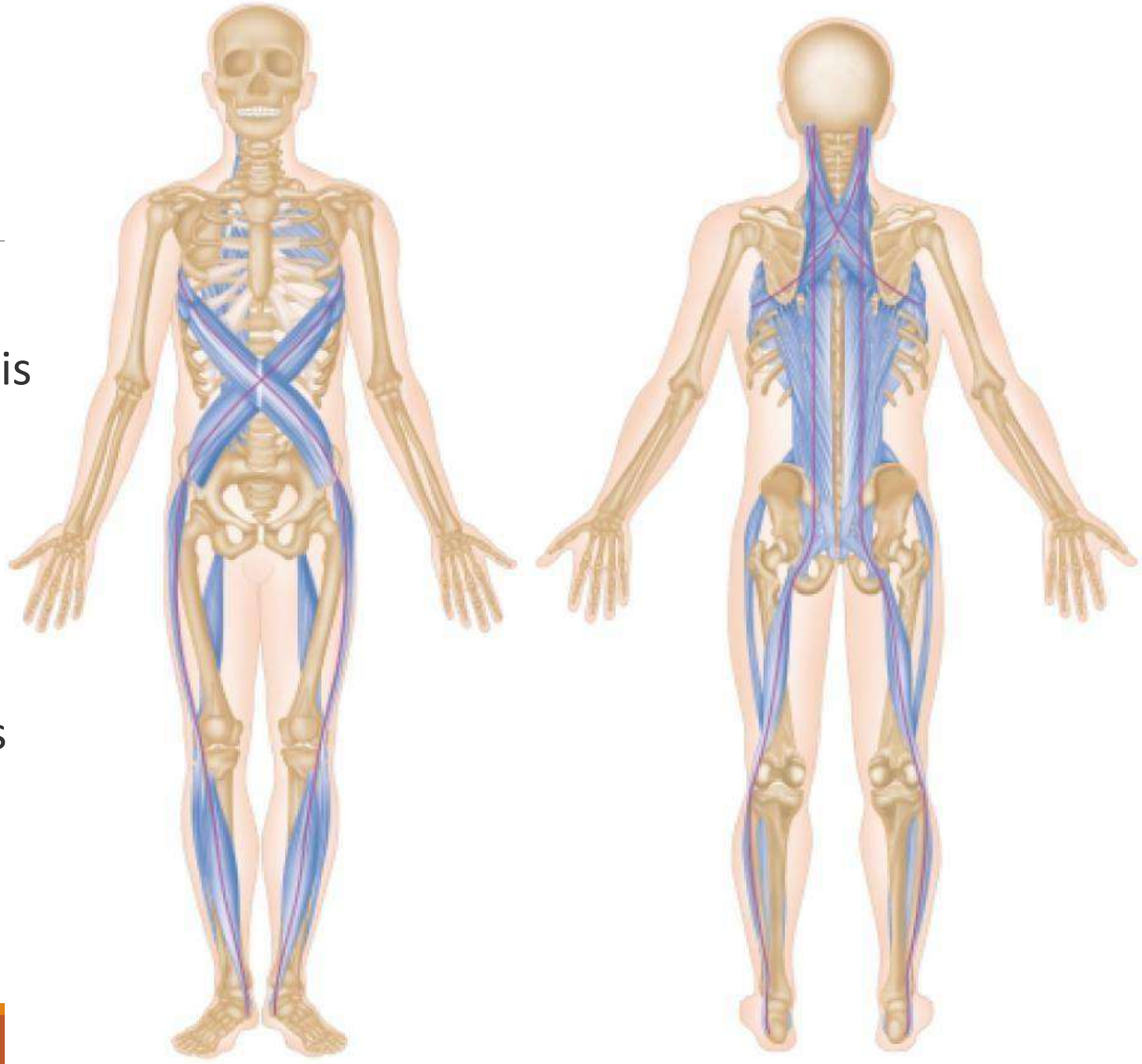
- Origin: where muscle attaches to a fixed point
- Insertion: where muscle attaches to a moving point
- Belly: main body of the muscle
- Tendons: attach muscles to bone
- Ligaments: attach bone to bone



Fascia

- **Fascia** is connective tissue that is woven around every muscle, bone, nerve, artery and vein in our bodies, as well as all of our internal organs

- It is quite literally what holds us together



Characteristics of skeletal muscle

Irritability :

- The ability to respond or contract in response to chemical and/or electrical signals

Contractility:

- The ability to shorten which moves structures the muscles are attached to

Extensibility:

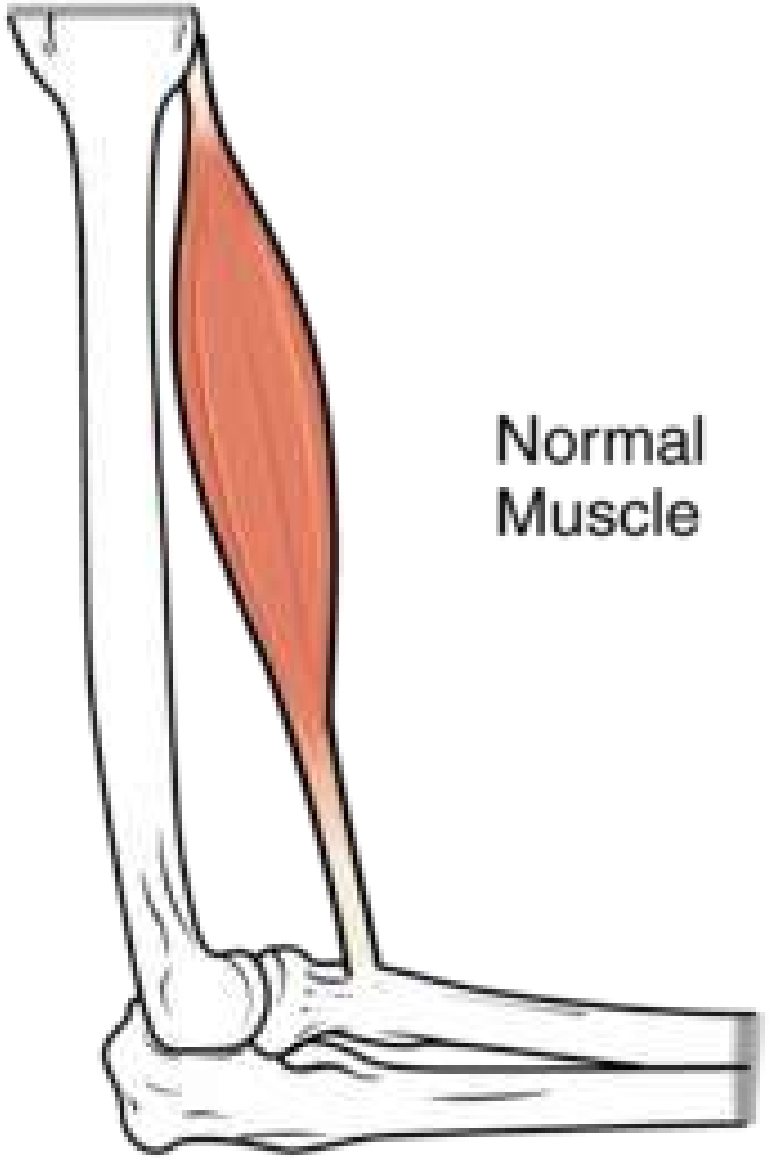
- The capacity to stretch to the normal length after contracting

Elasticity

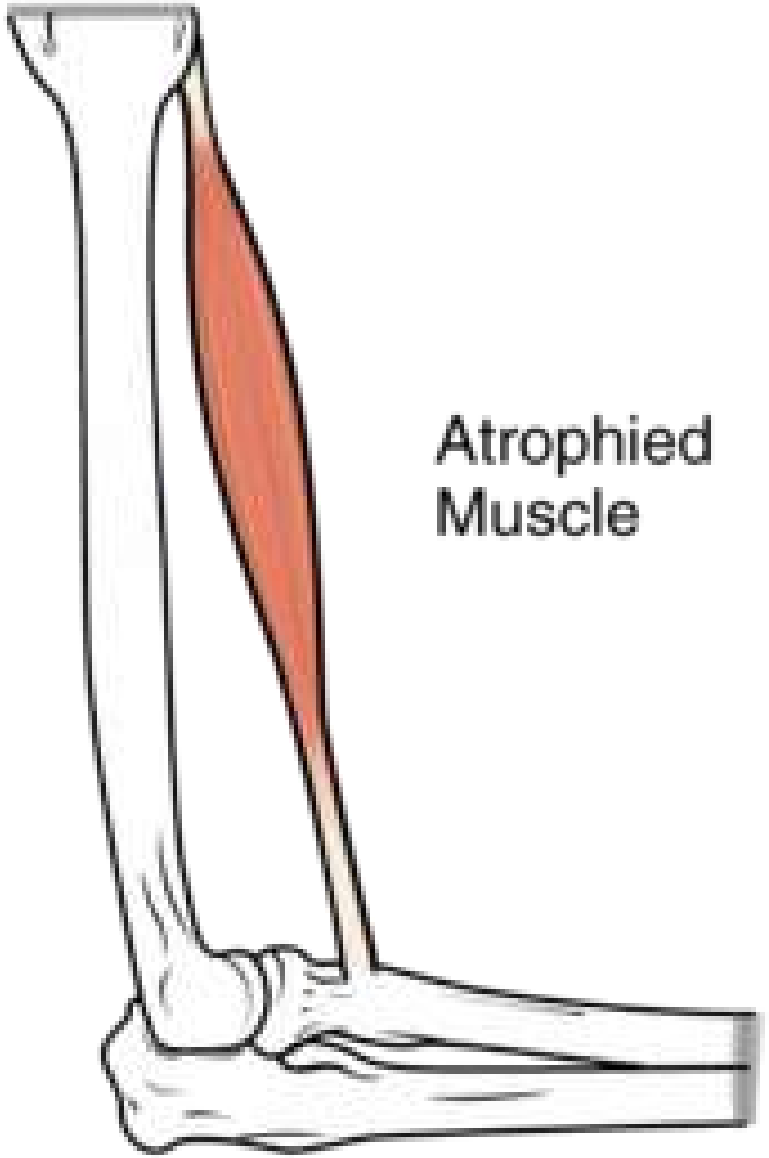
- The ability to return to the original resting length after a muscle has been stretched

Muscle tone

- **Normal tone**: Continuous contraction of a muscle
- **Atrophy:** muscle wasting, prolonged inactivity can lead to degeneration and loss of strength
- **Hypotonia:** loss of muscle tone and resistance, e.g. neurological disease – cerebral palsy
- **Hypertonia:** an increase muscle tone, generally due to an injury of the central nervous system, e.g. stroke, MS



Normal
Muscle



Atrophied
Muscle

Movement

- **Agonist:** The muscle that causes a movement
- **Antagonist:** A muscle that opposes movement of the agonist – e.g. agonist contracts, antagonist relaxes
- **Stabiliser:** Stabilise a joint so that movement can happen at another joint
- **Synergist:** Muscles that assist in a movement



flexion of leg



extension of leg



adduction of thigh

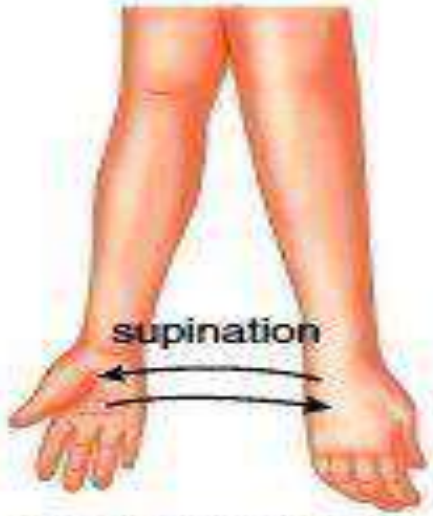


abduction of thigh

a. Angular movements



rotation of arm



pronation of hand

b. Circular movements



inversion



eversion

c. Special movements