

ISHIK UNIVERSITY

FACULTY OF EDUCATION

Department of BIOLOGY EDUCATION

Lecture series in Histology for undergraduate students

PREPARED BY :

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3-Muscle Tissue

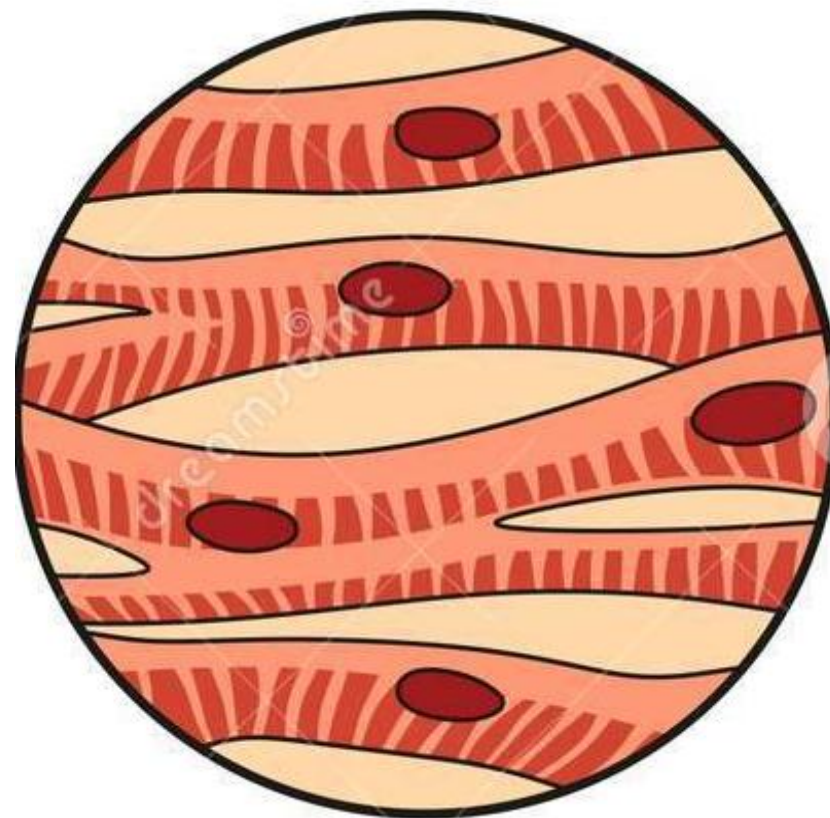
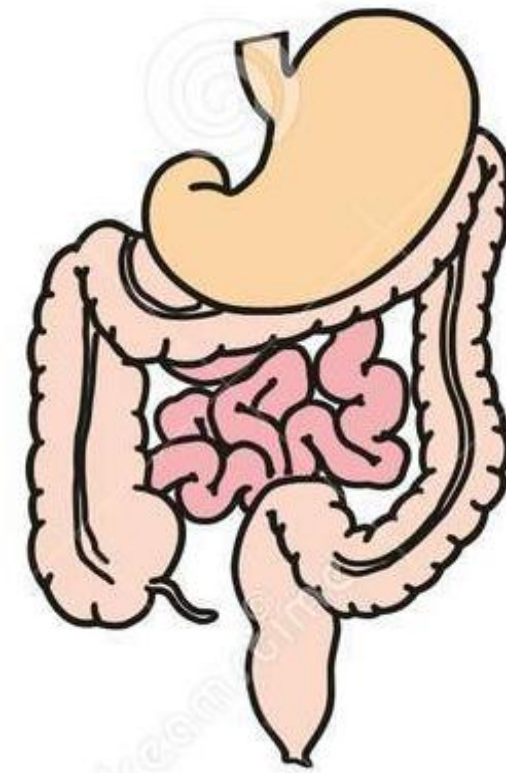
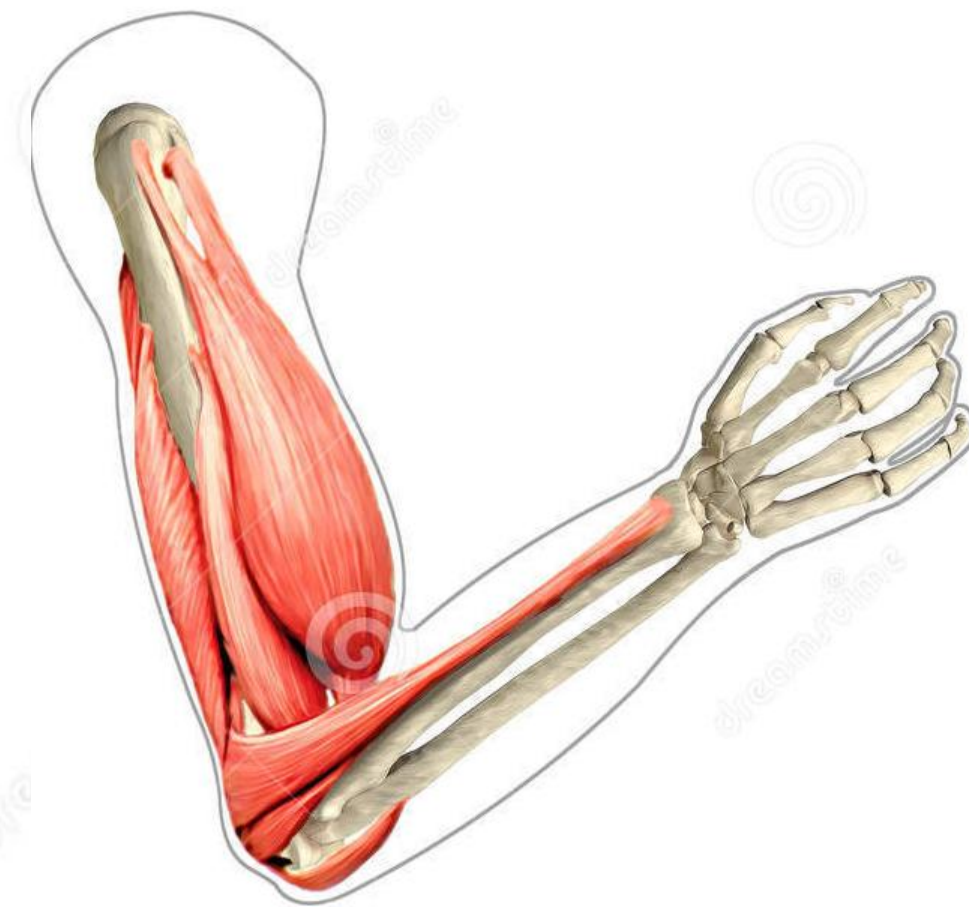
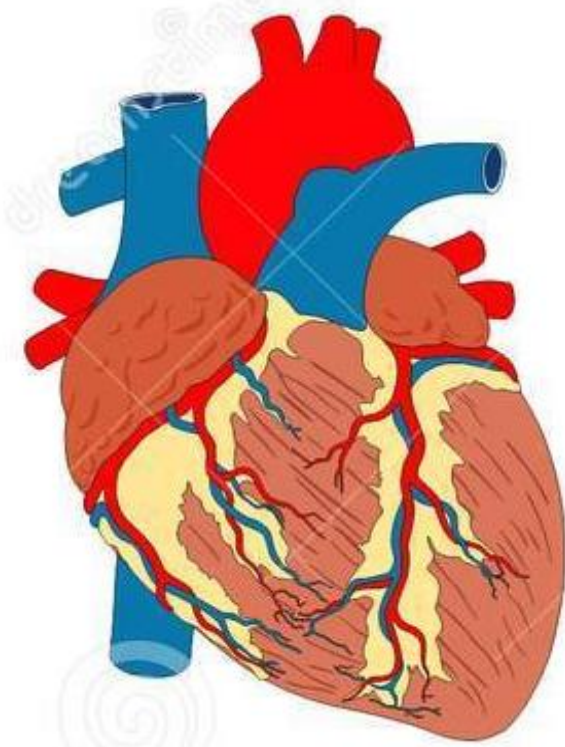
Introduction:

- **'Movement** is a fundamental characteristic of all living things.'
- The essential function of muscle is: Contraction (**forming movement**)
- A unique characteristic that sets it apart from any other body tissue.
- As a result of this ability, muscles are responsible for essentially all body movements and can be viewed as the "**machines of the body.**

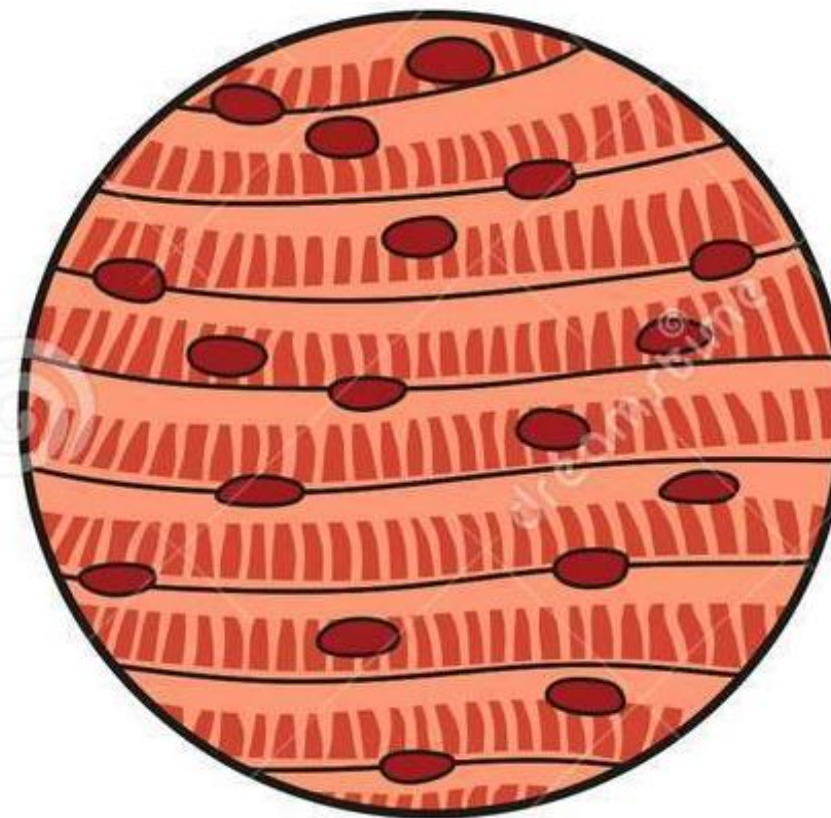
Types of Muscle Tissue(myocytes)

There are three types of Muscle:

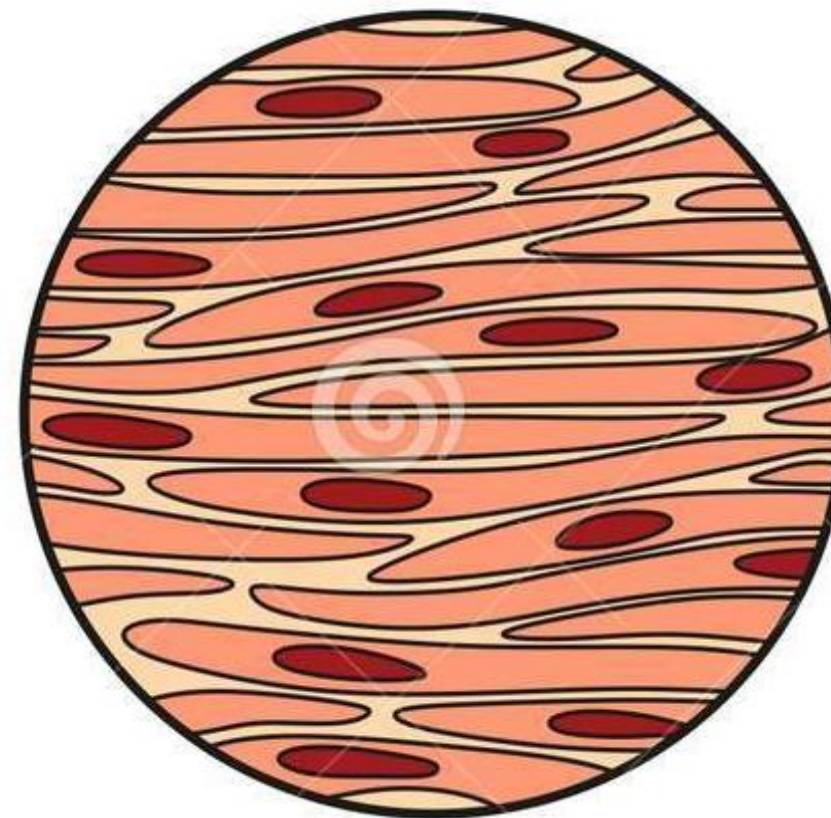
Skeletal , Cardiac and Smooth



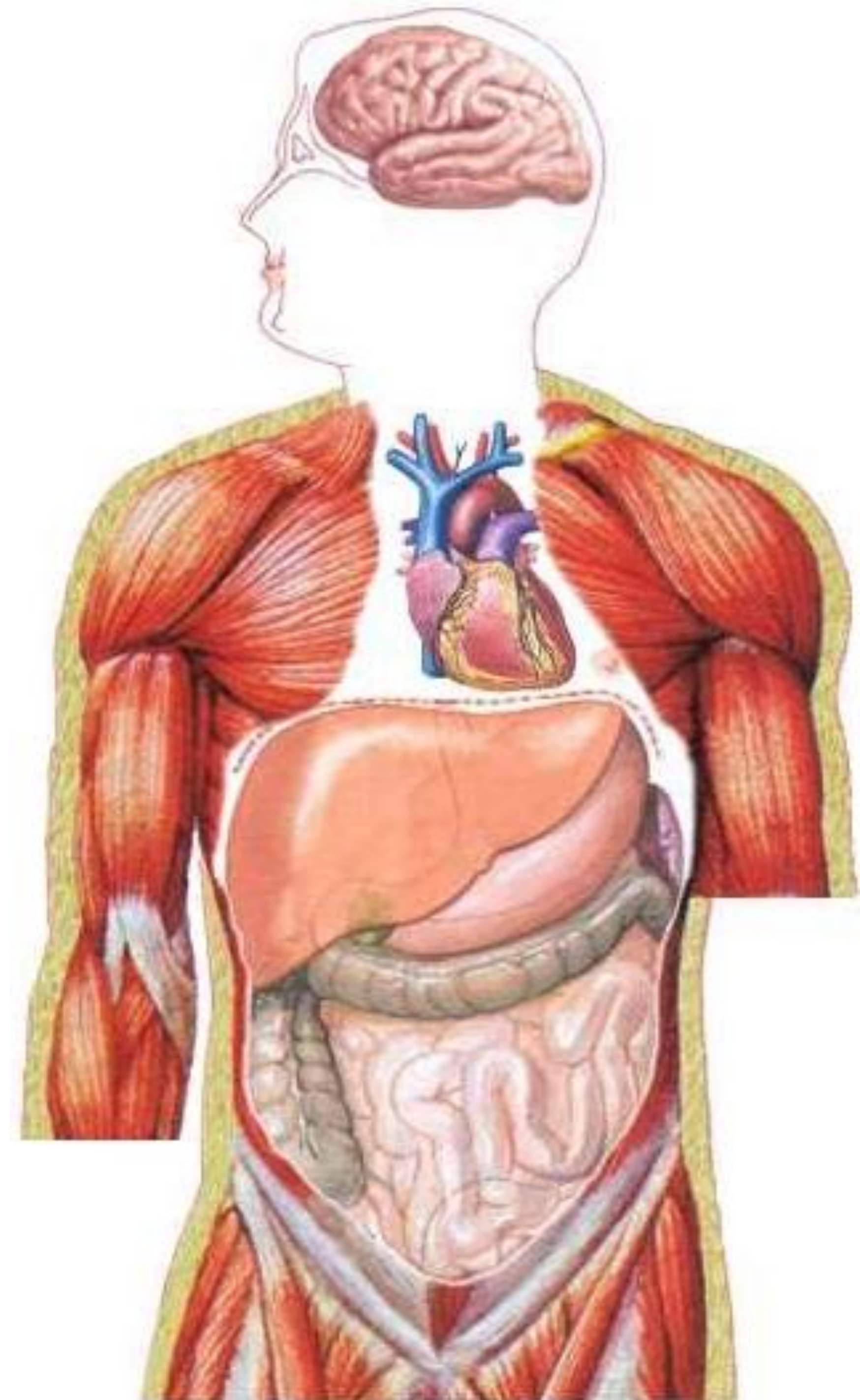
Cardiac



Skeletal



Smooth



Learning Objectives

- 1- Be able to identify the histological structure of the three types of muscle tissue .
- 2-To list **similarities and differences** in the **structure** and function of each type and to indicate where are they found in the body.
- 3-To understand the function and organization of the connective tissue in skeletal muscle (endomysium-, perimysium and epimysium).
- 4- Be familiar with the regenerative potential of each muscle type.

General Functions of Muscle Tissue

1. **Movement**
2. **Heat production**
3. **Maintenance of posture**
4. **Stabilization of joints**

What characteristics make the muscle be able to do these functions?

Major Characteristics of Muscle tissues

- ❖ **Excitability (irritability) ?**
- ❖ **Contractibility ?**
- ❖ **Extensibility ?**
- ❖ **Elasticity ?**

Muscle tissues are of two types ; striated and non striated

A- Striated muscle :

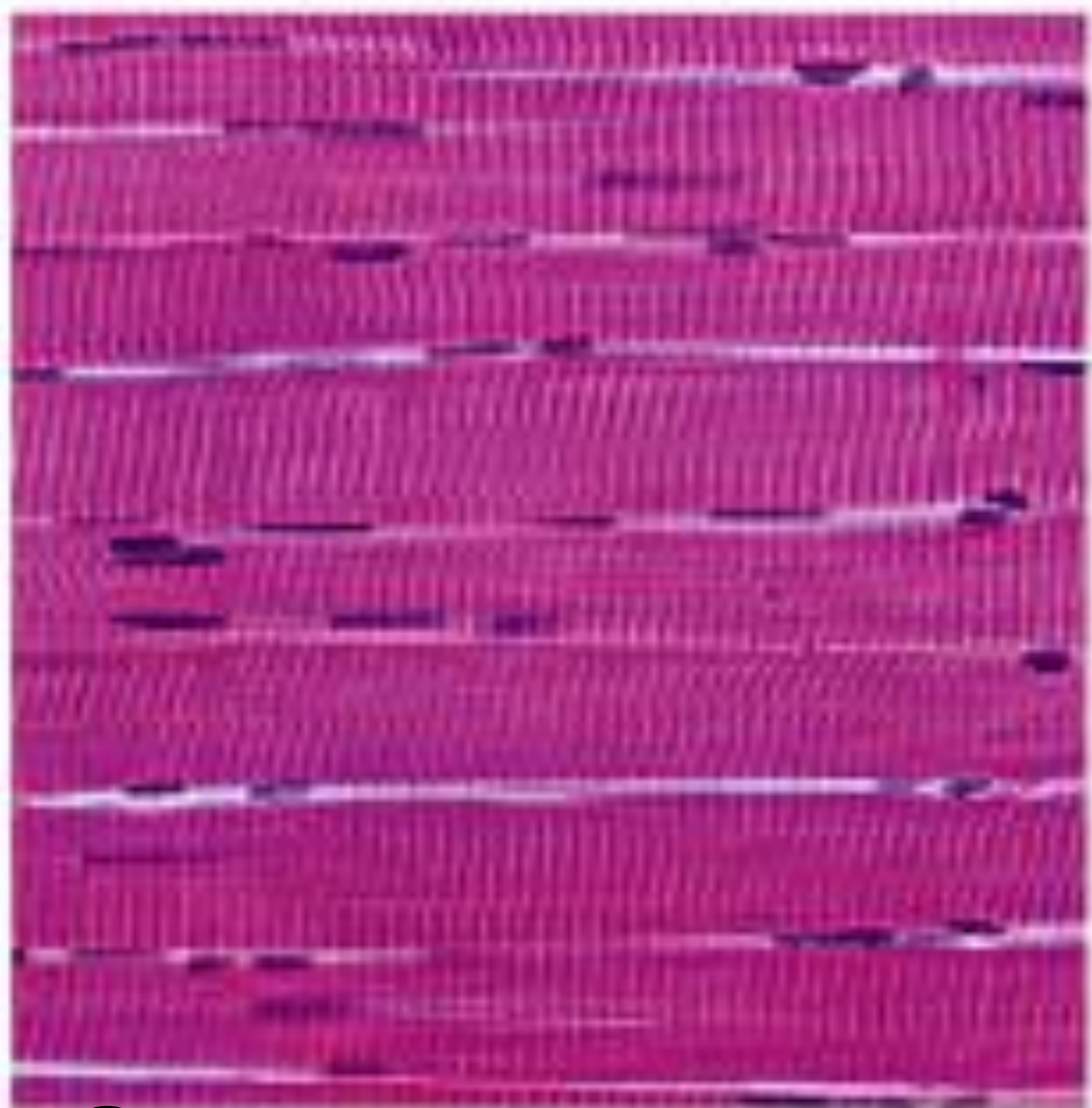
- 1- have a banded appearance(stripes).
- 2- single nucleus or multinucleated cells .
- 3- can be controlled **voluntarily** or **involuntarily**.

B- Non striated:

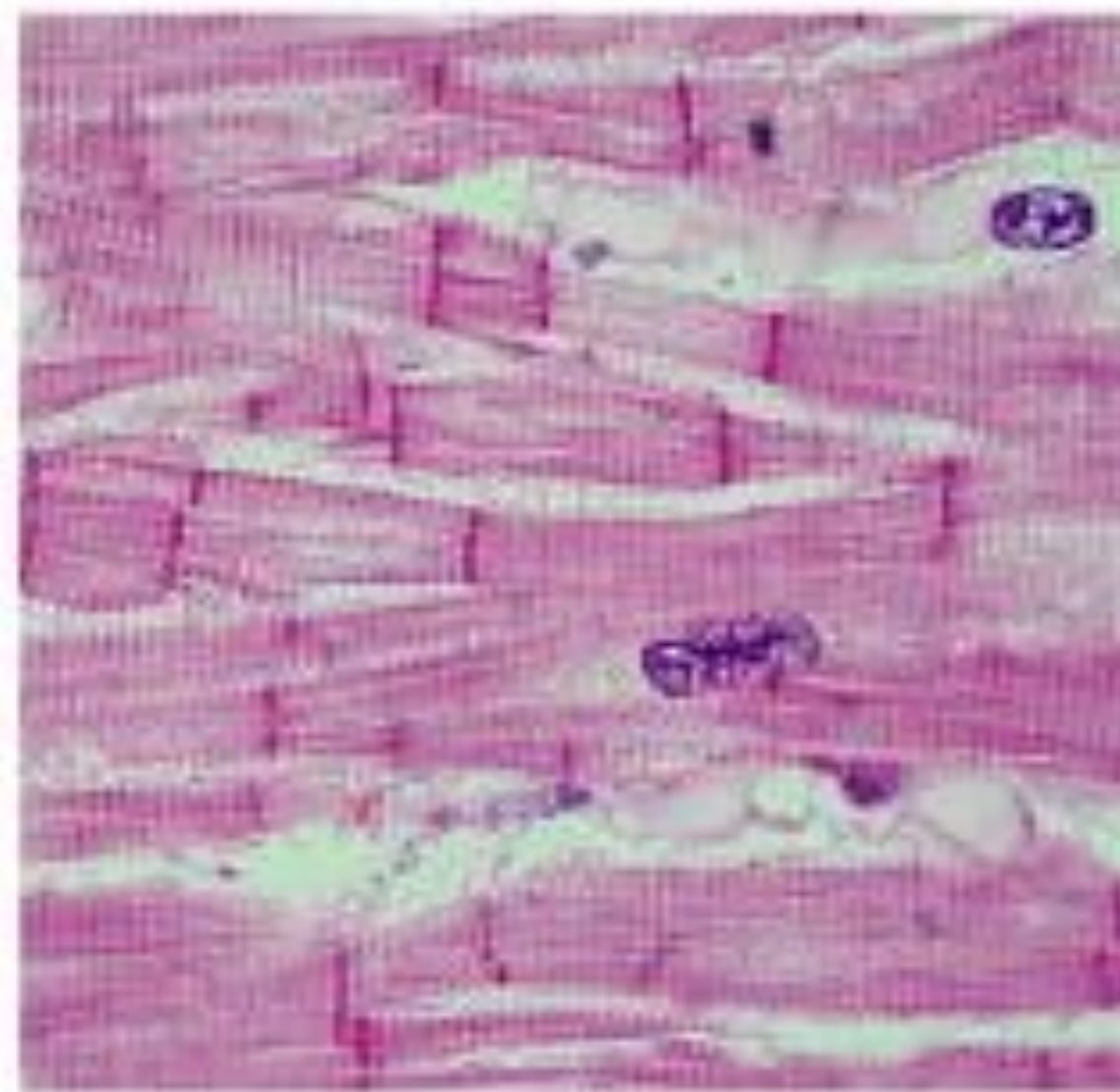
- 1- have no stripes
- 2- have single nucleus
- 3- are involuntary muscle cells

Types of Muscle Tissue

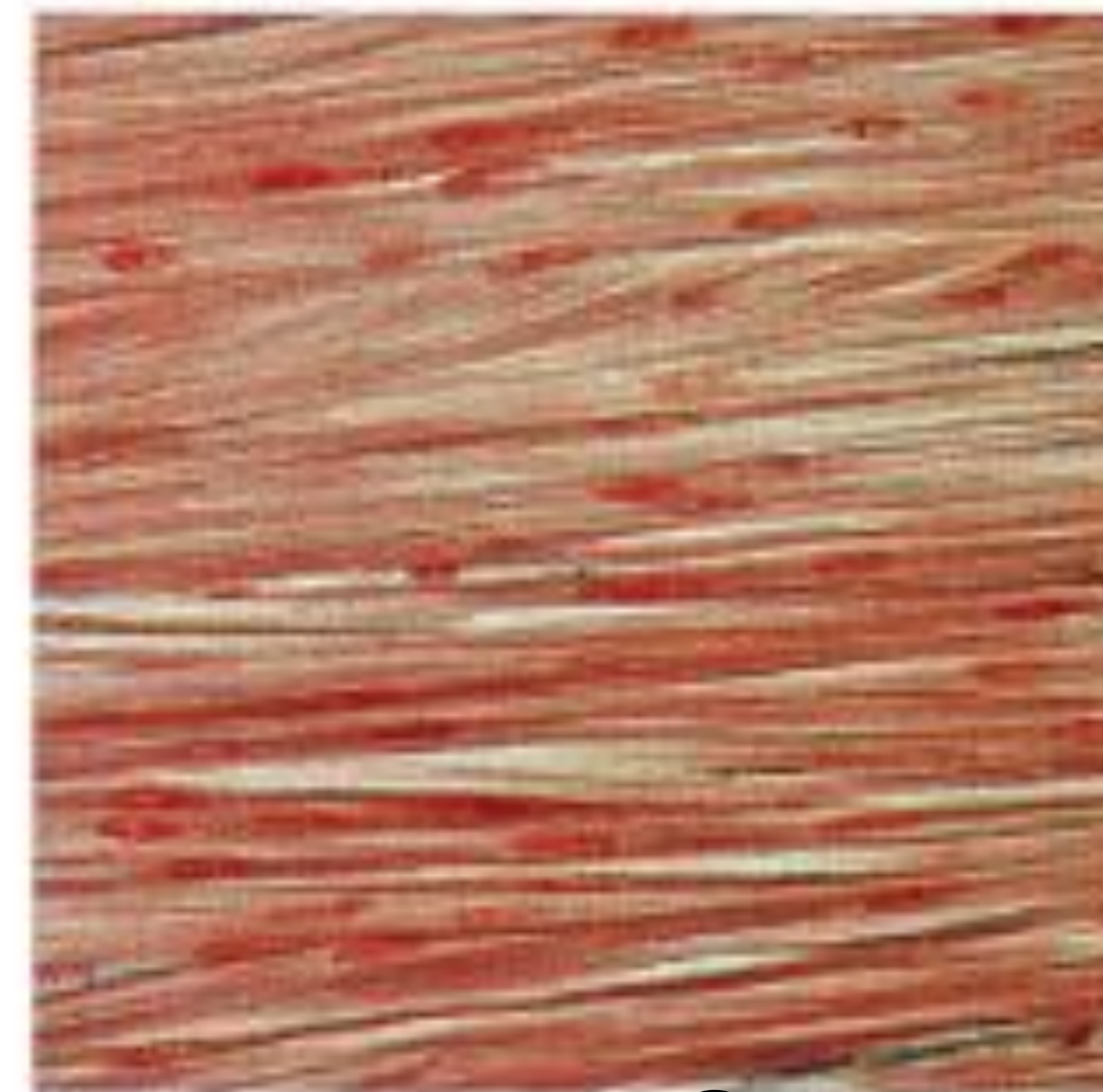
1. Skeletal muscle ,voluntary and striated(muscles attached to the skeleton)except?
2. Cardiac muscle , involuntary and striated forming the wall of the heart.
- 3-Smooth muscle,involuntary and not striated (found in wall of hollow & visceral organs)



Skeletal muscle



Cardiac muscle



Smooth muscle



1-Skeletal Muscle cell (fiber ?) m.f.

Regularly arranged contractile units have the following characteristic features:

1- long striated cylindrical multinucleated which are peripherally located.

2- voluntary control used for locomotion, mastication ,phonation and eye movements?

3-attached to the bones of skeleton for? And not attached to bones ???

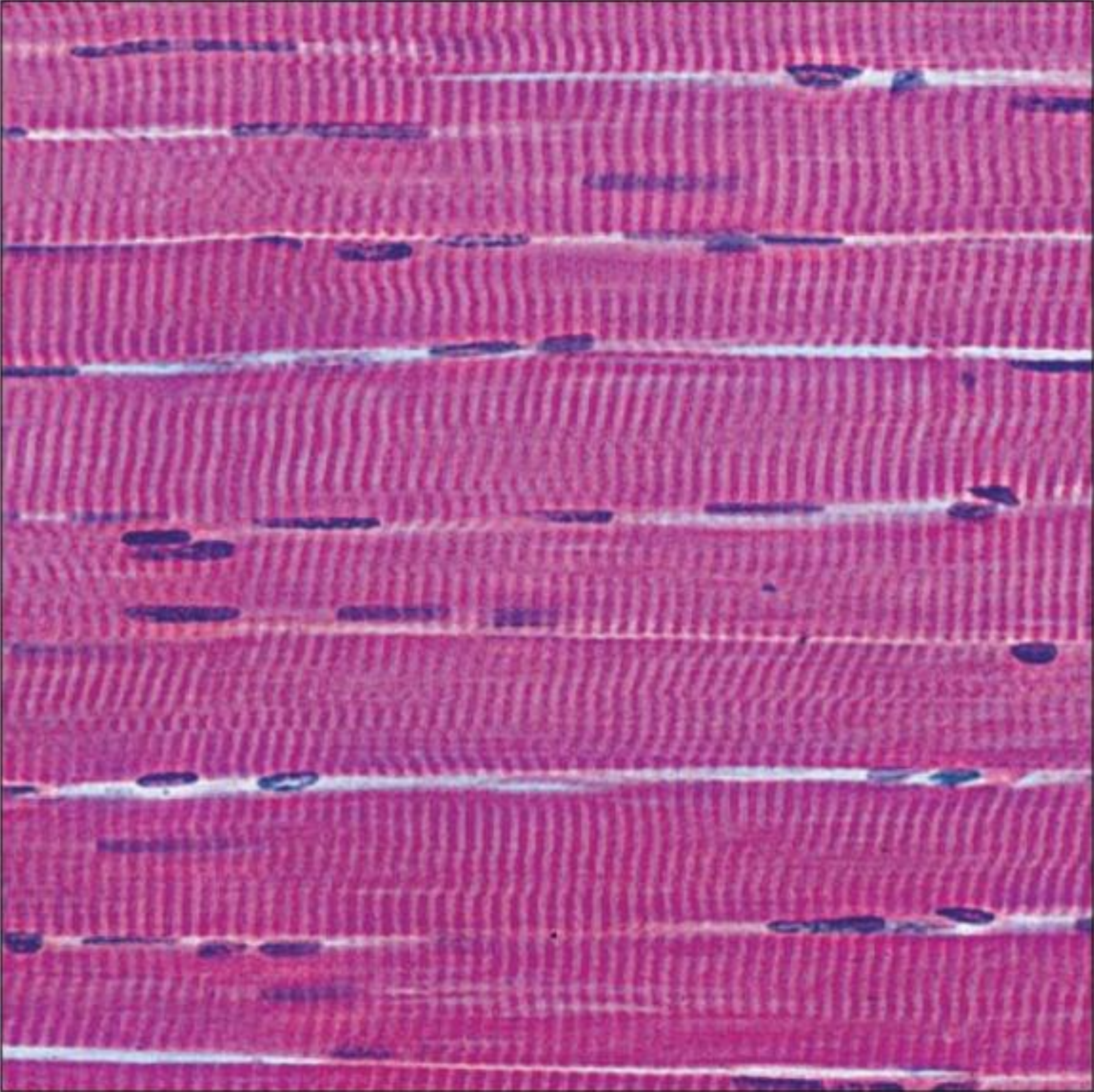
4-highly vascularized

5-highly innervated

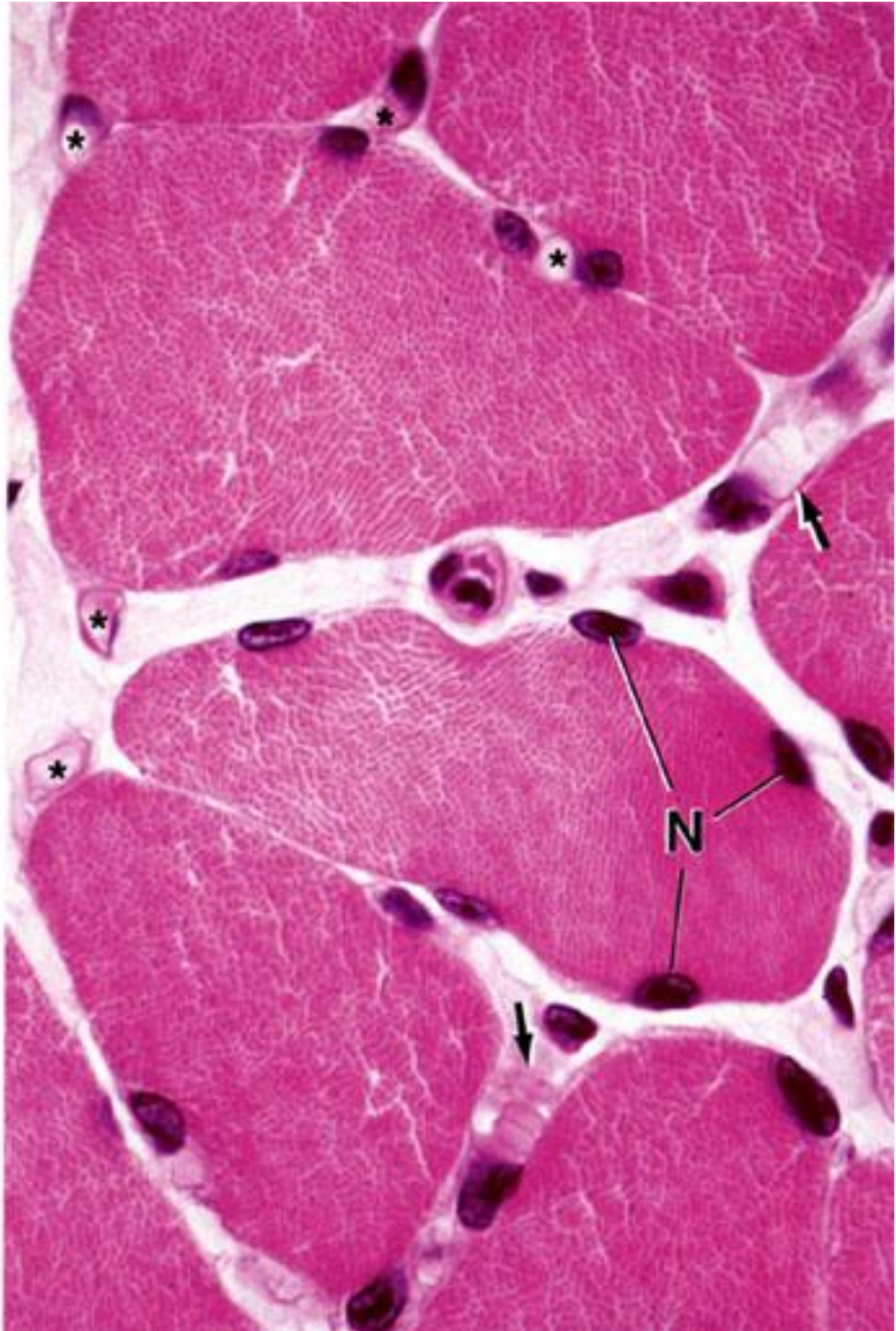
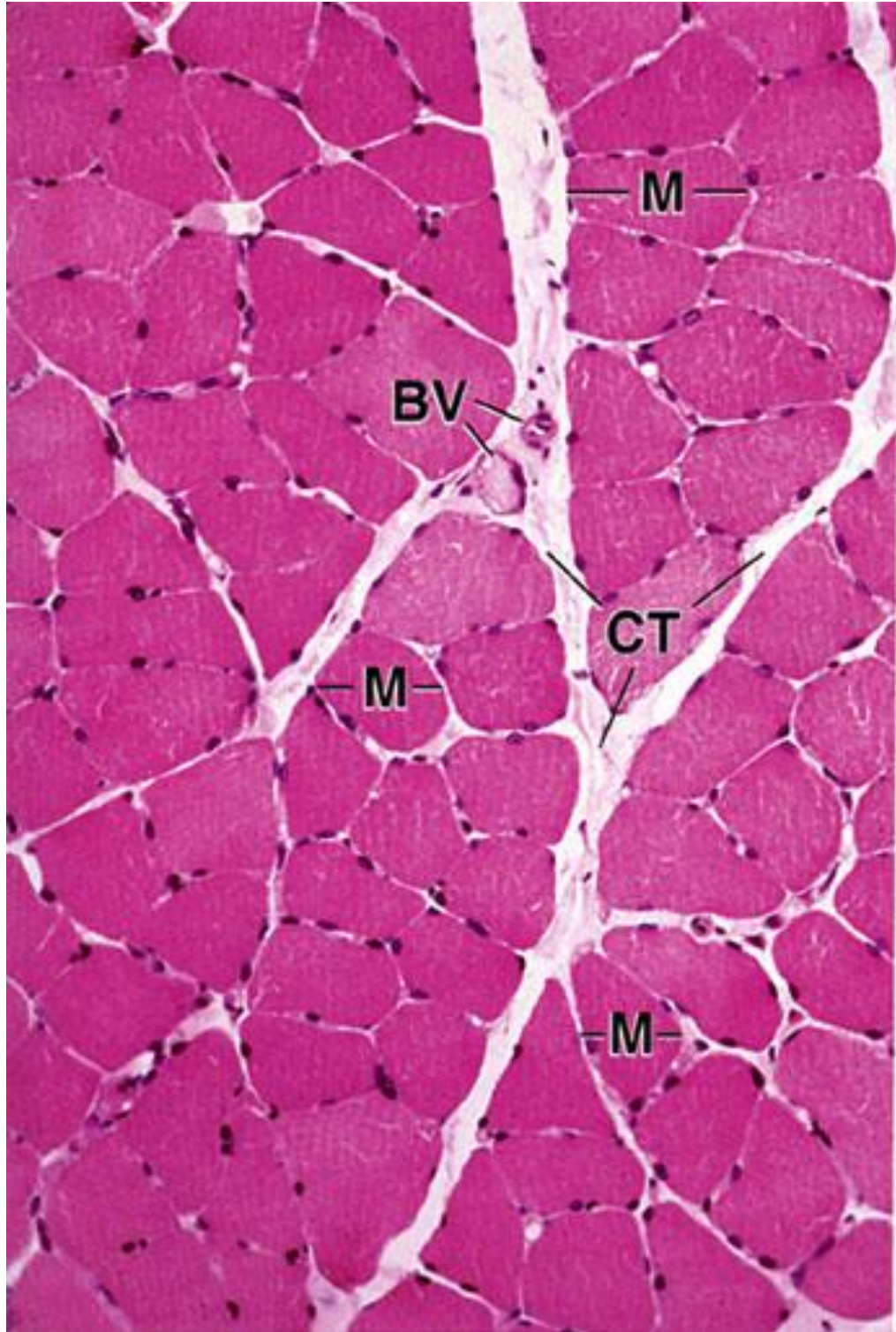
7- able to regenerate by stem cells.

8-Skeletal muscle is specialized for rapid and forceful contraction of short duration .

9-The plasma membrane of skeletal muscle is called the sarcolemma; its cytoplasm is known as sarcoplasm; the endoplasmic reticulum is called the sarcoplasmic reticulum.



Longitudinal section



cross section

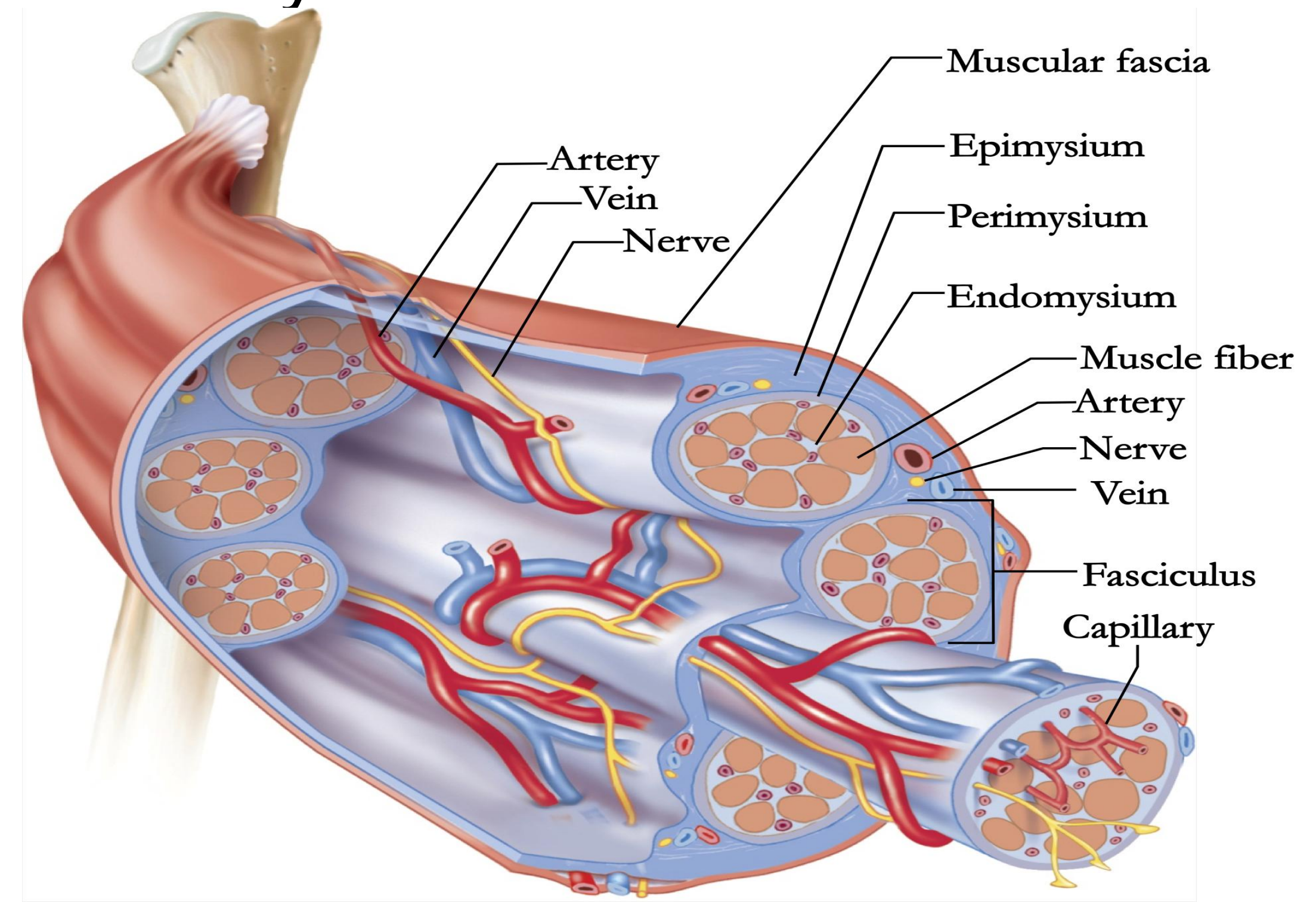
skeletal m.fibers

1-Skeletal Muscle

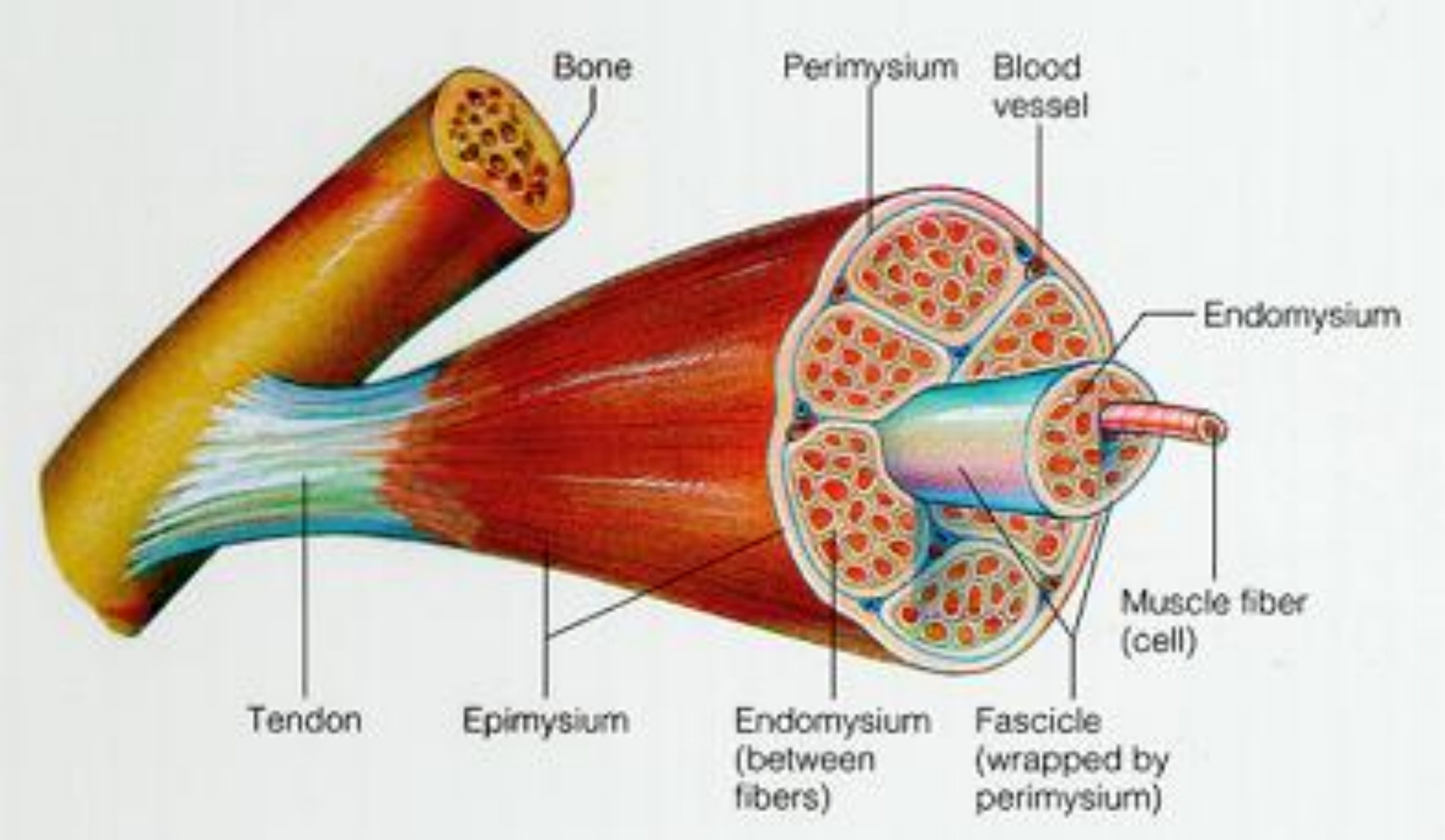
Characteristic features.....

10- Each skeletal muscle cell(fiber) contains numerous smaller **myofibrils**, these also composed of a large number of smaller fibrils called myofilaments of two contractile elements actin and myosin .

11- each muscle cell is covered by thin connective tissue layer endomysium, bundles of muscle cells are covered by another layer called **perimysium**, the whole muscle fiber covered by a thicker connective tissue layer called **epimysium**.

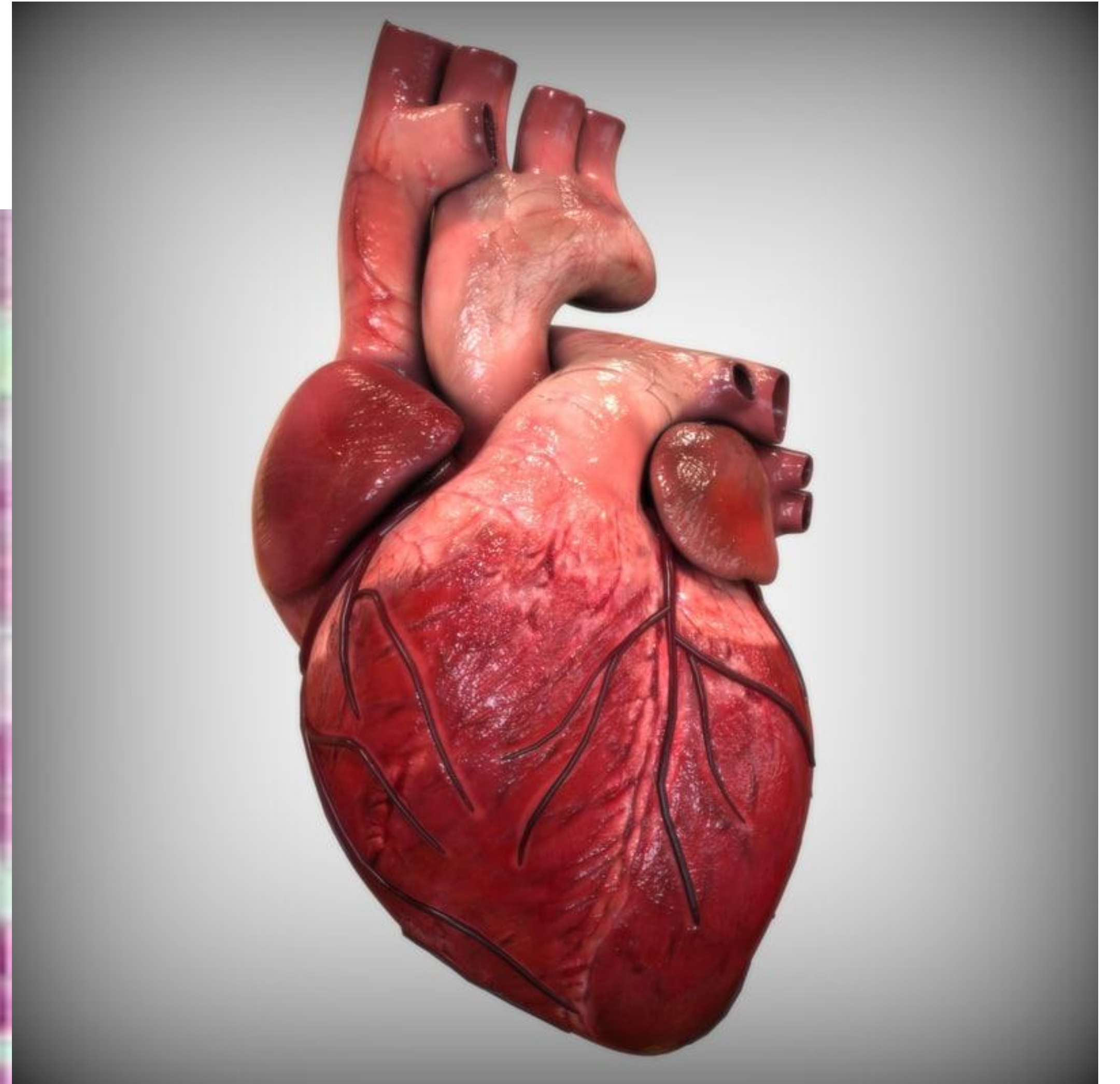
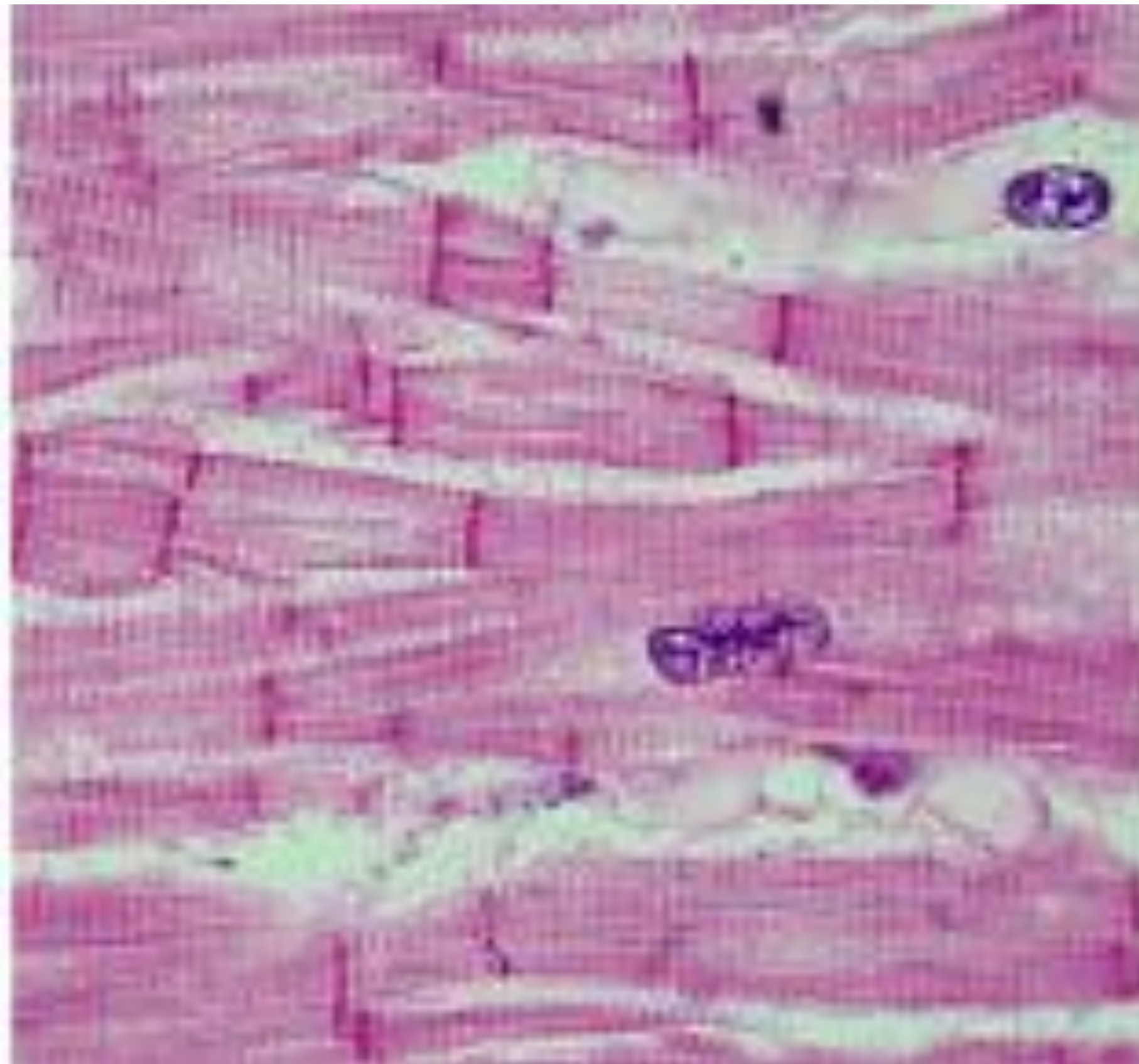


C.T coverings of Skeletal Muscle (endomysium, perimysium and epimysium)



2- Cardiac muscle

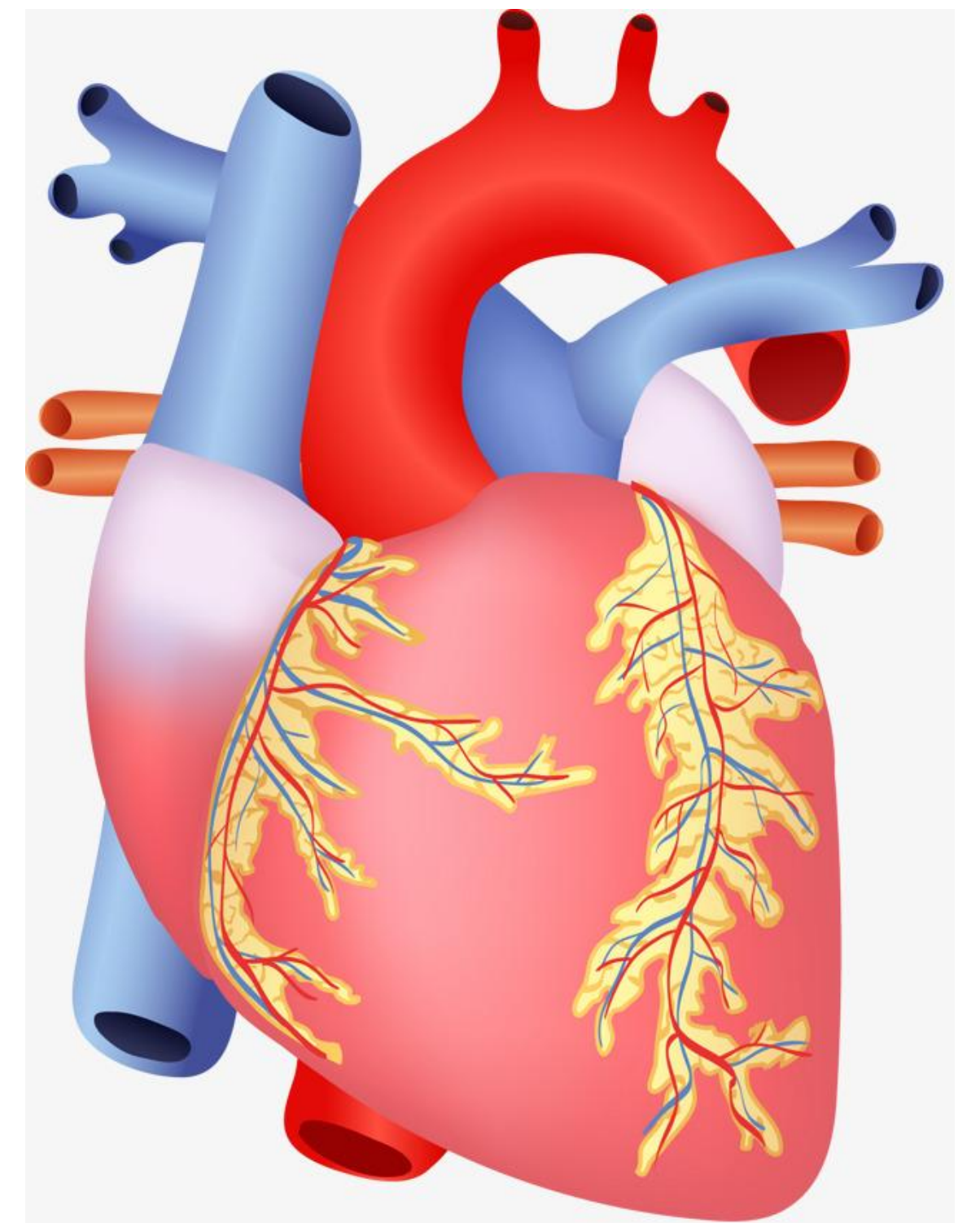
Found only in ?

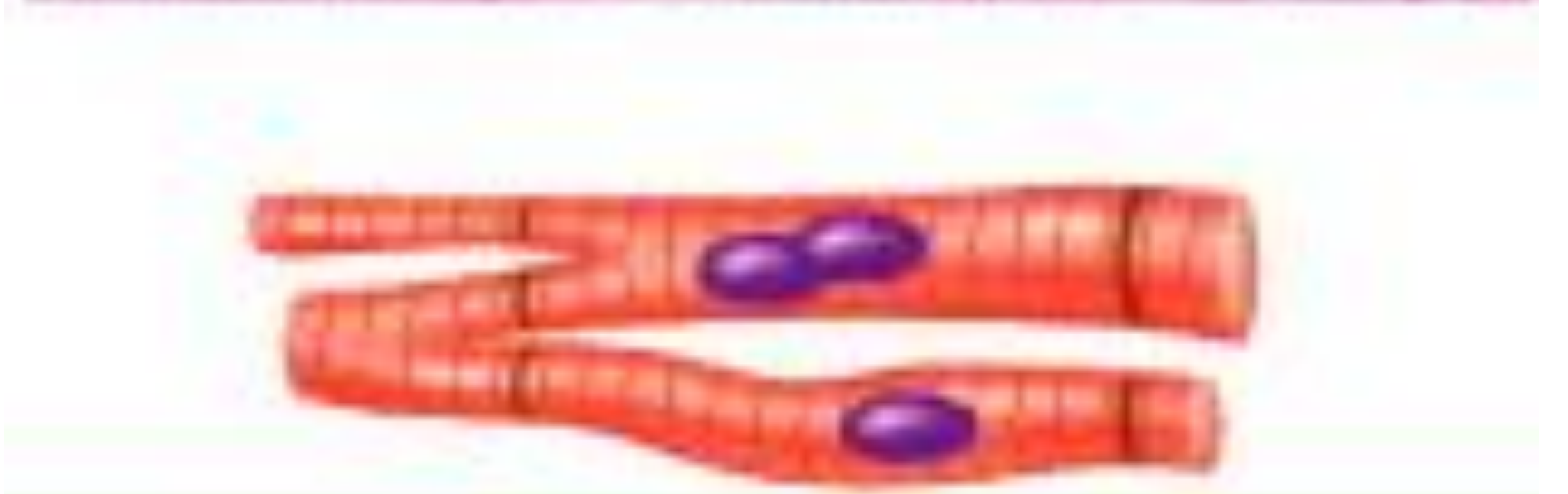
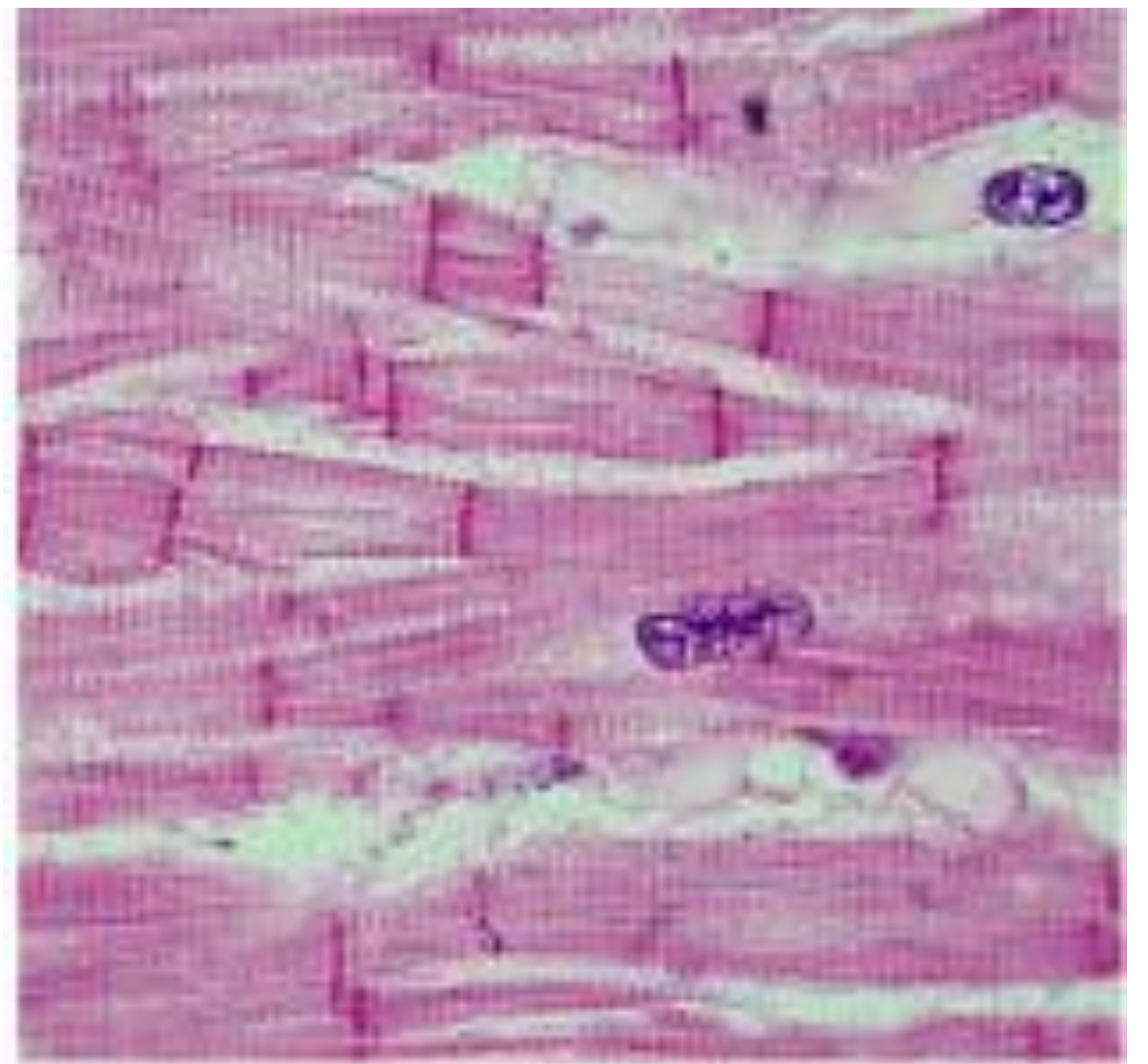
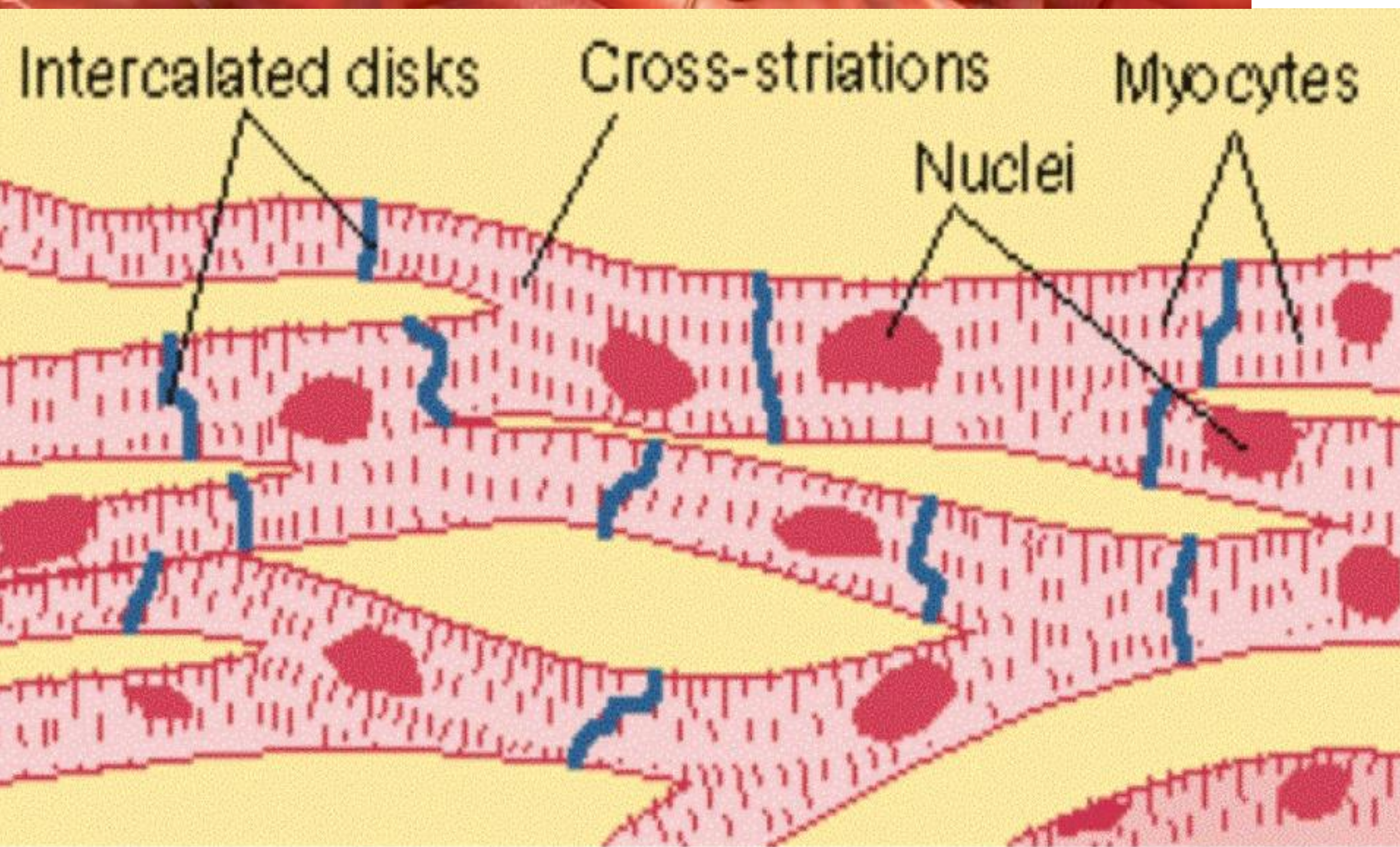


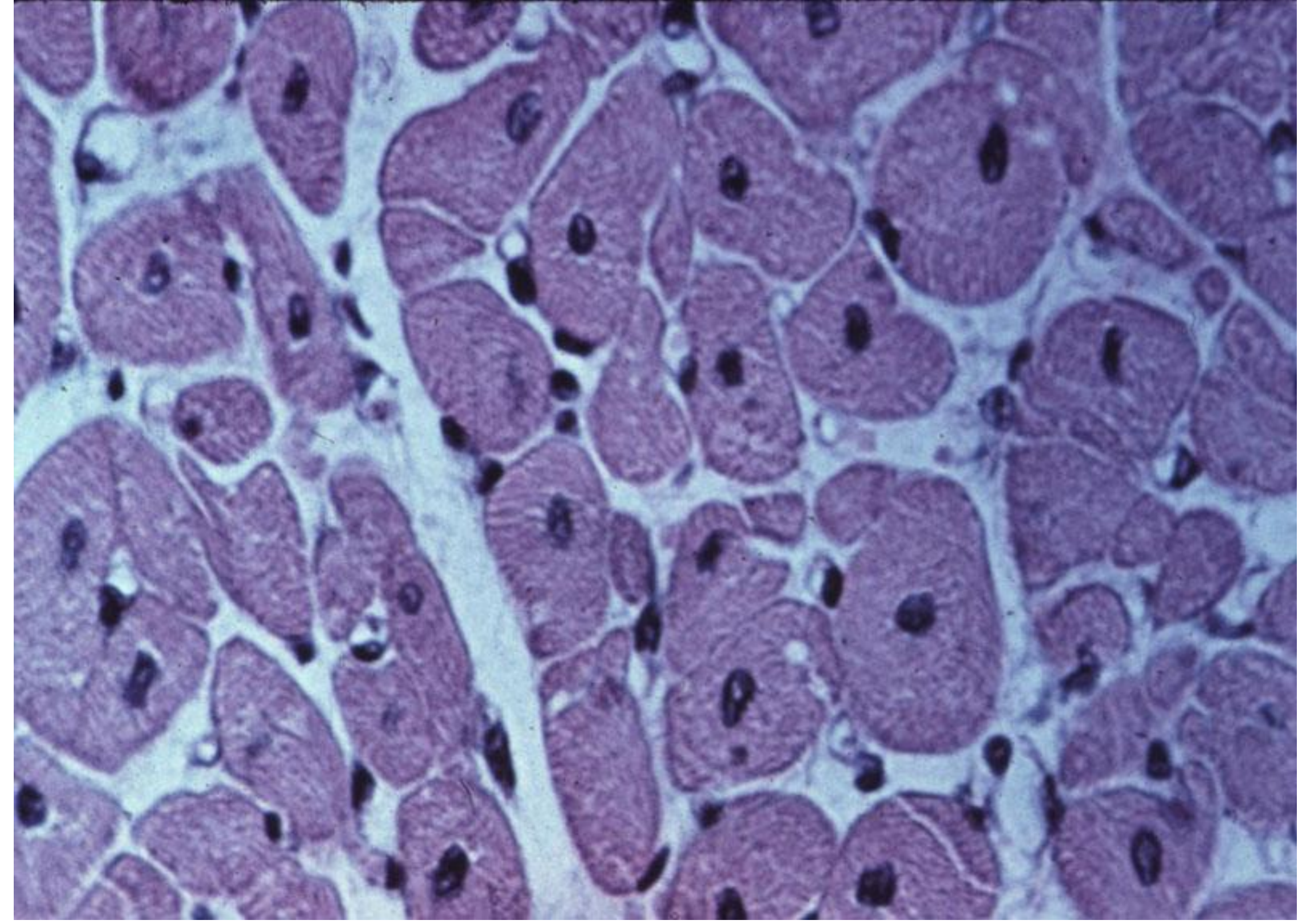
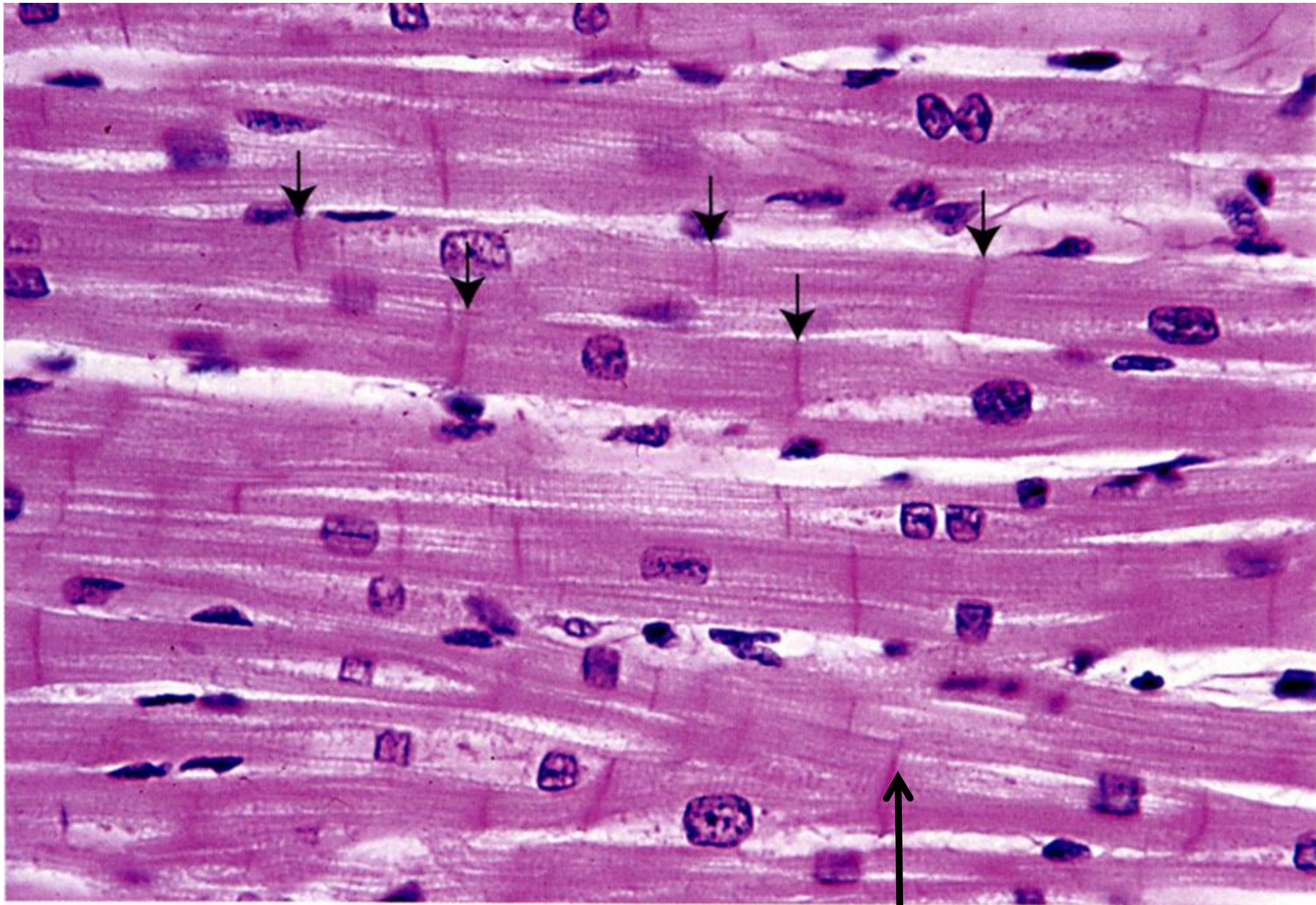
2- Cardiac muscle

Characteristic features:

- 1-are called “**cardiocytes**” and found in the wall of the heart.
- 2-branching cells connect **at intercalated disks** which allow contractions to occur faster.
- 3-striated, involuntary, and single nucleus centrally located
- 4-Contraction is vigorous, and rhythmic.



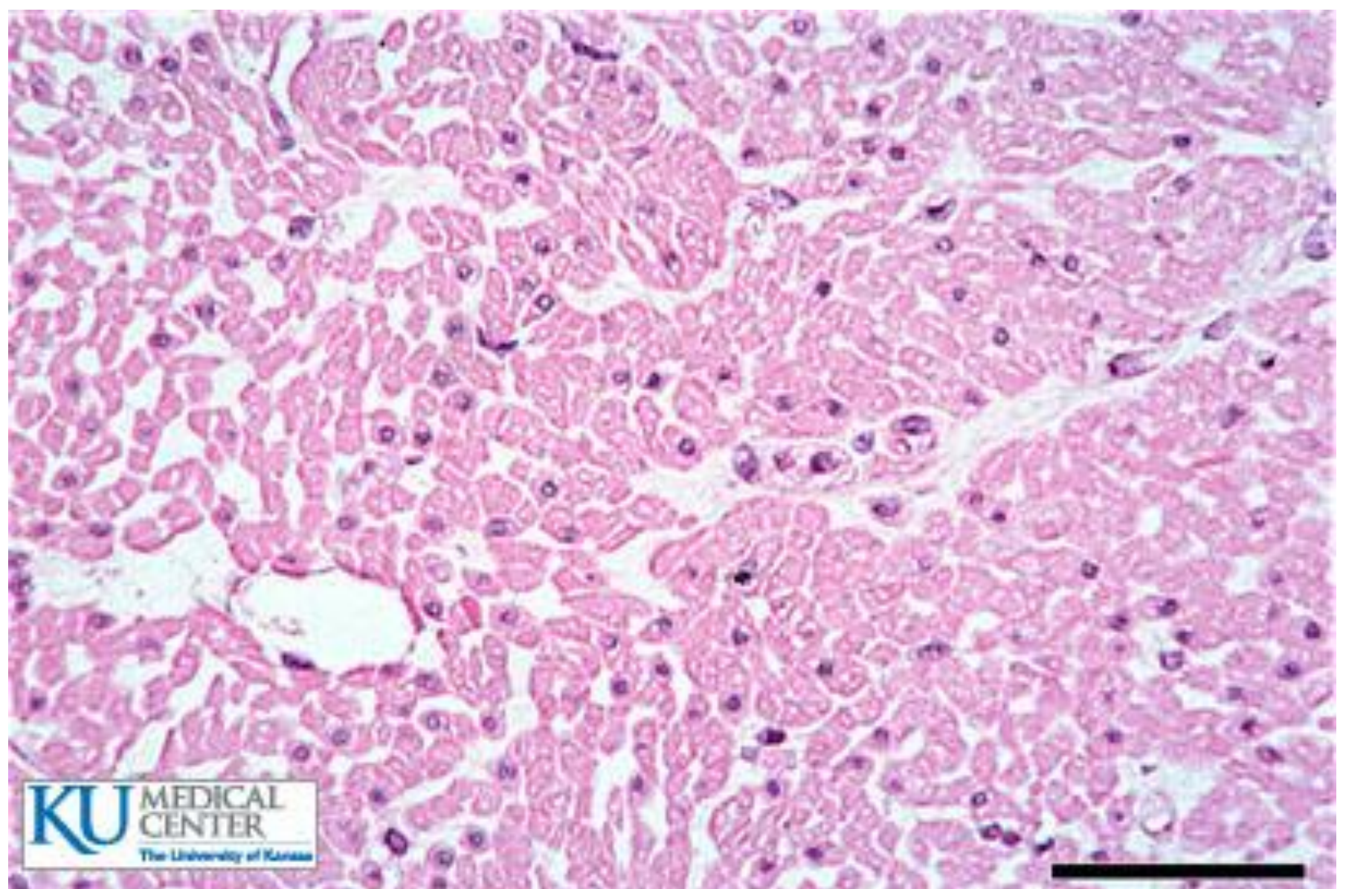
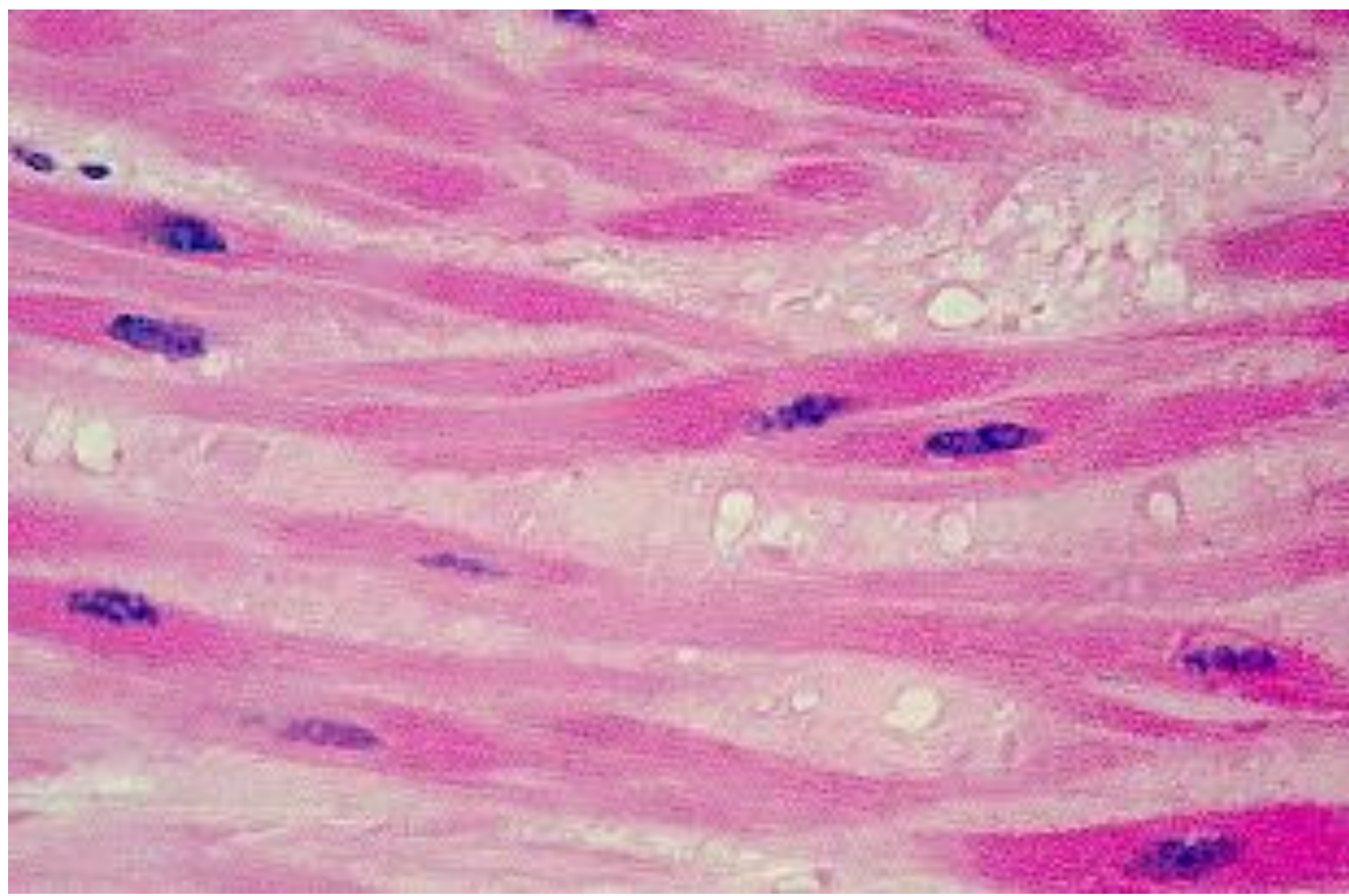
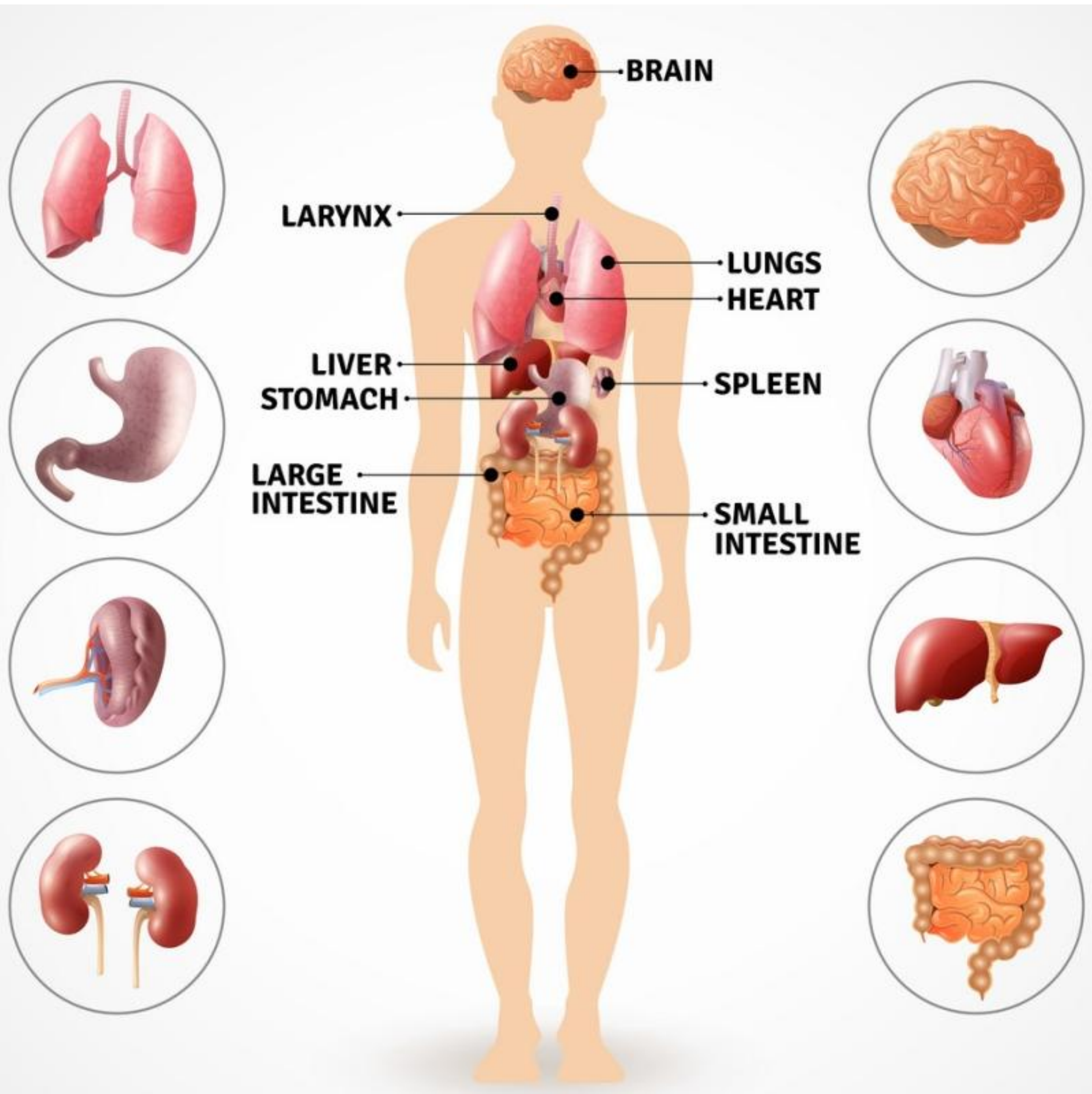




Cardiac muscle longitudinal & cross sections

intercalated disks

3- Smooth muscle

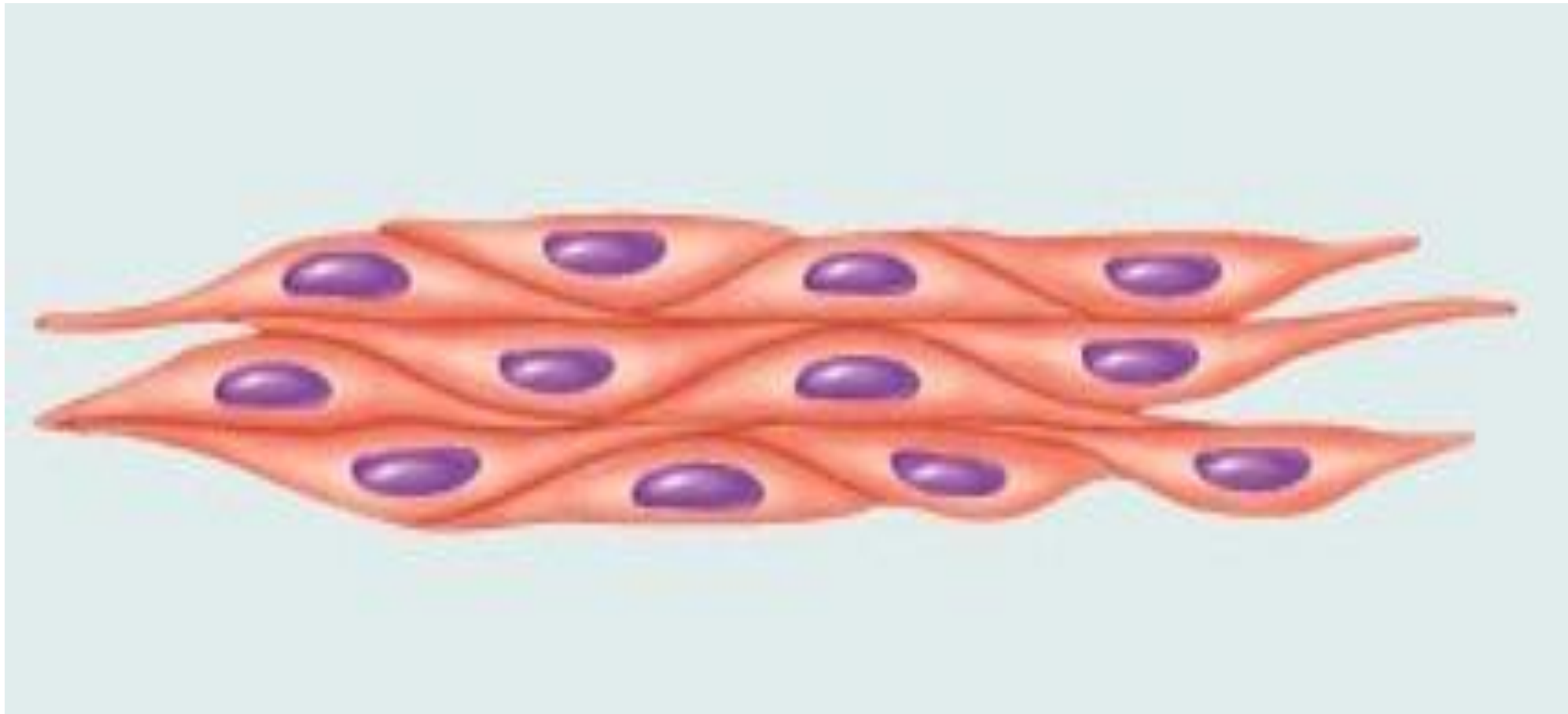


Smooth muscle locations:

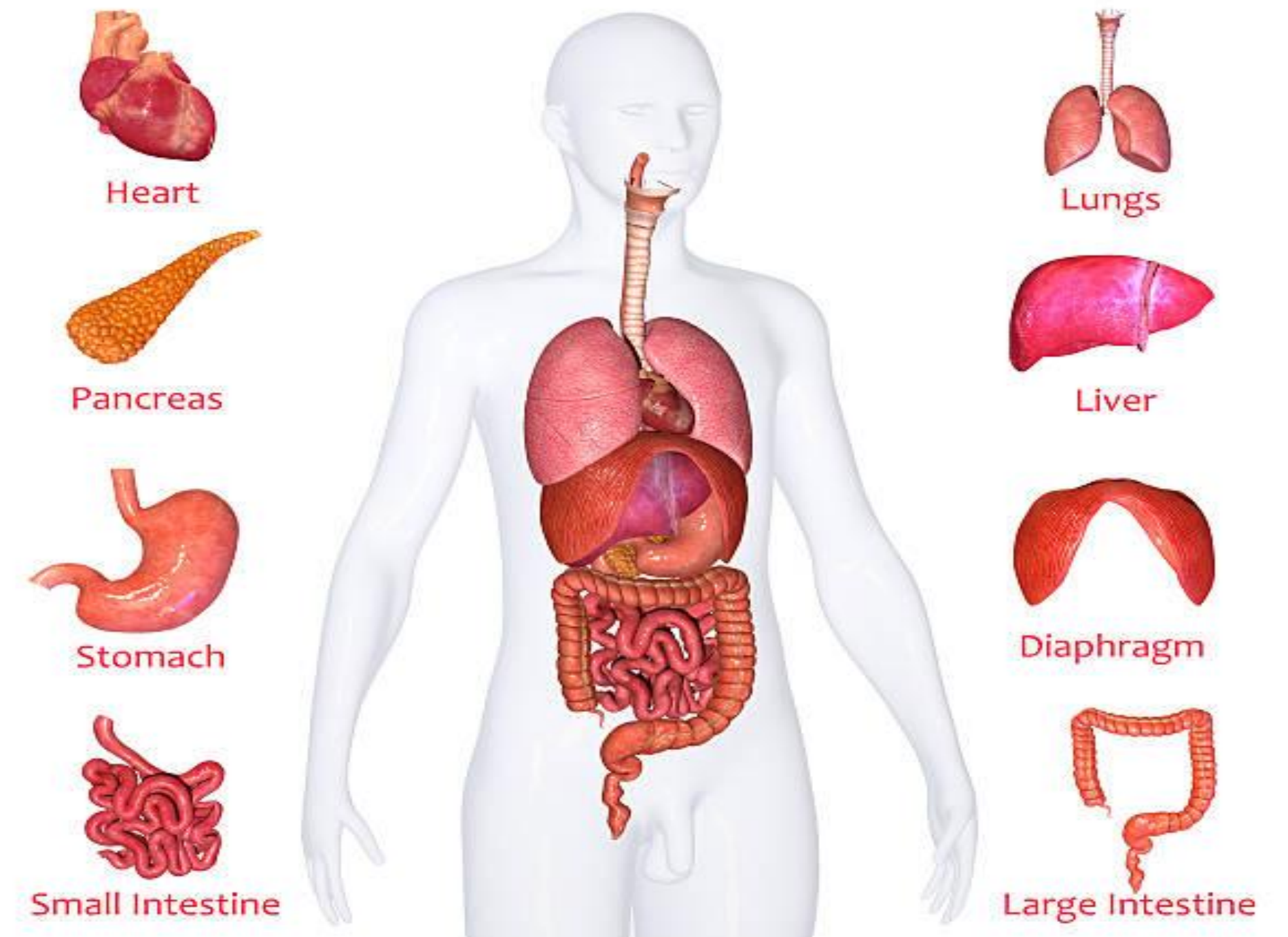
Smooth muscle forms the contractile portion of the wall of the **digestive tract** from the middle portion of the esophagus to the internal sphincter of the anus. It is found in the walls of the **ducts in the glands** associated with the alimentary tract, in the **walls of the respiratory passages** from the trachea to the alveolar ducts, and in **the urinary and genital ducts**. The walls of the **arteries, veins, and large lymph vessels** also contain smooth muscle.

Smooth Muscle characteristic features :

- 1-are small fusiform in shape and are pointed at their ends.
- 2-can divide and regenerate new cells
- 3-non-striated, involuntary, and single nucleus centrally located.
- 4-found in the wall of hollow organs like the intestine, bladder, lungs, and blood vessels.



Internal Organs



Smooth M

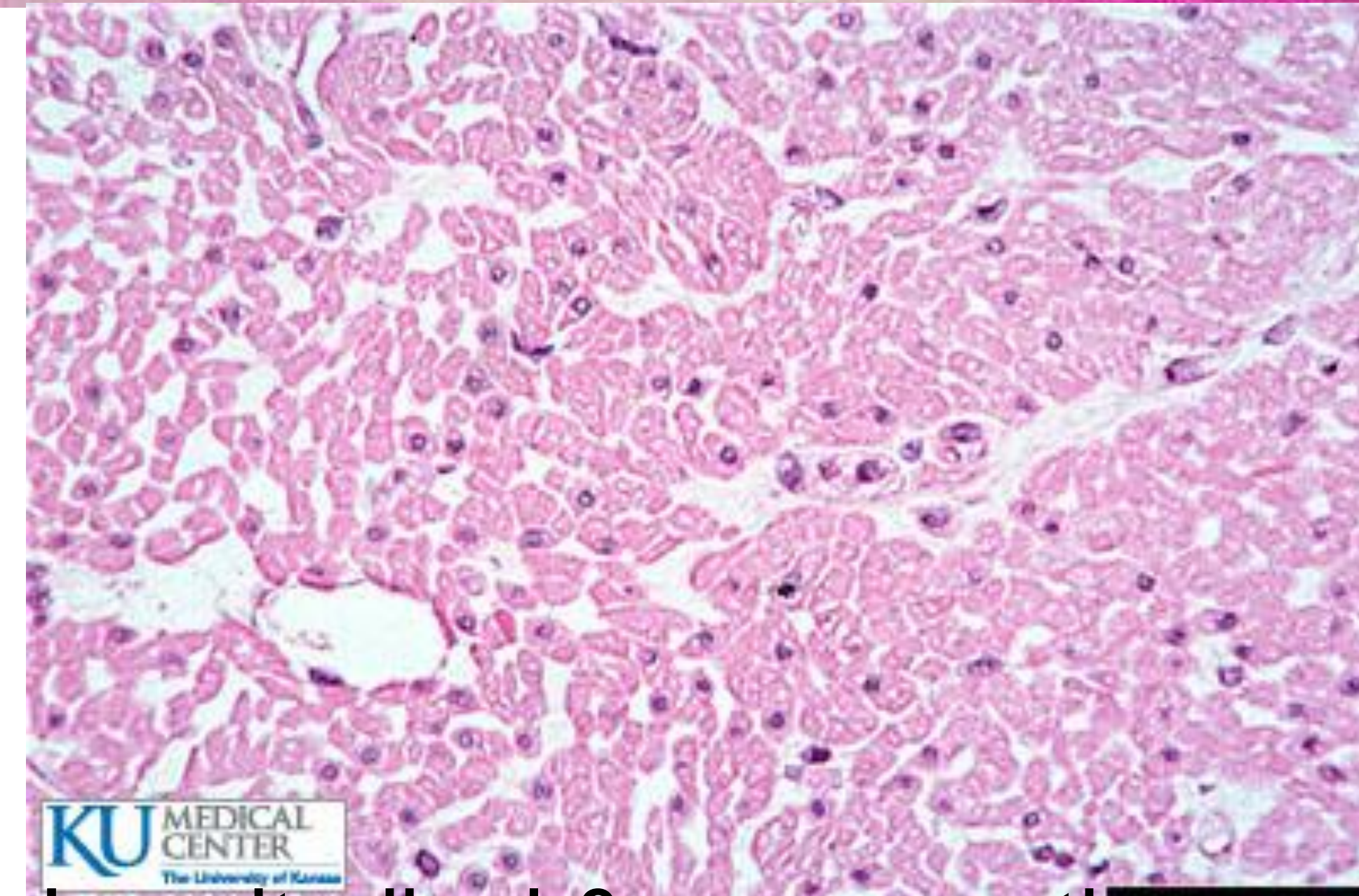
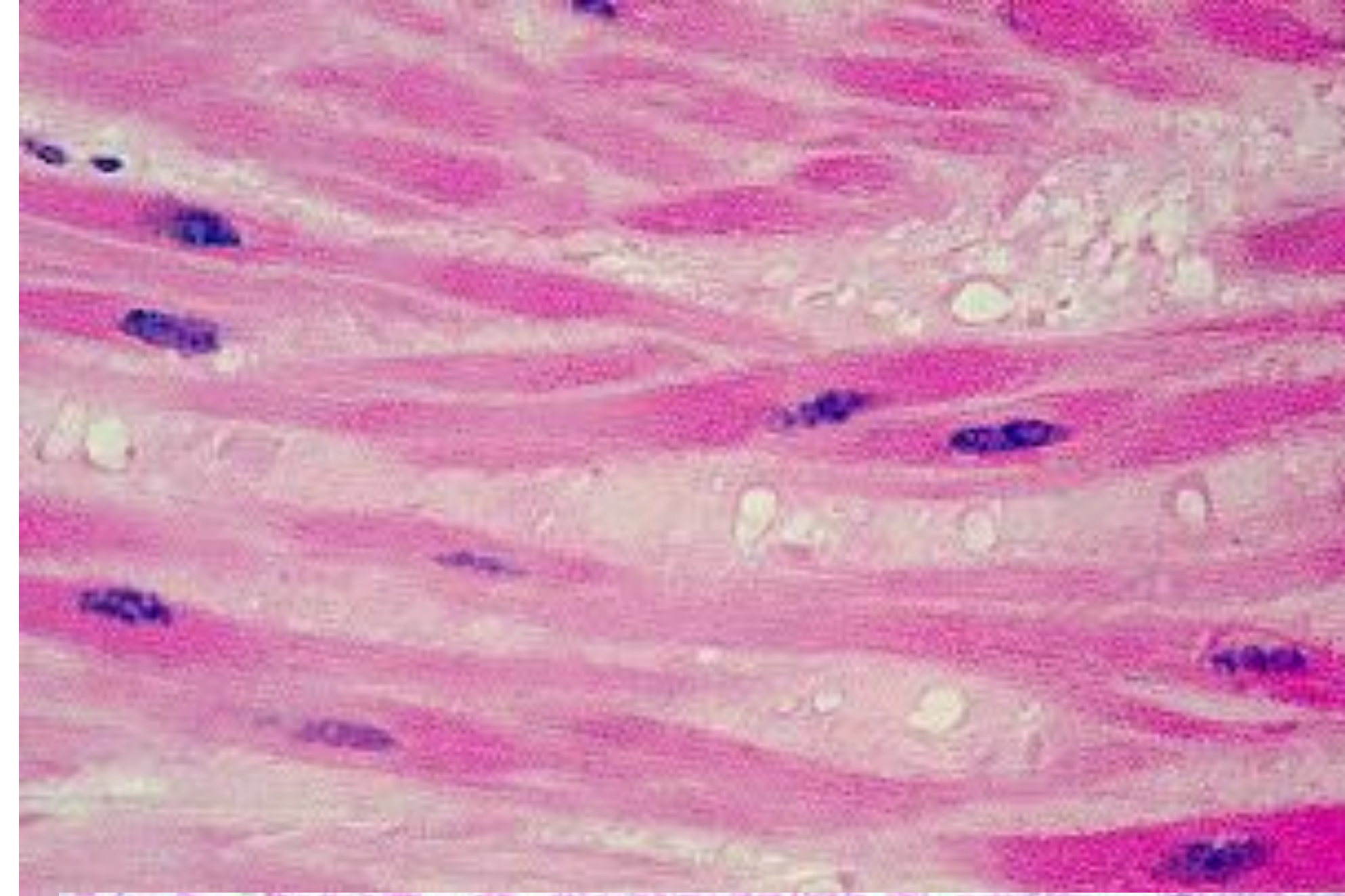
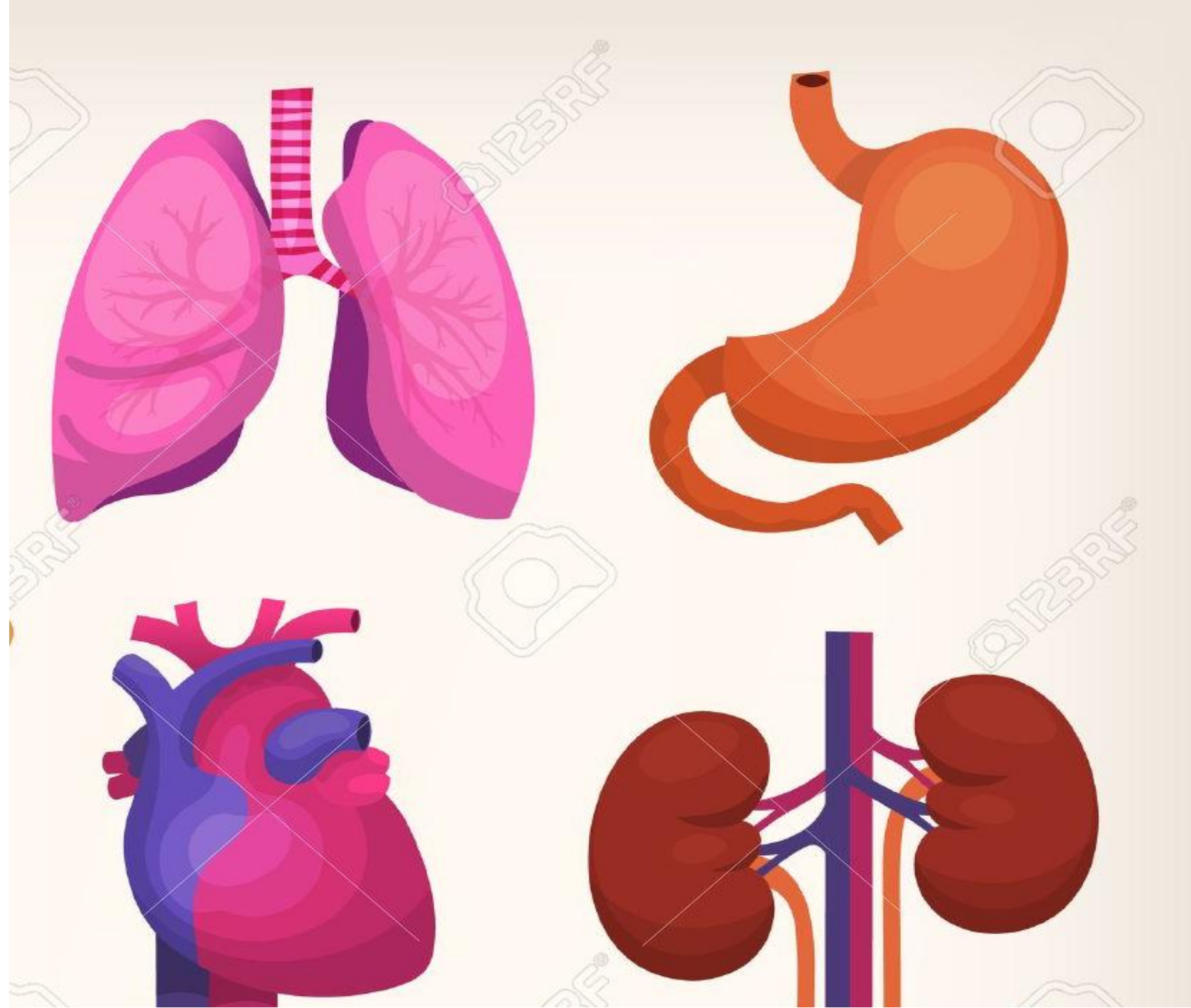
5-smooth muscle is specialized for slow and long lasting contractions of low force.

6- All cells within a whole smooth muscle mass contract together.

7-Smooth muscle has inherent contractility, and the autonomic nervous system, hormones and local metabolites can influence its contraction.

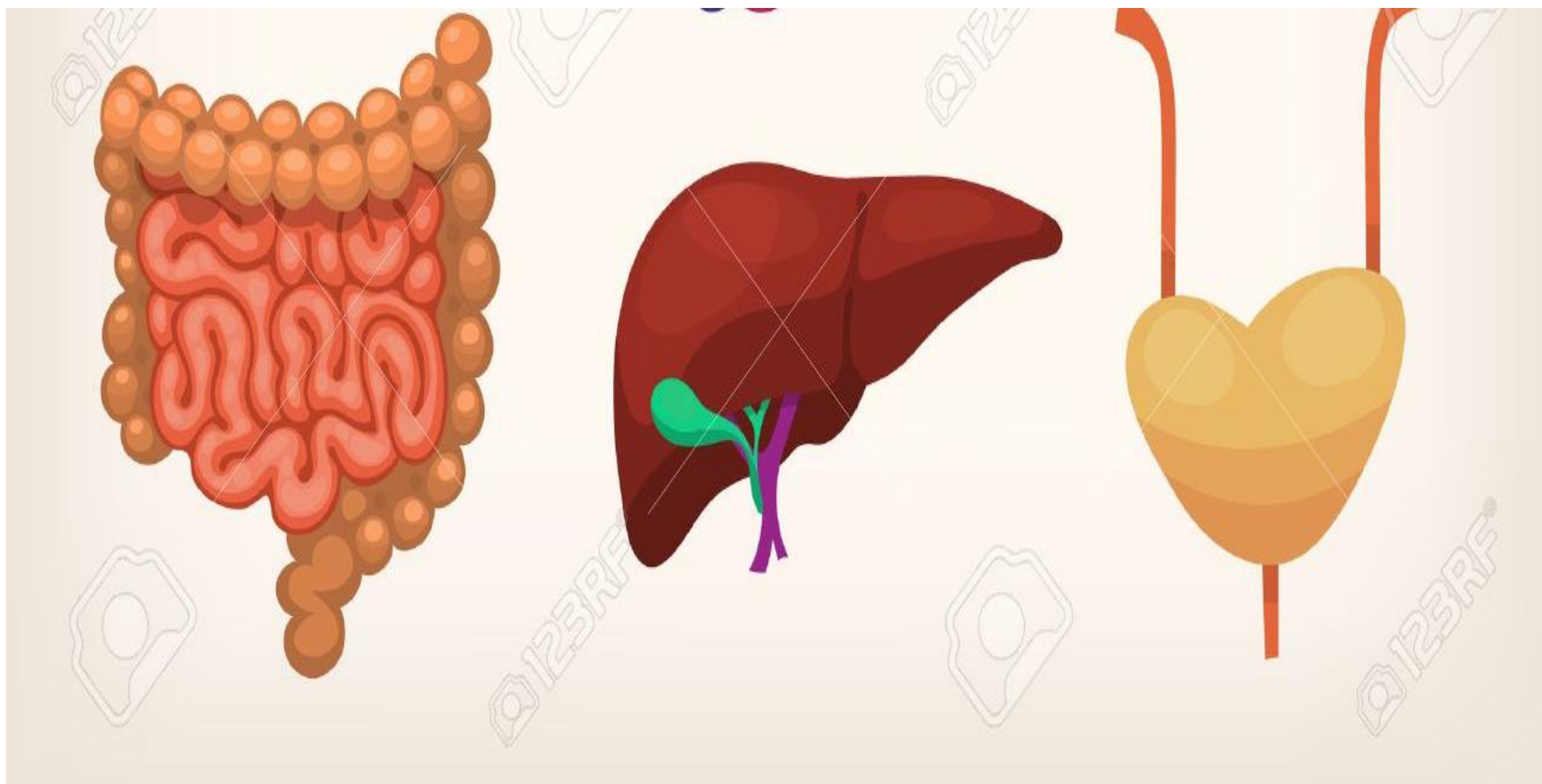
8-Since it is not under conscious control, smooth muscle is involuntary muscle.

9-move substances through hollow opening by contracting slowly; they squeeze things through .



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Longitudinal & cross sections
of smooth muscle



Muscle Regeneration and Growth

Skeletal Muscle

- Increase in size (hypertrophy)
- Increase in number (regeneration/proliferation)
- Can regenerate ,satellite cells are proposed source of regenerative cells

Muscle Regeneration and Growth

Heart Muscle

- Increase in size (hypertrophy)
- Non-proliferative (no regeneration)
- Post-infarction tissue remodeling by connective tissue (fibrosis/scarring)

Muscle Regeneration and Growth

Smooth Muscle

- Increase in size (hypertrophy)
- Increase in number (regeneration/proliferation)
- Smooth muscle cells are proliferative
(e.g. uterine myometrium and vascular smooth muscle)
- Vascular pericytes can also provide source of smooth muscle

Interaction Summary

Type of Muscle Tissue	Striations	Number of Nuclei & location	Voluntary or Involuntary
SKELETAL	?	?	?
CARDIAC	?	?	?
SMOOTH	?	?	?

Summary of the learning outcomes

- 1-Contrast the structure and function of skeletal, smooth, and cardiac muscle tissue.
- 2-Identify morphological differences in smooth muscle across other tissues.
- 3-Explain the structure and function of the intercalated disc
- 4- Enumerate the locations in the body of the three types muscle tissue.
- 5- Muscle tissues share nervous tissue in what concept?
- 6- The importance of C.T coverings in skeletal muscle ?

THE END

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