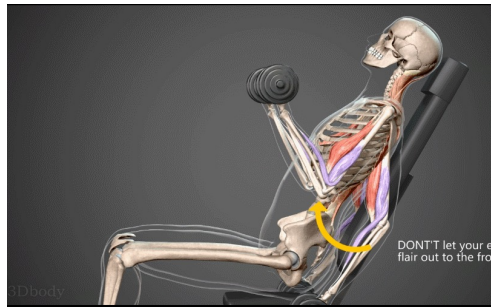




Physiology of Muscular System

By
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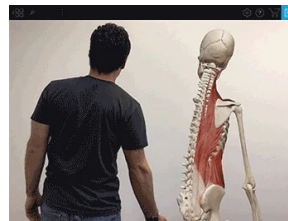
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1

Contents:

- **Muscular Tissues:**
 - **The properties,**
 - **The types,**
 - **The functions**

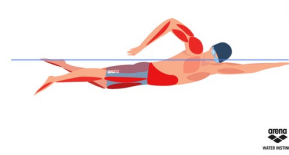


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Objectives:

After studying this lecture, you will be able to:

- Know the properties,
- Differentiate the types, and
- List the functions of muscular tissues.



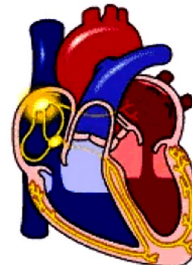
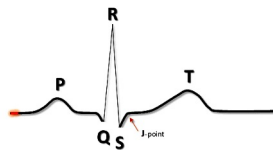
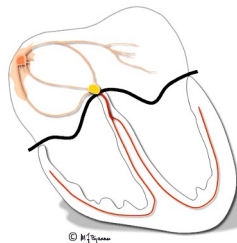
3

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (1 of 4):

1. Electrical excitability:

- ✓ is the ability to respond to certain stimuli by producing electrical signals called **action potentials**.
- ✓ Action potentials can travel along a cell's plasma membrane.



4

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (1 of 4):

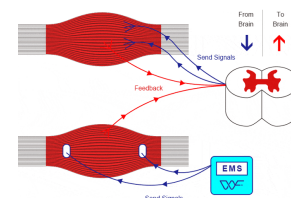
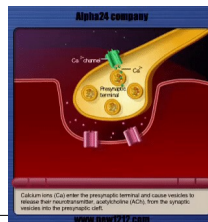
1. Electrical excitability: *cont.....*

- In muscle cells, two main types of **stimuli** trigger action potentials.

■ Autorhythmic electrical signals (the heart's pacemaker).

■ Chemical stimuli

- neurotransmitters released by neurons.
- hormones distributed by the blood.

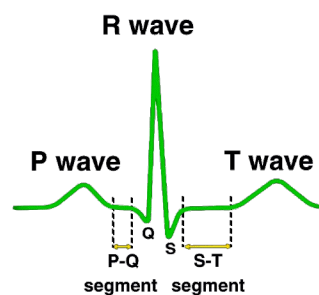
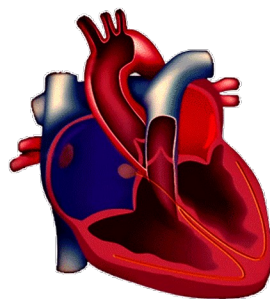


5

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (1 of 4):

1. Electrical excitability: *cont.....*



6

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (2 of 4):

2. Contractility:

- ✓ is the **ability of muscular tissue to contract forcefully** when stimulated by an action potential.
- ✓ When a muscle contracts, it generates **tension (force of contraction)** while pulling on its attachment points.
- ✓ If the tension generated is great enough to overcome the resistance of the object to be moved, the muscle shortens and movement occurs.



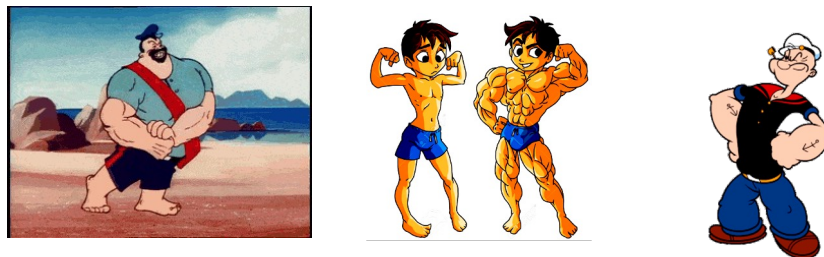
7

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (3 of 4):

3. Extensibility:

- ✓ Is the ability of muscular tissue to stretch without being damaged.
- ✓ It allows a muscle to contract forcefully even if it is already stretched.



8

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (3 of 4):

3. Extensibility: *cont....*

- Normally, smooth muscle is subject to the greatest amount of **stretching**.

For example:

- Each time your stomach fills with food, the muscle in its wall is **stretched**.
- Cardiac muscle also is **stretched** each time the heart fills with blood.



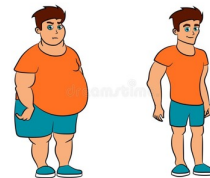
9

Properties of Muscular Tissue:

Four special properties of muscular tissues are: (4 of 4):

4. Elasticity

- the ability of muscular tissue to return to its original length and shape after contraction or extension.

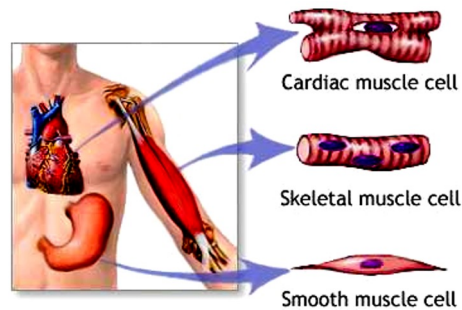


10

Types of Muscular Tissue:

- Muscular tissue consists of elongated cells called **muscle fibers** or **myocytes** that can use ATP to generate force.
- Based on its **location**, **structural** and **functional features**, muscular tissue is classified into 3 types:

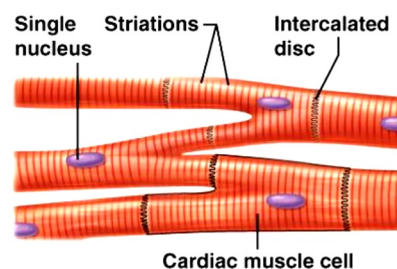
1. Skeletal Muscle.
2. Cardiac Muscle.
3. Smooth Muscle.



11

Types of Muscular Tissue: Cardiac Muscle:

- forms most of the wall of the heart.
- striated (like skeletal muscle).
- involuntary (not consciously controlled).
- branched and usually have only one centrally located nucleus.
- pumps blood to all parts of the body.



12

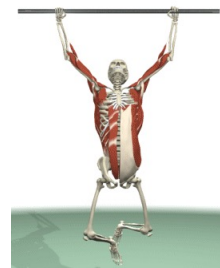
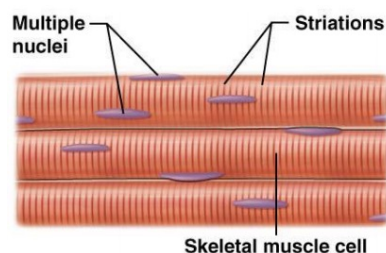
Types of Muscular Tissue: **Cardiac Muscle:**

- Cardiac muscle fibers attach end to end by **intercalated discs** (contain both **desmosomes** and **gap junctions**).
- **Intercalated discs** are transverse thickenings of the plasma membrane and are **unique to cardiac muscle**.
- **Desmosomes:** strengthen the tissue and hold the fibers together during their vigorous contractions.
- **Gap junctions:** provide a route for quick conduction of muscle action potentials throughout the heart.

13

Types of Muscular Tissue: **Skeletal Muscle:**

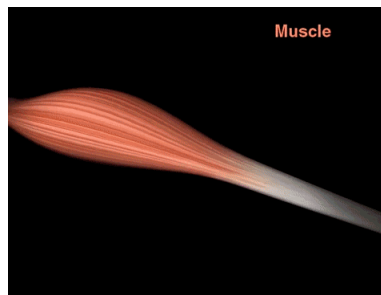
- It is named for its location (usually attached to the bones by tendons).
- Long, cylindrical, striated fibers (light & dark bands).
- Many peripherally located nuclei.
- Skeletal muscle fibers can vary in length from a few cm (short muscles) to up to 30–40cm (longest muscles).



14

Types of Muscular Tissue: **Skeletal Muscle:**

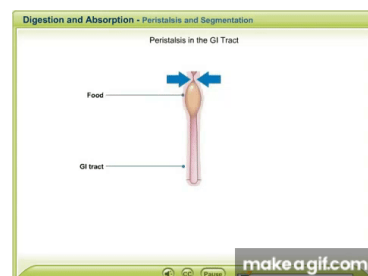
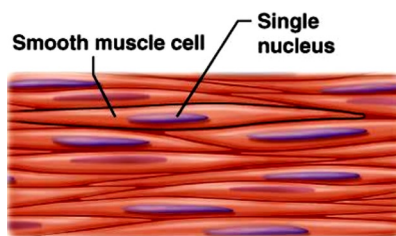
- Voluntary control (consciously controlled by neurons)
- Most skeletal muscles also are controlled subconsciously to some extent. For example, your diaphragm continues to alternately contract and relax without conscious control so that you don't stop breathing.



15

Types of Muscular Tissue: **Smooth Muscle:**

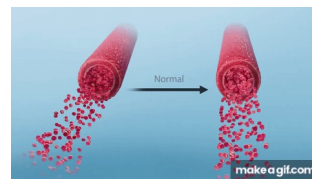
- The fiber is small, Spindle-shaped (thickest in middle and tapering at both ends).
- are usually involuntary (**not consciously controlled**).
- are nonstriated.
- It contains a single, centrally located nucleus.



16

Types of Muscular Tissue: **Smooth Muscle:**

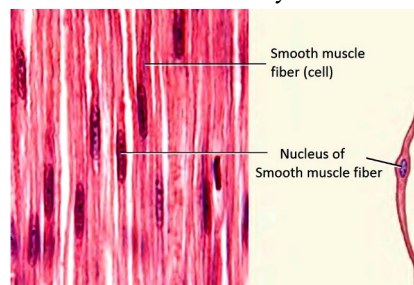
- located in the walls of hollow internal structures such as:
 - ✓ blood vessels,
 - ✓ airways to the lungs,
 - ✓ the stomach, intestines, gallbladder,
 - ✓ urinary bladder.



17

Types of Muscular Tissue: **Smooth Muscle:**

- **Its contraction helps:**
 - ✓ constrict or narrow the lumen of blood vessels.
 - ✓ physically break down and move food along the GIT.
 - ✓ move fluids through the body, and eliminate wastes.
 - ✓ In the iris smooth muscle fibers contract individually, because gap junctions are absent.

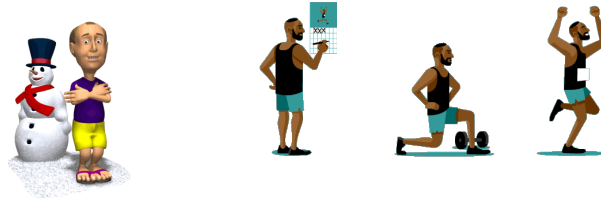


18

Functions of Muscular Tissue:

■ Through **contraction** and **relaxation**, muscular tissue performs four important functions:

1. Producing body movements
2. Stabilizing body positions
3. Storing and Moving substances within the body
4. Generating heat.



19

Functions of Muscular Tissue: 1 of 4

1. Producing body movements:

- Movements of the whole body (walking and running).
- localized movements: grasping a pencil or nodding the head as a result of muscular contractions, rely on the integrated functioning of skeletal muscles, bones, and joints.

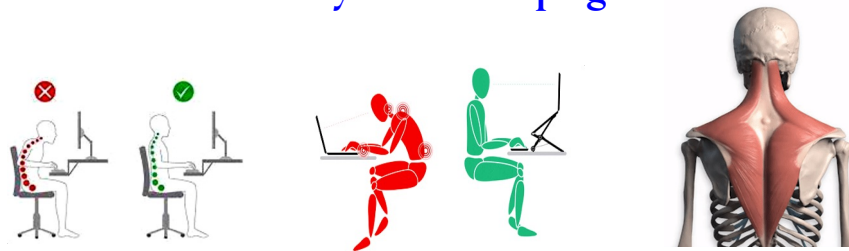


20

Functions of Muscular Tissue: 2 of 4

2. Stabilizing body positions:

- Skeletal muscle contractions stabilize joints and help maintain body positions, such as standing or sitting.
- Postural muscles contract continuously when you are awake; for example, **sustained contractions of your neck muscles hold your head upright.**

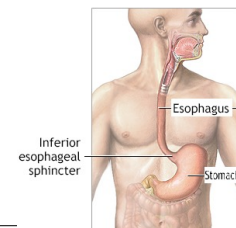


21

Functions of Muscular Tissue: 3 of 4

3. Storing and moving substances within the body:

- Storage is accomplished by sustained contractions of ringlike bands of smooth muscle called **sphincters**.
- Temporary storage of food in the **stomach** or urine in the urinary bladder is possible because the sphincters close off the outlets of these organs.
- Cardiac muscle contractions of the heart pump blood through the blood vessels of the body.



22

Functions of Muscular Tissue: 4 of 4

4. Generating heat:

- As muscular tissue contracts, it produces heat, a process known as **thermogenesis**.
- Much of the heat generated by muscle is used to maintain normal body temperature.
- Involuntary contractions of skeletal muscles, known as **shivering**, can increase the rate of heat production.



23

Questions and Comments:



24