



ALAYEN UNIVERSITY

ANESTHESIA DEPARTMENT

FIRST STAGE

BIOLOGY

Muscle tissue

- is composed of elongated cells or fibers containing **special contractile proteins** responsible ➤
for contraction
- usually develops from **mesoderm** that gives rise to mesenchymal cells ➤
- classified into three types according to structure, function and location ➤

Striated skeletal muscle .1

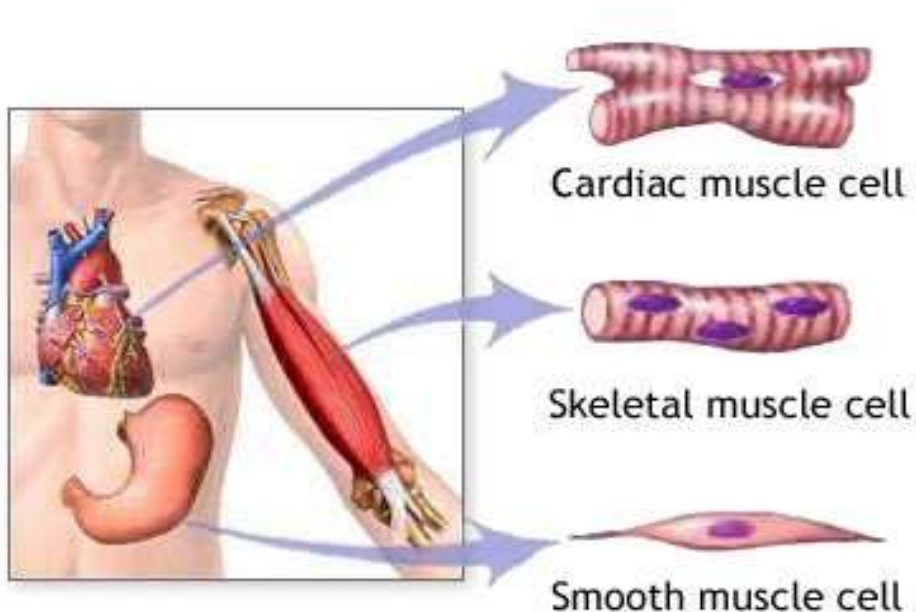
- occurs mainly in association with **bones** and is responsible for **movement of the skeleton** •
- and for **maintenance of body position** (e.g., tongue, pharynx and diaphragm)
- its contraction is **quick, strong** and under **voluntary** control •

Striated cardiac muscle .1

- occurs exclusively in the heart (**myocardium**) •
- contraction is **quick, strong, rhythmic** and **involuntary**. •

Smooth muscle .2

- does NOT exhibit cross-striations** found in the wall of hollow organs (e.g., stomach, ▪
intestines, blood vessels)
- contraction is **slow and involuntary**. ▪

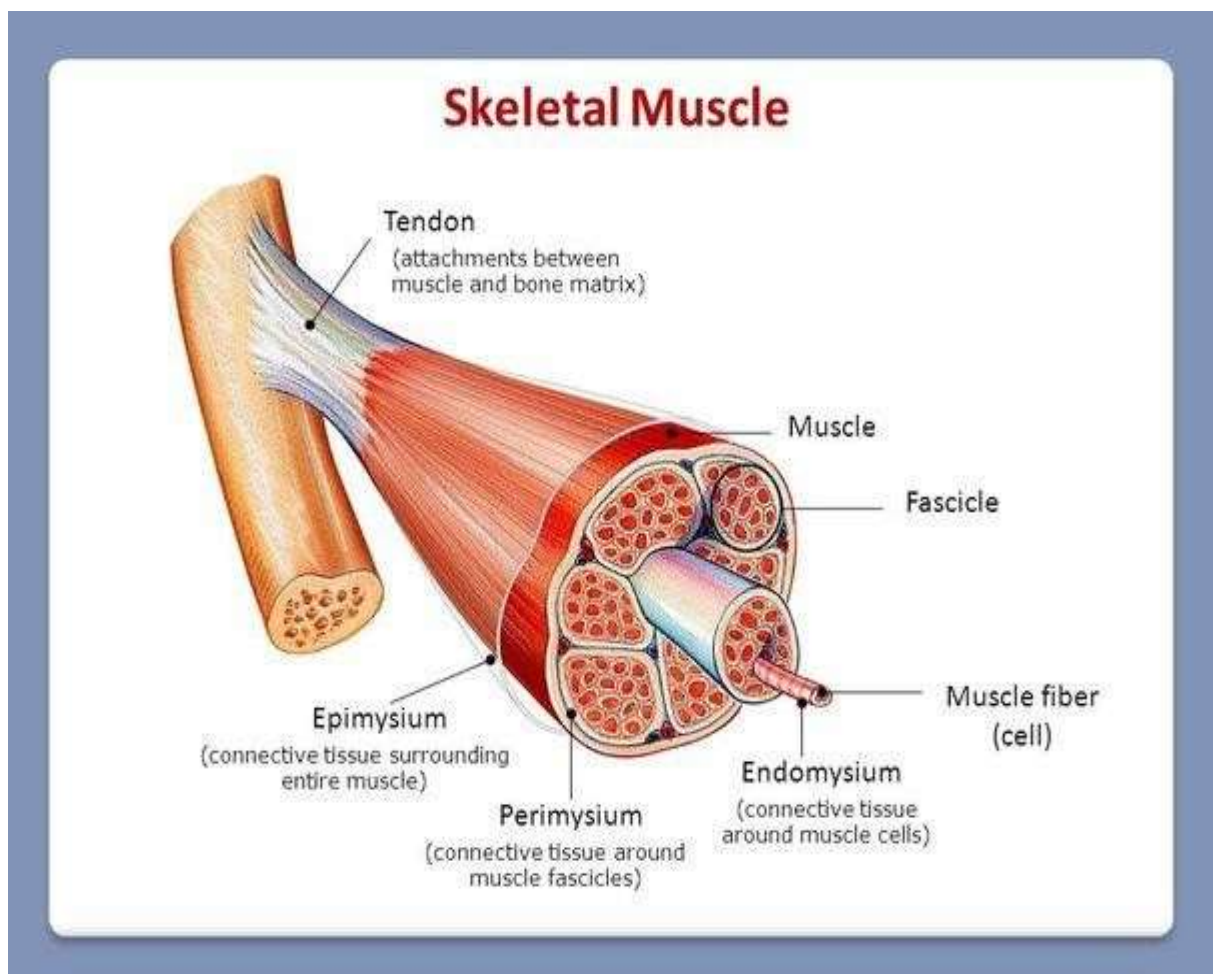


Skeletal muscle

Basic morphological unit is multinucleated muscle fiber with cross striations visible under light microscope.

Organization of skeletal muscles:

- consist of striated muscle fibers held together by connective tissue, ✓
- ends of muscle fibers insert to tendons, that are attached to bones and make body movement, ✓
- the whole muscle is surrounded by dense connective tissue sheath externally – **epimysium**, ✓
- fascicles containing several muscle fibers are surrounded by **perimysium**, ✓
- individual muscle fibers are surrounded by fine network of reticular fibers called **endomysium**. ✓



Smooth muscle

- Structural unit is a spindle-shaped cell, ▪
- Nucleus – rod-shaped in center, ▪
- Myofibrils** - are responsible for contractions (non striated), ▪
- are involuntary in action ▪
- Site of smooth muscle:** ▪
- Single - prostate, ▪
- dermis of skin. ▪
- in the wall of digestive system, ▪
- tunica media of vessels. ▪

MYOHISTOGENESIS - from **mesenchymal cells**

This process involves:

- elongation of cells into myoblast (a)
- differentiation into spindle shape (b)

HYPERTROPHY- process by increase of cell volume by formation of new myofibrils.

HYPERPLASIA - tissue growth by increase in the number of cells
- does not occur in skeletal either cardiac muscle

Cardiac muscle

Is formed of **cardiomyocytes joined together end to end by intercalated disc.** ✓

Intercalated disc: ○

is a junctional complex between two membranes of cardiac muscle cells -

Cardiac muscle fibers: ○

branch, with oval nuclei in centre -

involuntary in action -

are innervated by autonomic nervous system -

cannot regenerate -

Regeneration of muscle tissue







Cardiac muscles » no regeneration capacity in adults. Damaged cardiac muscle is replaced by ✓
connective tissue scars after infarction.

Skeletal muscles » limited regeneration : *satellite cells* become activated, proliferate and ✓
differentiate to new myoblasts.

Smooth muscles are able to regenerate : undifferentiated cells in *tunica adventitia*, or from ✓
pericytes (in the uterus during menstrual cycle and pregnancy-under hormonal control).

Hyperplasia – increased number of cells (proliferation). ○

Hypertrophy – increased size of the cells (increased volume). ○

	Main features	Location	Type of cells	Histology
Skeletal muscle	<ul style="list-style-type: none"> - Fibers : striated, tubular and multi nucleated - Voluntary - Usually attached to skeleton 			
Smooth muscle	<ul style="list-style-type: none"> - Fibers : non-striated, spindle-shaped, and uninucleated. - Involuntary - Usually covering wall of internal organs. 			
Cardiac muscle	<ul style="list-style-type: none"> - Fibers : striated, branched and uninucleated. - Involuntary - Only covering walls of the heart. 	