



The Muscular System

Human Anatomy

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Objectives of this lecture


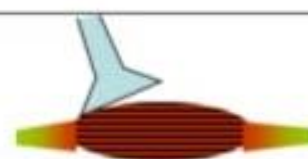


You should be able to describe the following;

- ❖ Functions of the muscular system
- ❖ Properties of Muscular Tissue
- ❖ Muscular system components
- ❖ Types of muscles
- ❖ Structure of skeletal muscle
- ❖ Shapes of muscles



Properties of Muscular Tissue

- ▶ Contractility; ability to contract when stimulated
- ▶ Electrical excitability; ability to respond to certain stimuli
- ▶ Extensibility; ability to stretch without being damaged ex; stomach wall is stretched when fills with food.
- ▶ Elasticity; ability to return to its original length and shape after contraction or extension

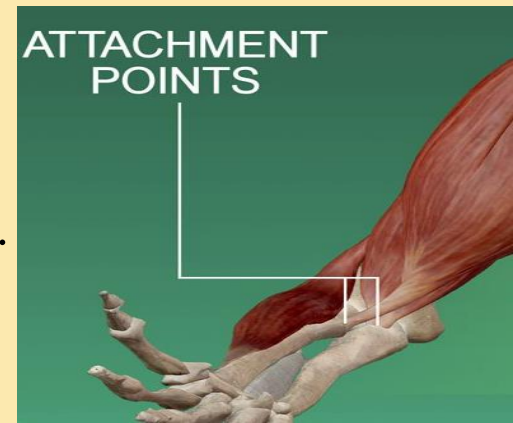
Contractility	
Excitability	
Extensibility	
Elasticity	

Functions of Muscular System

- ▶ **Producing body movements. Movements of the whole body such as walking and running, and localized movements such as grasping**
- ▶ **Stabilizing body positions. Skeletal muscle contractions stabilize joints and help maintain body positions**
- ▶ **Storing and moving substances within the body, ex; storage of food in the stomach or urine in the urinary bladder**
- ▶ **Generating heat. Involuntary contractions of skeletal muscles, known as shivering, can increase the rate of heat production.**

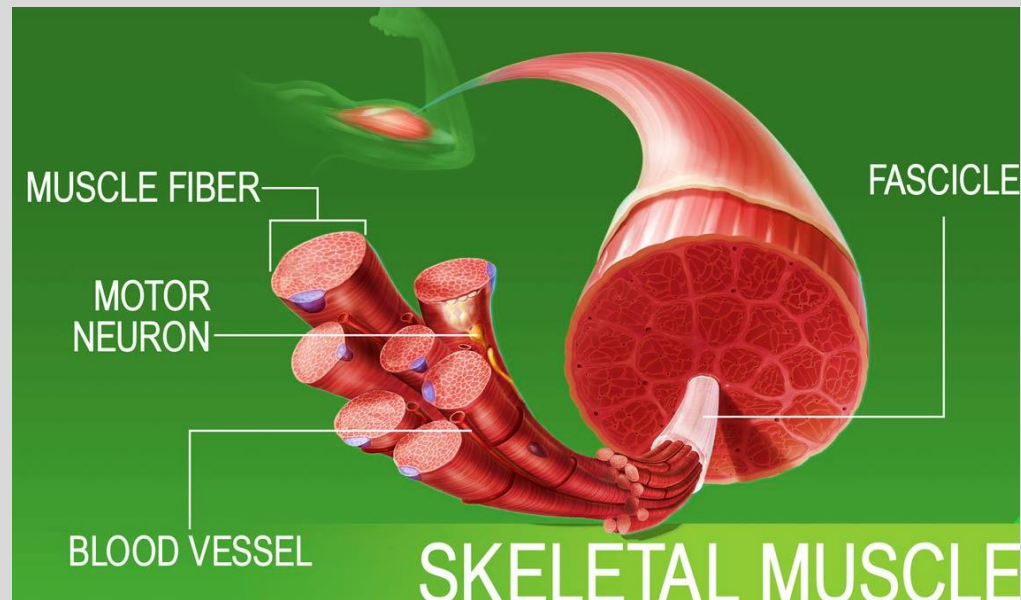
Introduction to Muscular System

- ▶ The muscular system makes up about 40% of our mass with over 600 muscles
- ▶ It is controlled by the nervous system except the cardiac muscle is autonomous.
- ▶ Each muscles is an organ consist of muscle tissue, blood vessels, tendons, and nerves.
- ▶ Skeletal Muscles attach to bones, muscles pull on bones to move the body
- ▶ Smooth and cardiac muscle facilitate body functions like heartbeats & digestion.
- ▶ Blood vessels and nerves run to every muscle, helping control and regulate muscle's function.
- ▶ Muscles vary greatly in shape& size and extend to all body parts.
- ▶ Muscles make up the walls of many organs



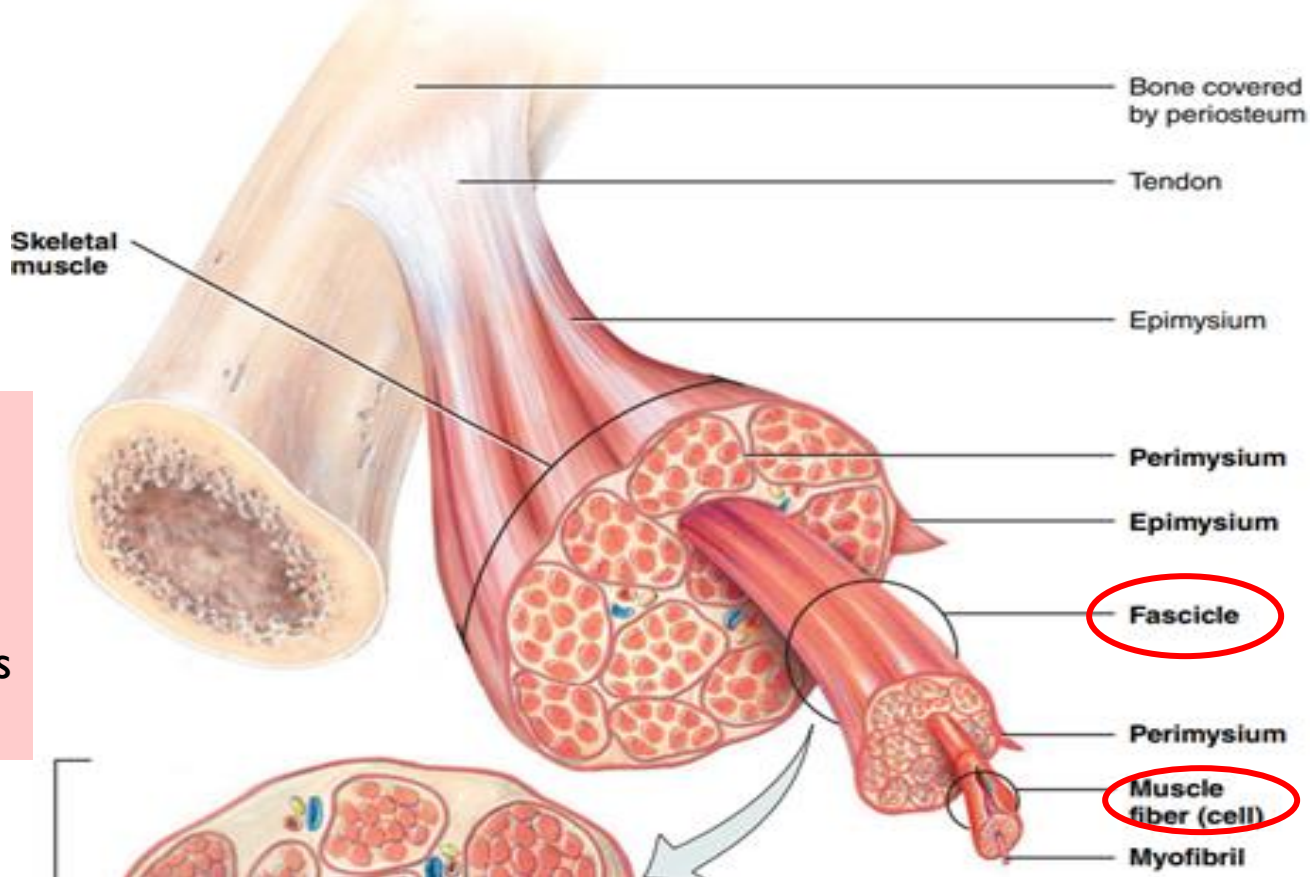
Types of Muscular tissue

- ▶ The three types of muscular tissue are: skeletal, cardiac, and smooth
- ▶ **I. Skeletal muscles(voluntary)**
- ▶ Move the bones of the skeleton by contracting and relaxing in response to voluntary messages from the nervous system
- ▶ Skeletal muscle tissue is composed of long cells called muscle fibers
- ▶ Muscle fibers are organized into bundles supplied by blood vessels and innervated by motor neurons.



A skeletal muscle consists of fascicles that contain muscle fibers (cells), and surrounded by fascia.

Fascia (bandage) is a dense sheet of irregular connective tissue that supports and surrounds muscles, carries nerves, blood vessels, and fills spaces between muscles.



Fascia consist of;

Epimysium, the outer layer of the entire muscle.

Perimysium, surrounds groups of 10-100 or more muscle fibers, separating them into bundles

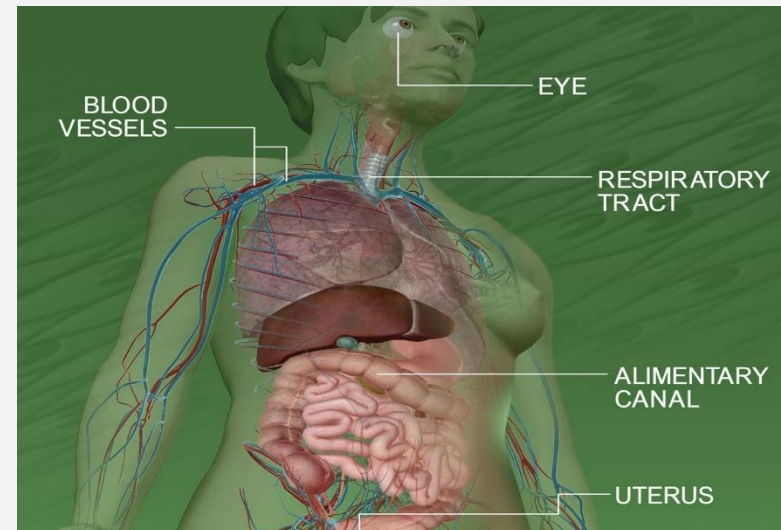
fascicles, made of many muscle fibers

Endomysium separates individual muscle fibers from one another in the fascicles

Fascia extend beyond the muscle fibers to form a ropelike **tendon** that attaches a muscle to the bone.

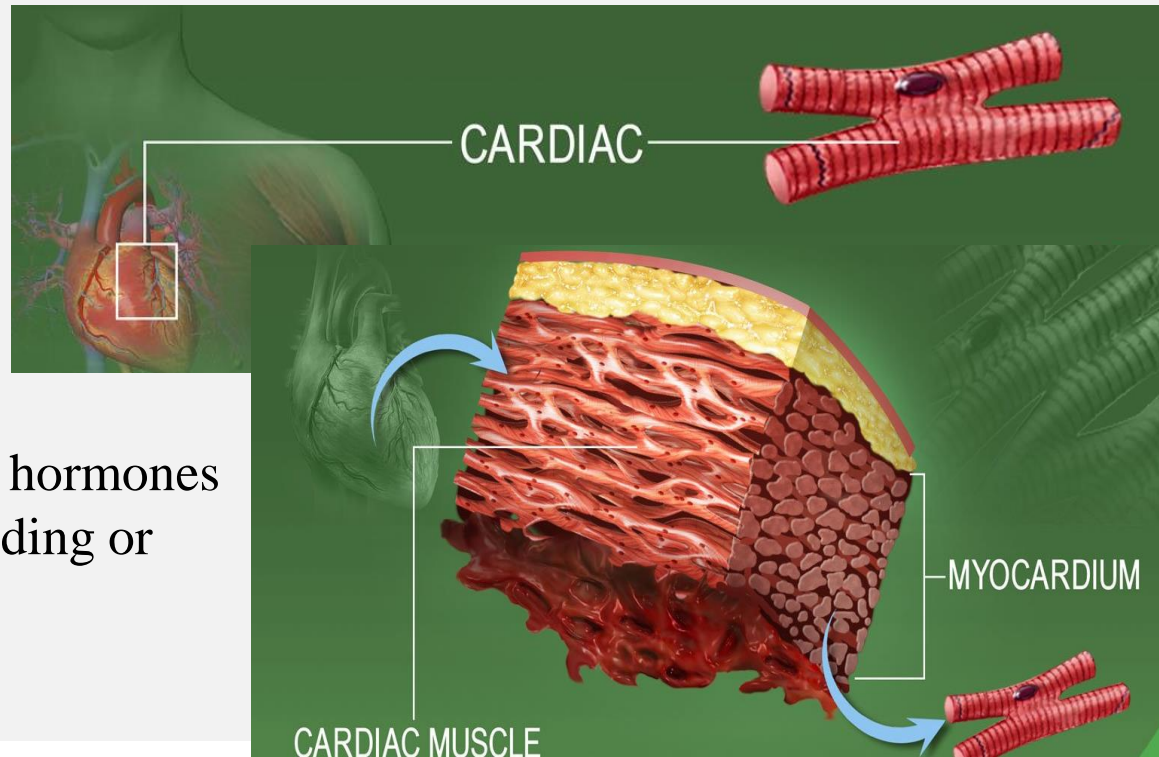
Types of Muscular tissue

- ▶ **2. Smooth muscle:** located in the walls of internal structures, such as blood vessels, airways, and most organs in the abdominopelvic cavity.
- ▶ Its contractions are involuntary movements triggered by impulses from autonomic nervous system to the smooth muscle tissue.
- ▶ Allow organs to expand and relax as needed ex; In the walls of urinary bladder & the uterus.
- ▶ facilitates the peristaltic waves that move swallowed food and nutrients of the alimentary canal (the digestive tract).



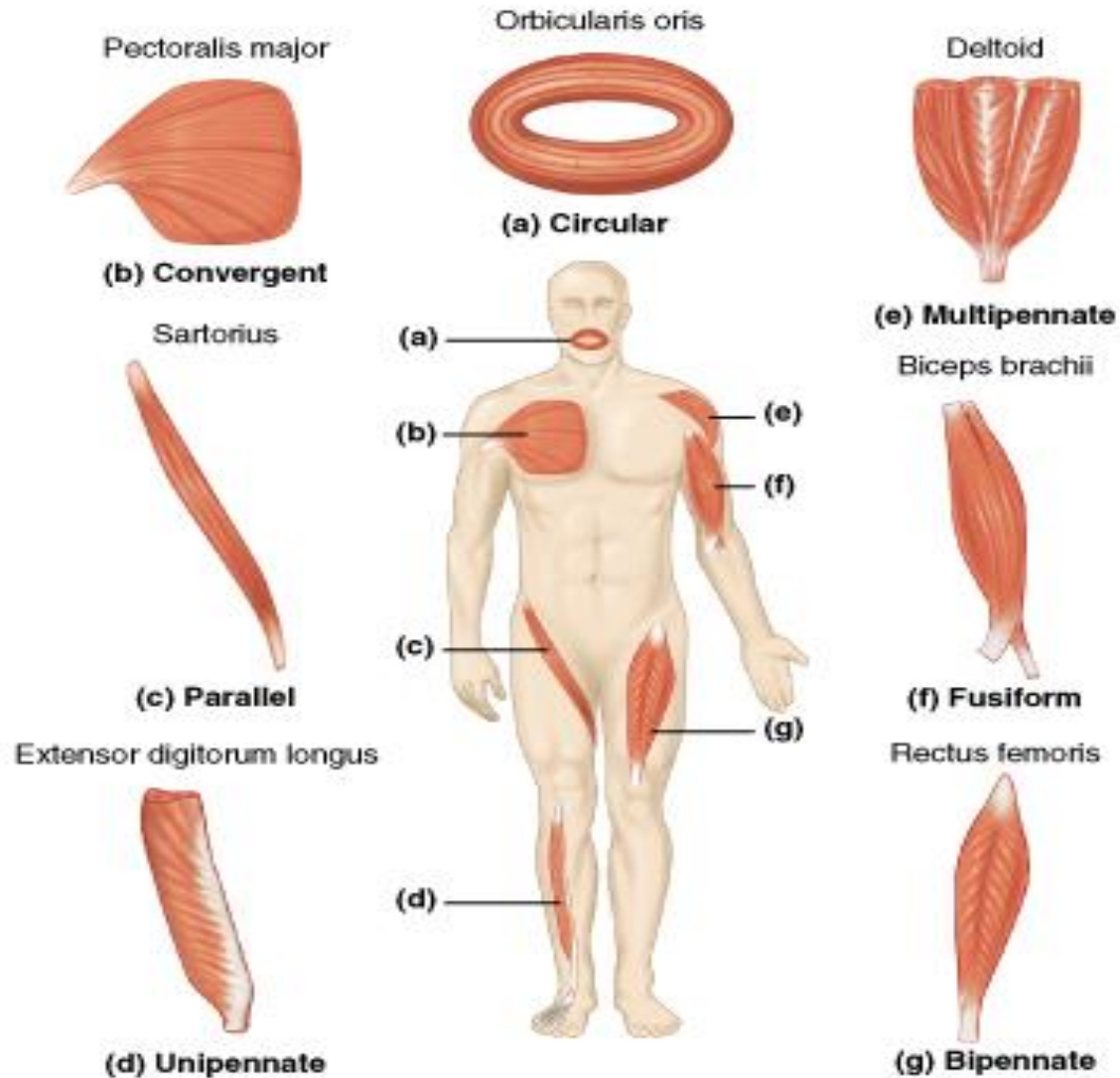
Types of Muscular tissue

- ▶ **3. Cardiac muscle;** forms most of the heart wall, contracts the heart to pump blood,
- ▶ Its contraction and relaxation makes the heart beats
- ▶ Involuntary muscles, it has a natural **pacemaker** that initiates each contraction.
- ▶ This built-in rhythm is termed autorhythmicity



- Heart rate adjusted by several hormones and neurotransmitters by speeding or slowing the pacemaker.

Shapes of muscles



How muscles work

A motor unit consists of a somatic motor neuron plus all of the skeletal muscle fibers it stimulates

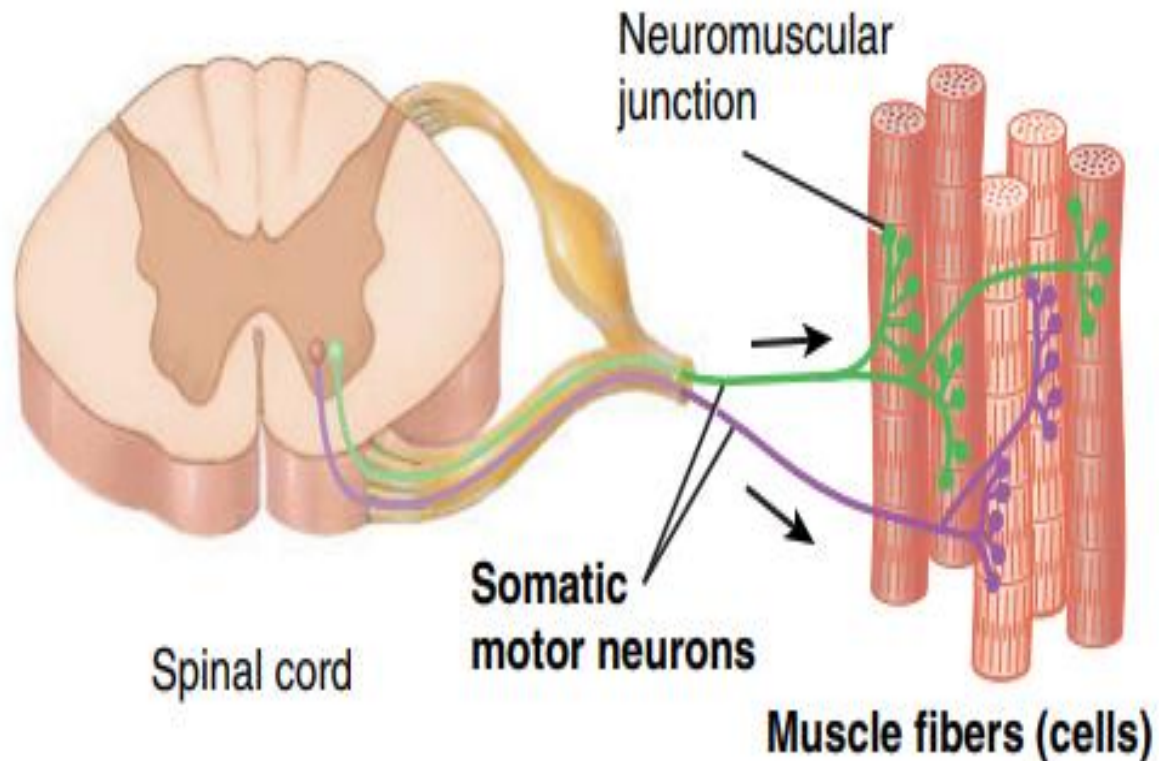
Somatic motor neurons provide the nerve impulses that stimulate skeletal muscle to contract.

Motion results from alternating contraction and relaxation of muscles,

A single somatic motor neuron makes contact with an average of 150 skeletal muscle

Whole muscles that control precise movements consist of many small motor units.

Because all of the muscle fibers of a motor unit contract and relax together



Summary

Tissue	Histology	Function	Location
Skeletal	Long cylindrical fiber, striated, many peripherally located nuclei	Voluntary movement, produces heat, protects organs	Attached to bones and around entrance points to body (e.g., mouth, anus)
Cardiac	Short, branched, striated, single central nucleus	Contracts to pump blood	Heart
Smooth	Short, spindle-shaped, no evident striation, single nucleus in each fiber	Involuntary movement, moves food, involuntary control of respiration, moves secretions, regulates flow of blood in arteries by contraction	Walls of major organs and passageways

Q & A

- ▶ Describe the six main functions of the muscle system
- ▶ What features distinguish the three types of muscular tissue?
- ▶ List the general functions of **muscular** tissue.
- ▶ Describe the four properties of muscular tissue.
- ▶ Describe the microscopic anatomy of a skeletal muscle fiber.



References

- ▶ **For further reading please see:**
 - ▶ **Tortora, G. J., & Derrickson, B. H. (2018). Principles of anatomy and physiology. John Wiley & Sons.**
 - ▶ **Kenneth, S. S. (2017). Anatomy & physiology: The unity of form and function. 8th edition. The McGraw–Hill Companies,. New york.**
 - ▶ **Drake, R. L., Gray, H., Vogl, W., & Mitchell, A. W. (2019). Gray's anatomy for students. Elsevier Health Sciences TW. Netter, F. H. (2018).**
 - ▶ **Atlas of Human Anatomy (Netter Basic Science). Elsevier; 7th edition. Charles K. Weichert (2017).**
 - ▶ **Human Anatomy Atlas; Comprehensive 3D reference and study platform for anatomy, physiology and pathology; <https://www.visiblebody.com/anatomy-and-physiology-apps/human-anatomy-atlas>**
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