BLOCK CAS-206

Cardio Vascular System

Lecture 1

Histology of the heart

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Learning objectives

- After this lecture, students should be able to:

- **Recognize the different parts of the heart.**
- **List the names of layers of cardiac wall, (Epicardium, pericardium, endocardium).**
- **Discuss the normal structure of cardiac skeleton and cardiac valve**
- **Describe the normal structure of intercalated disc.**
- **Identify and describe the structure of Purkinje muscle fibers.**

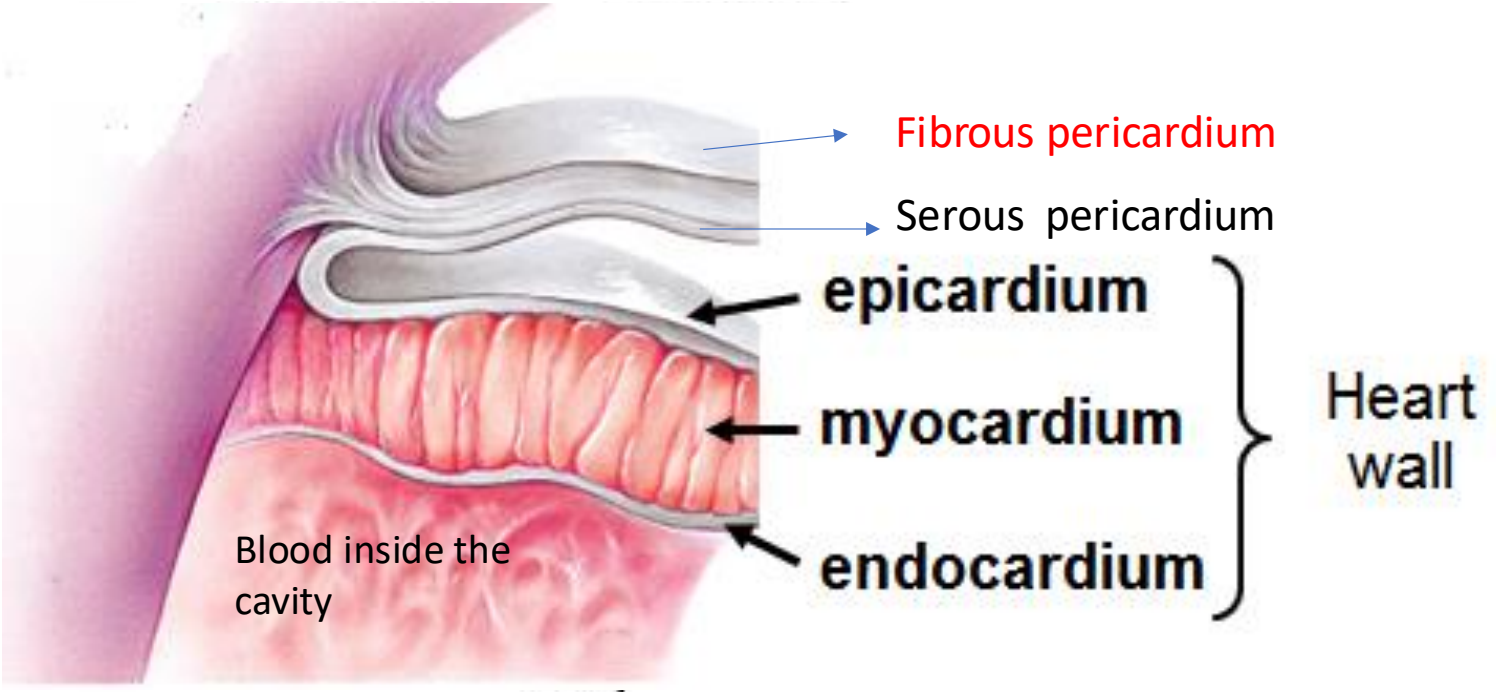
Wall of the heart

It consists of 3 layers:

Epicardium (outer Layer) = Visceral Pericardium

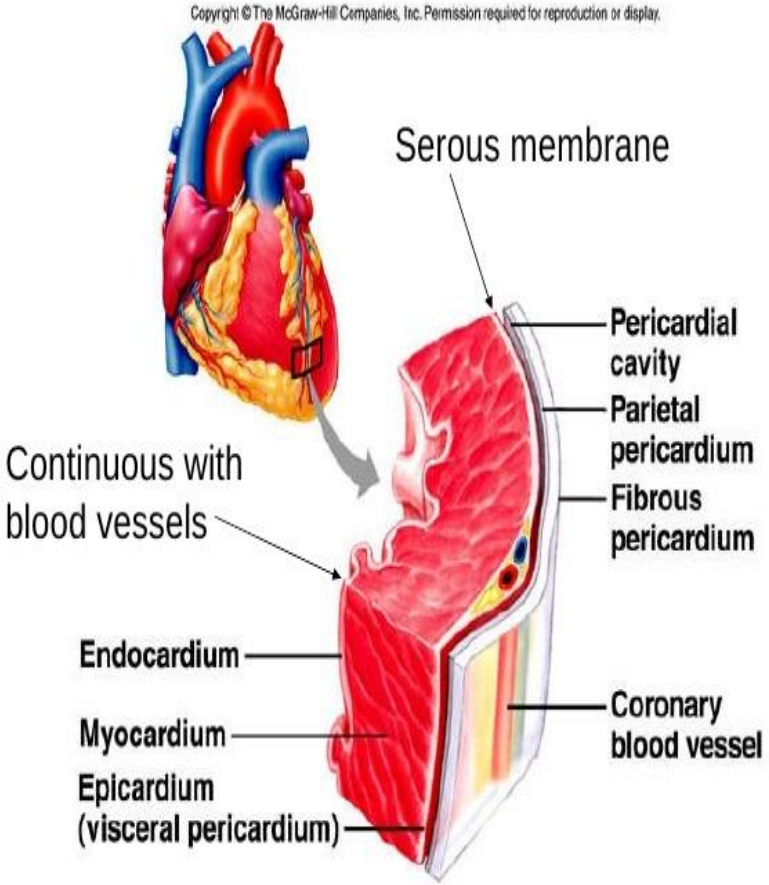
Myocardium (Middle layer)

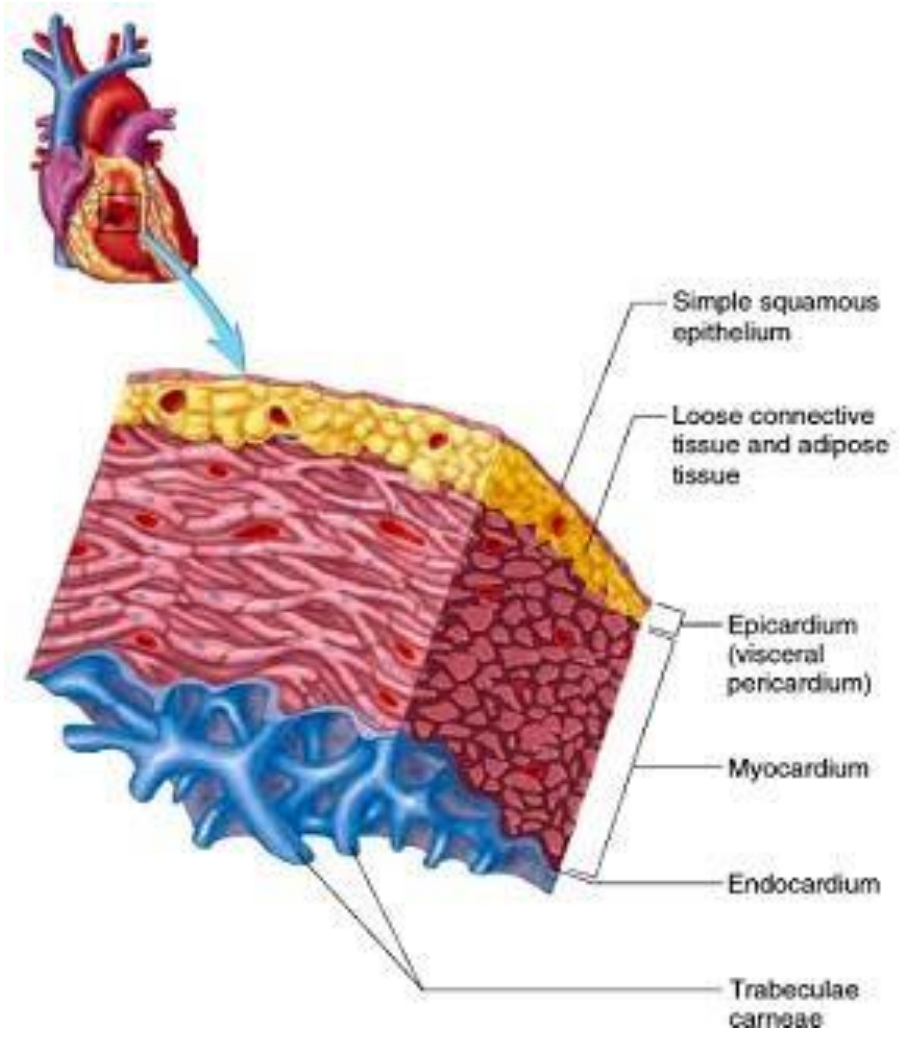
Endocardium (Inner layer)

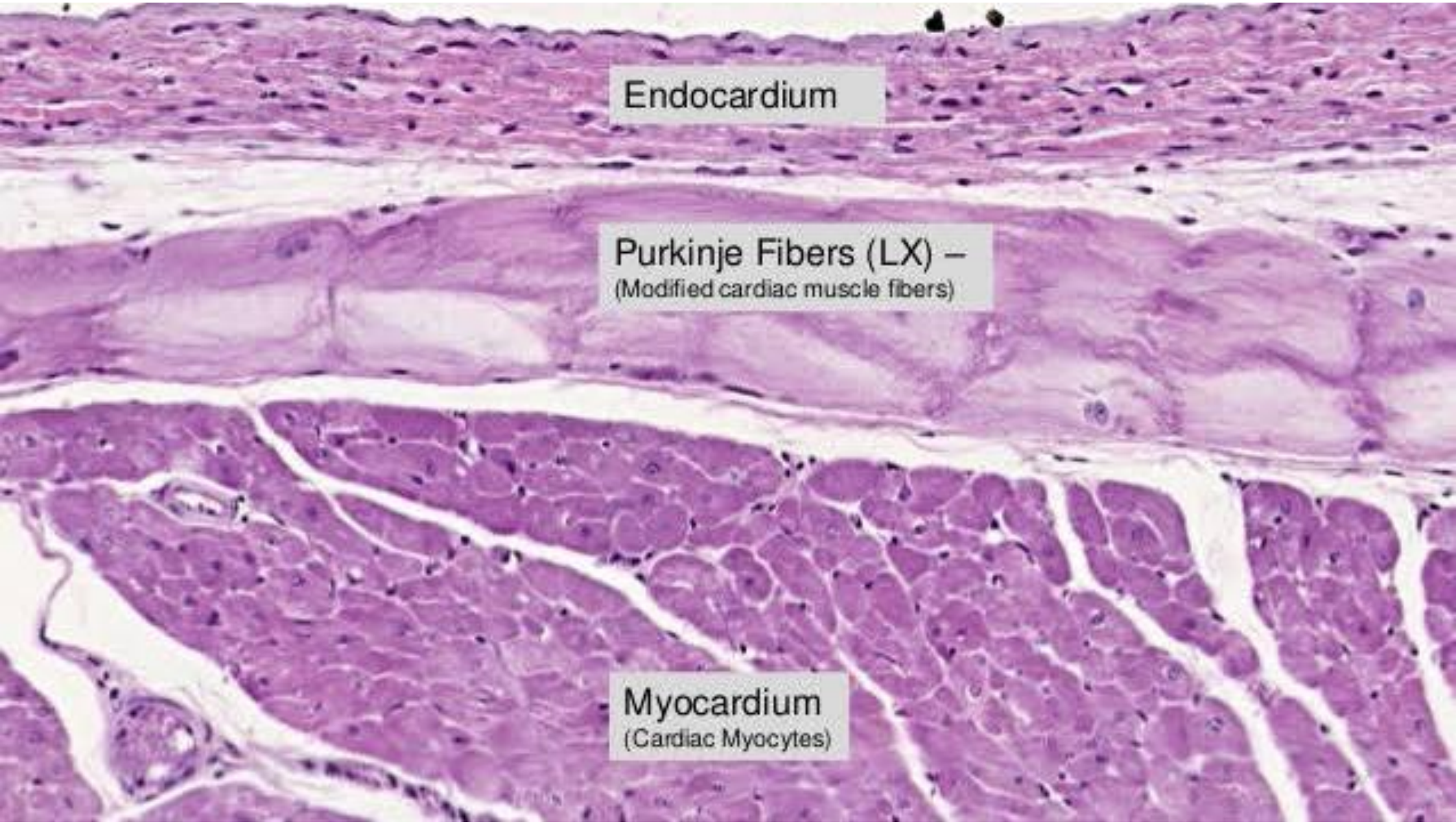


Histology of the heart

- The heart wall can be divided into three layers:
  - **The endocardium** (the innermost layer, in contact with blood) is an endothelial cell-lined layer continuous with the tunica intima of those blood vessels that join and leave the heart.
  - **The myocardium** (the main bulk of the heart) is composed of cardiac muscle and corresponds to the tunica media of the blood vessel wall.
- **The epicardium** (the outermost layer) is covered by a reflection of the mesothelial-lined (serous or visceral) pericardium, contains coronary blood vessels and nerves, and corresponds to the tunica adventitia of blood vessels





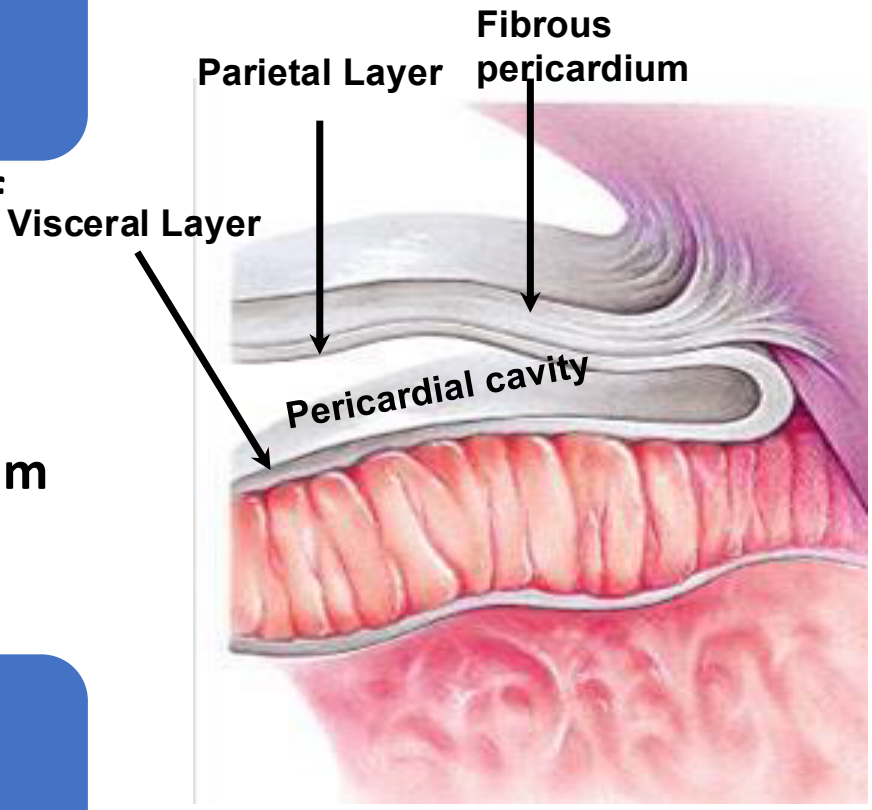

Endocardium
Purkinje Fibers (LX) –
(Modified cardiac muscle fibers)
Myocardium
(Cardiac Myocytes)

The Pericardium (Covering of the Heart)

Consists of 3 layers:

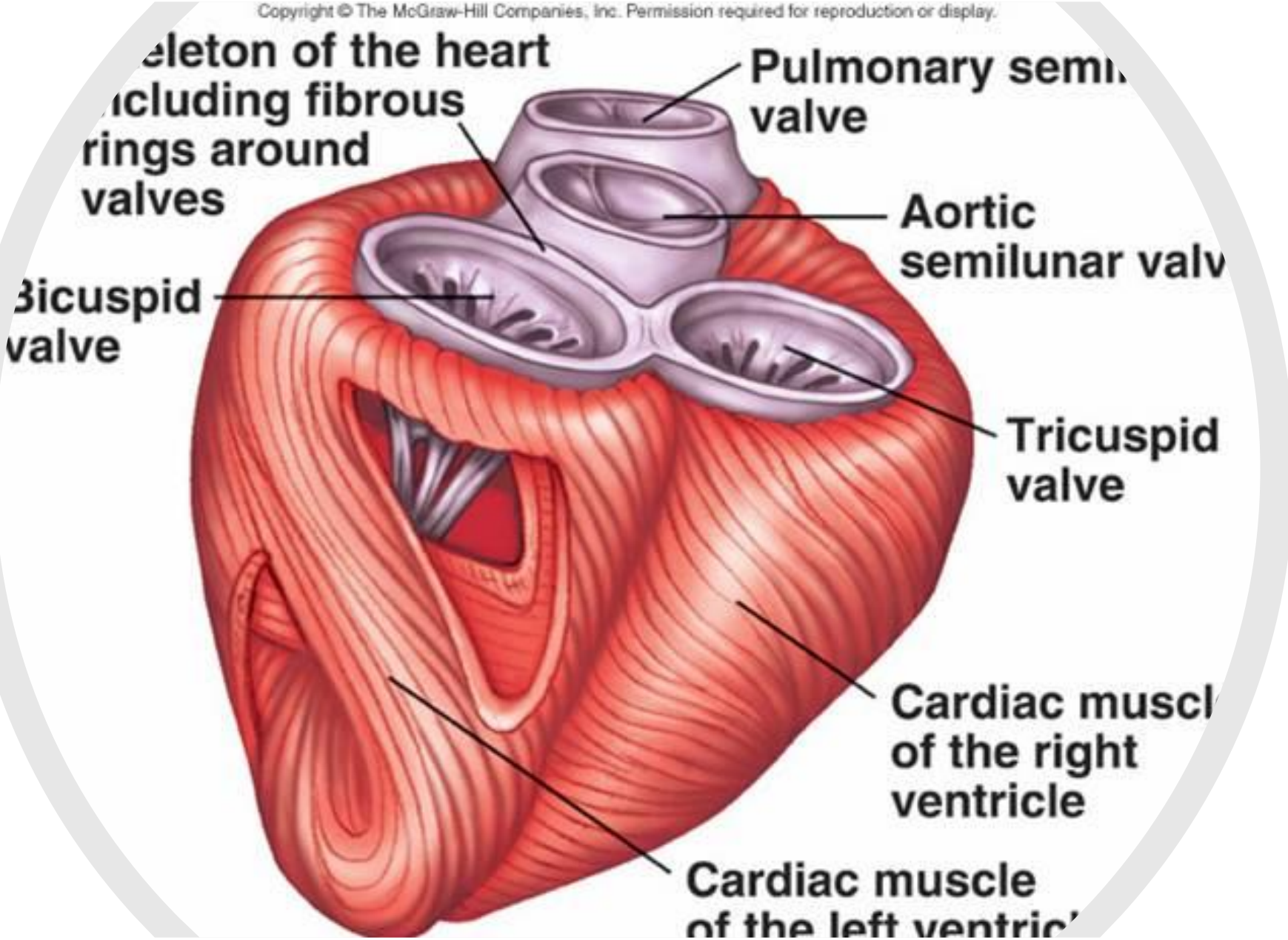
- **Fibrous pericardium(outer layer) made of dense CT, holds heart in place, prevents overfilling**
- **Serous pericardium (2 layers)**
  - **Parietal layersticks to fibrous pericardium**
  - **Visceral layer(= epicardium) is the outermost layer of the heart wall**

Between parietal and visceral layers is the**pericardial cavity**, which contains serous fluid (which reduces friction).



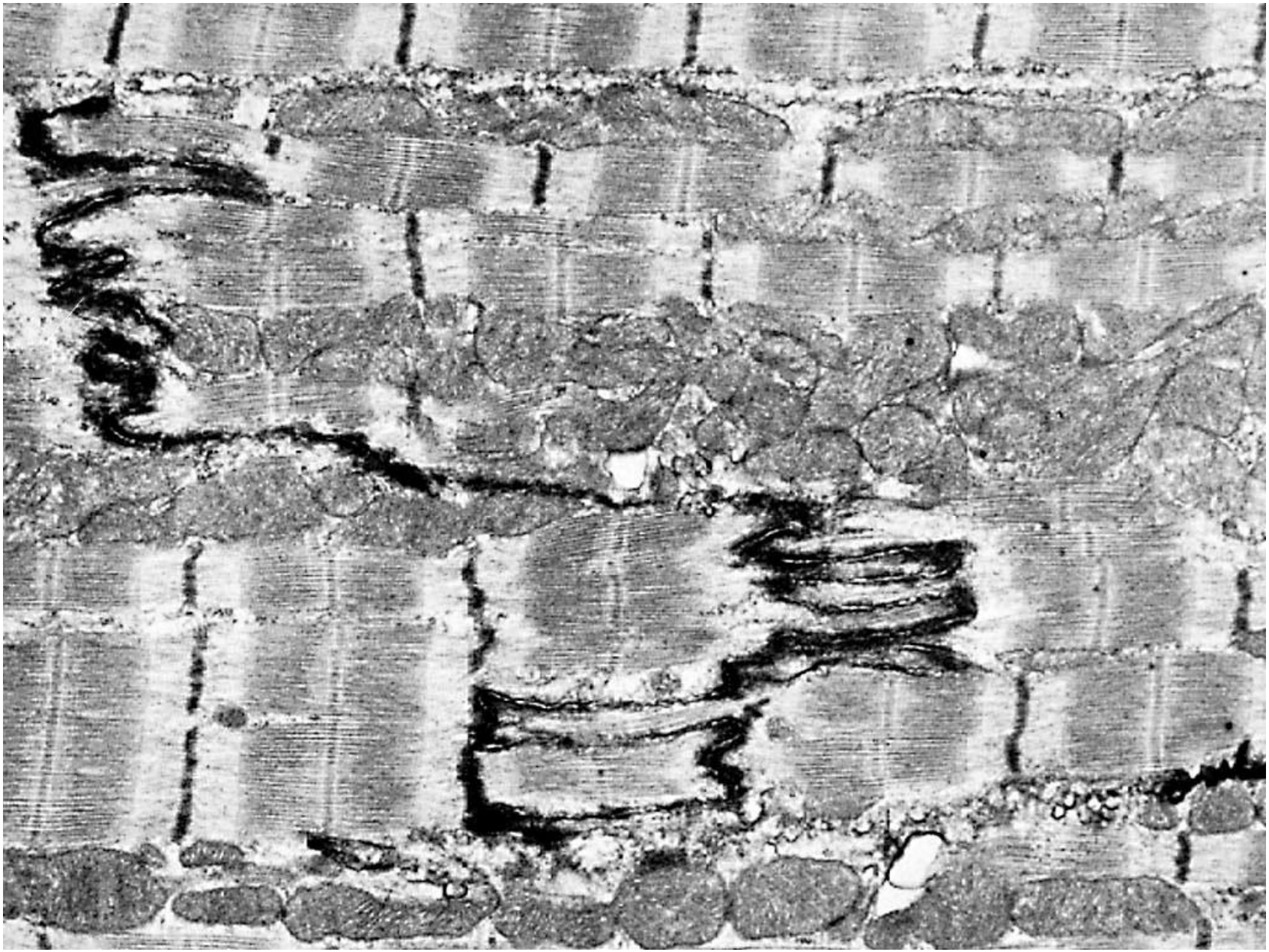
Cardiac skeleton

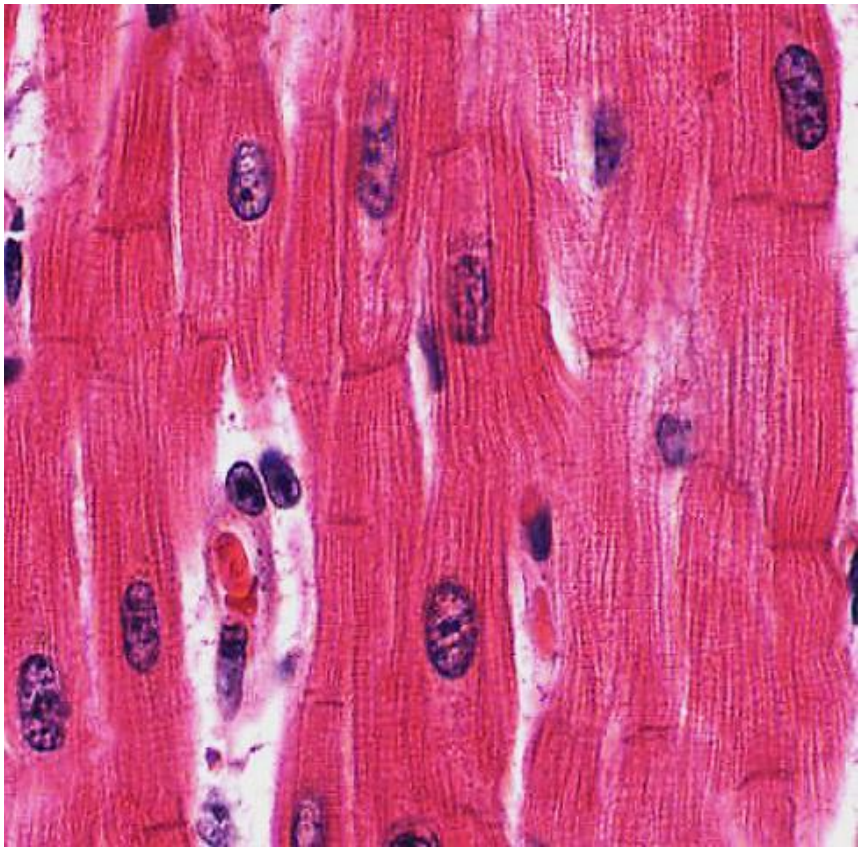
- The central supporting structure of the heart is the "cardiac skeleton," composed of dense white fibrous (collagenous) connective tissue into which the cardiac muscle fibers of the atria and ventricles insert and to which the heart valves are attached. This skeleton provides structure and support for the heart, as well as isolating the atria from the ventricles.
- some species these fibrous rings have a cartilage-like appearance.

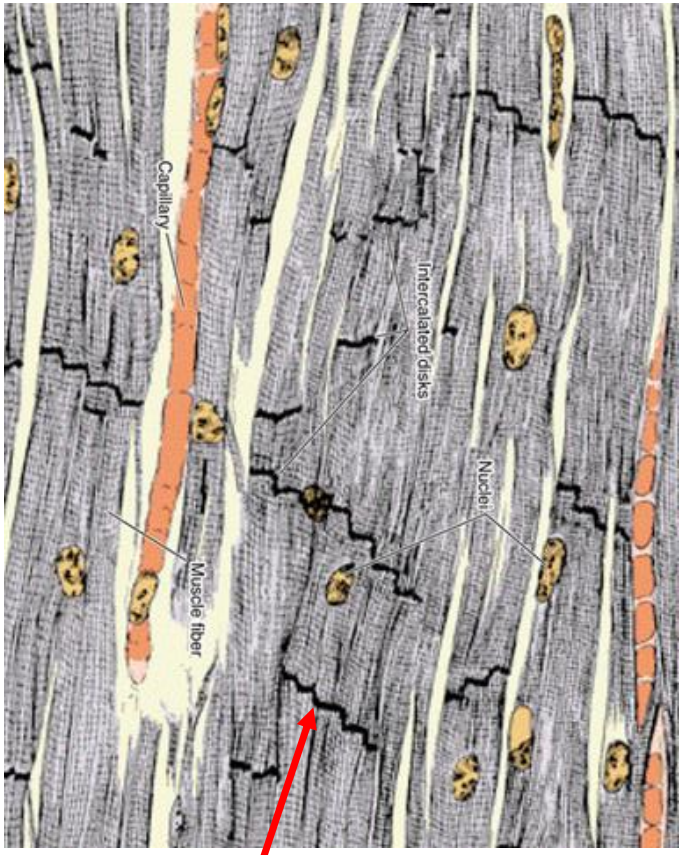


Intercalated disc

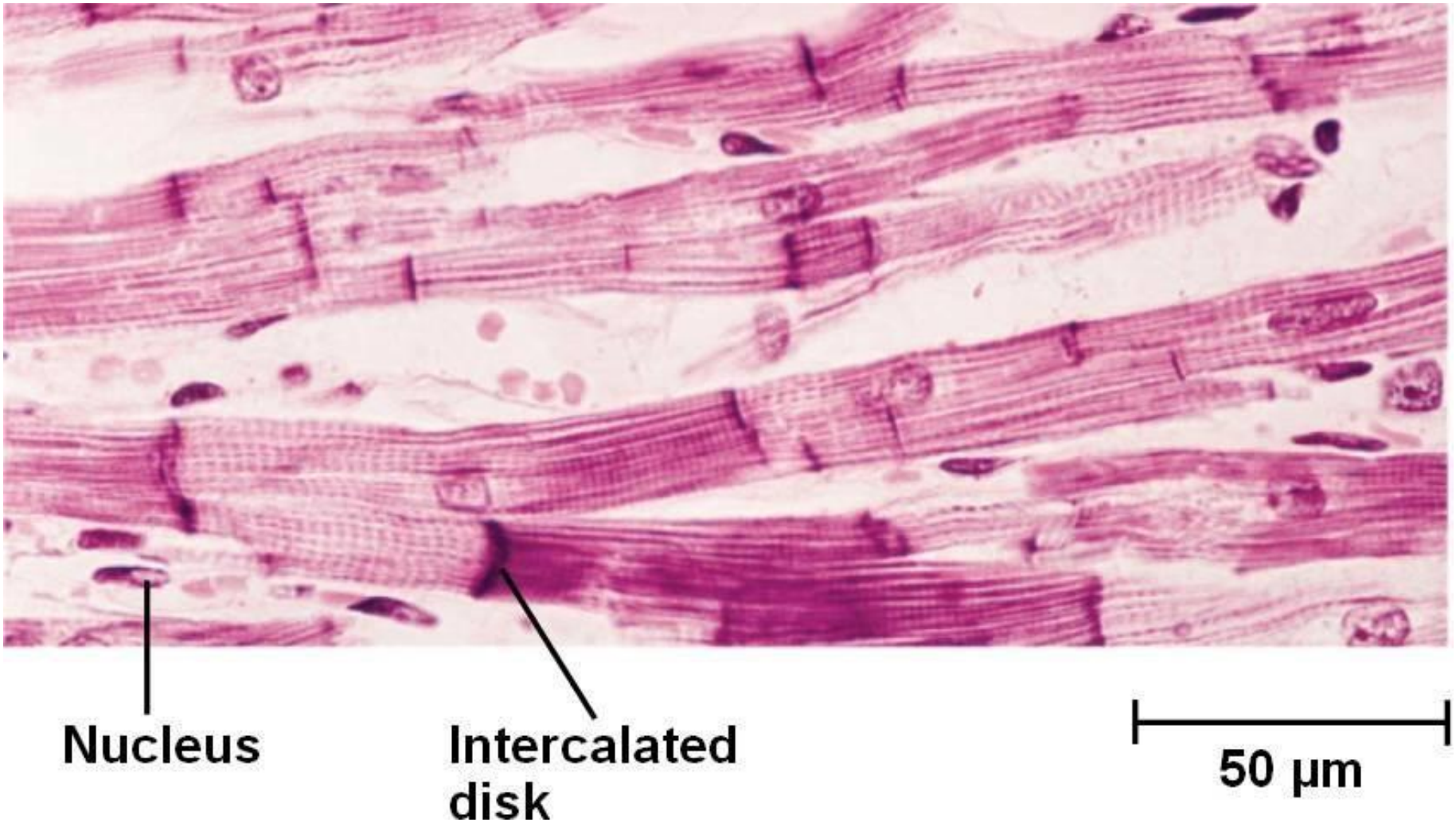
- Three types of cell junction make up an intercalated disc — fascia adherens, desmosomes and gap junctions.
  - Fascia adherens are anchoring sites for actin, and connect to the closest sarcomere.
  - Desmosomes (macula adherens) prevent separation during contraction by binding filaments, joining the cells together.
  - Gap junctions allow action potentials to spread between cardiac cells by permitting the passage of ions between cells at the same time, producing depolarization of the heart muscle.





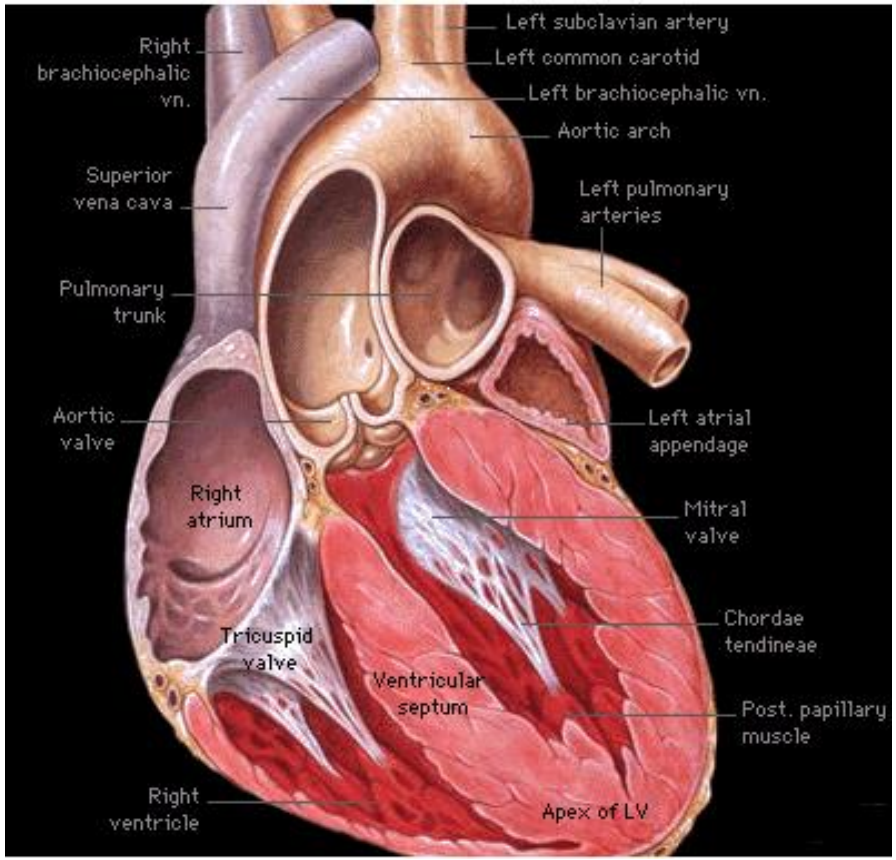


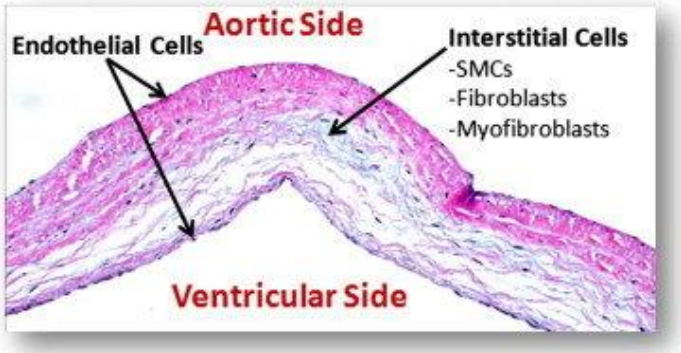
Intercalated disc

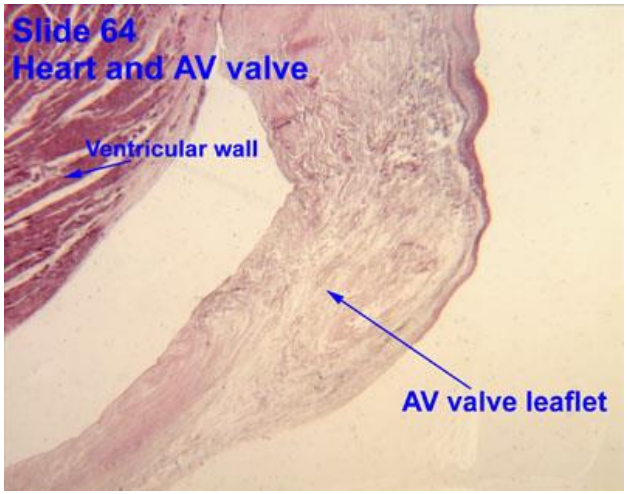

Nucleus
Intercalated disk
50 µm

Cardiac valves

- Are endocardial folds supported by internal plates of dense collagenous and elastic connective tissue continuous with the fibrous ring of cardiac skeleton.
- The valves are arranged to prevent retrograde or reverse blood flow.
- The innermost part of the valves is continuous with the fibrous rings. The atrioventricular valves have connective tissue extensions, the chordae tendinae, which connect to muscular extensions of the inner heart wall called papillary muscles.

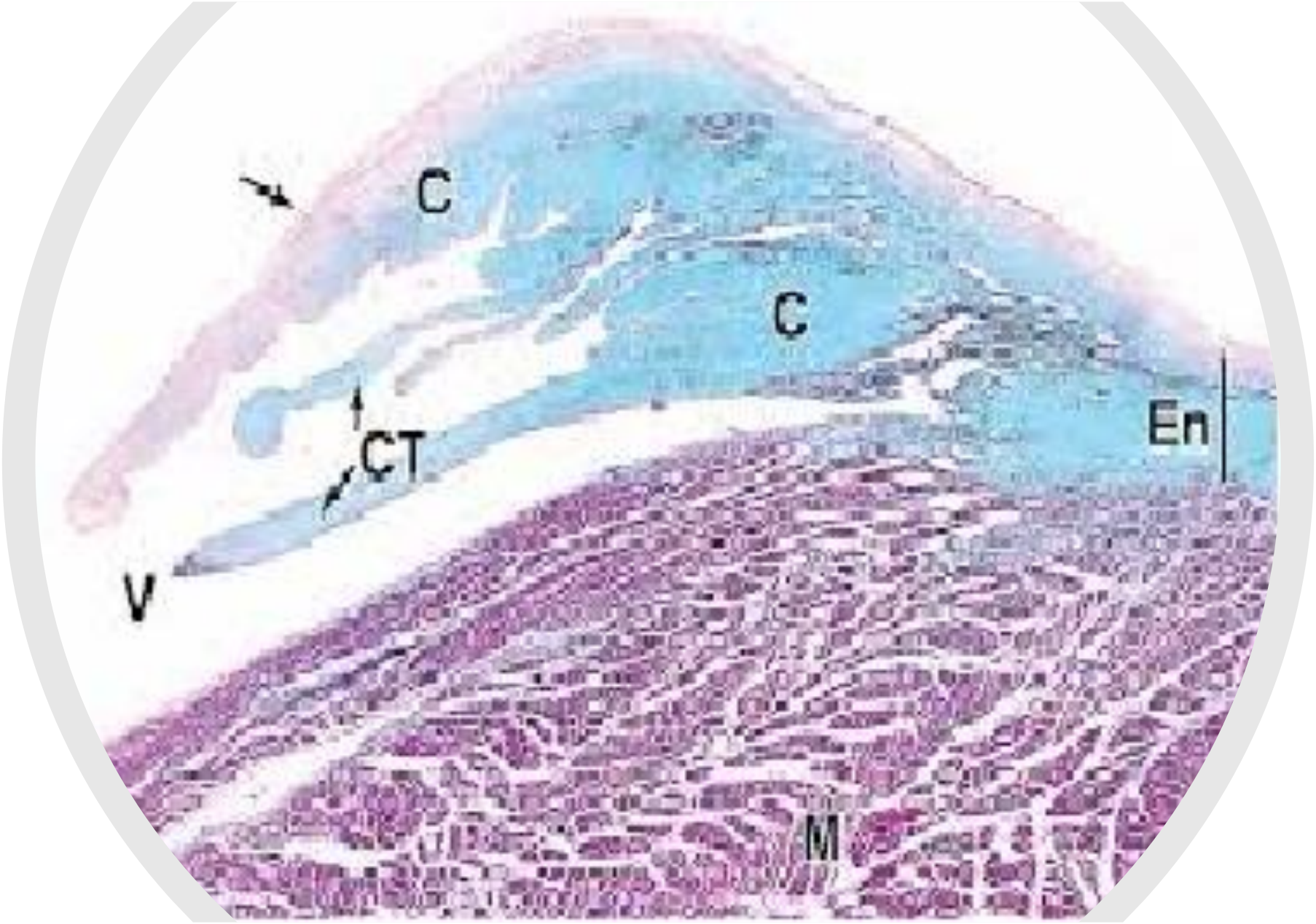

Left subclavian artery
Right brachiocephalic vn.
Left common carotid
Left brachiocephalic vn.
Aortic arch
Superior vena cava
Left pulmonary arteries
Pulmonary trunk
Aortic valve
Left atrial appendage
Right atrium
Mitral valve
Chordae tendineae
Tricuspid valve
Ventricular septum
Post. papillary muscle
Right ventricle
Apex of LV





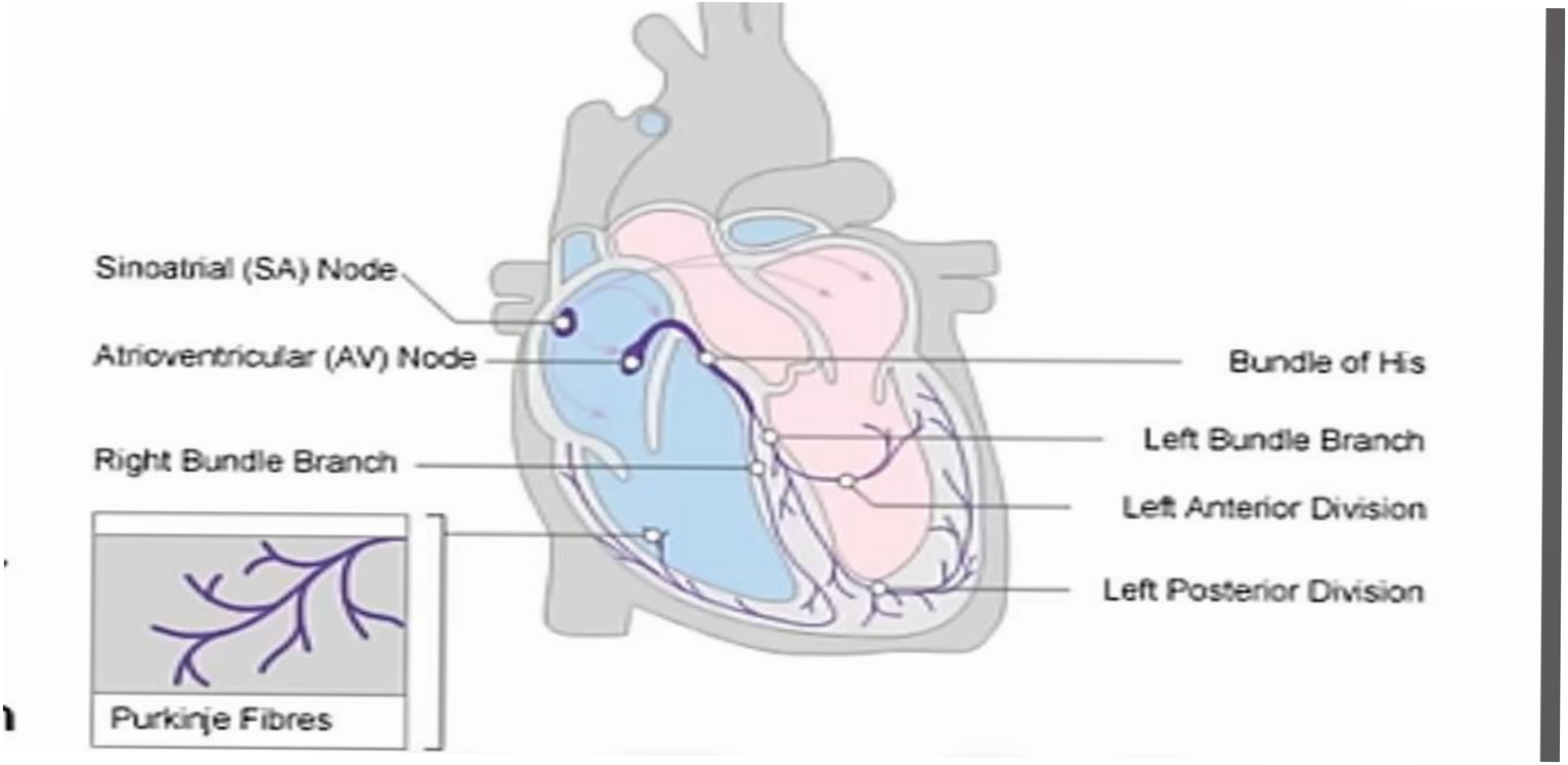
Structure of valves of the heart

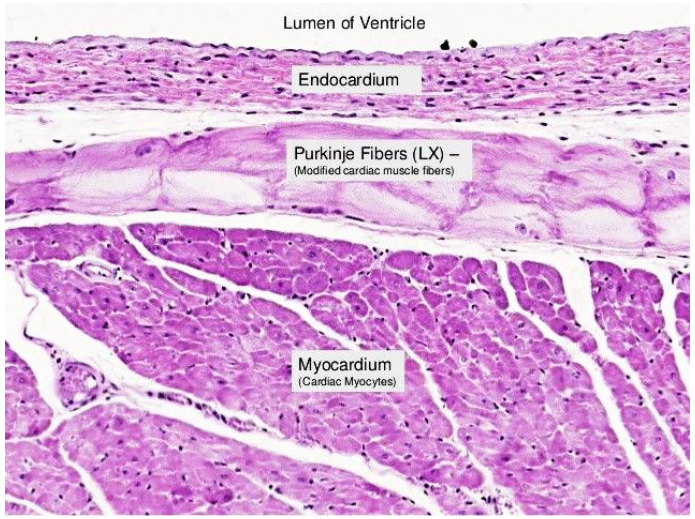
1. **Atrio-ventricular valves (A-V valves):** (tricuspid & mitral) are composed of core of dense irregular connective tissue that is lined on both sides by endothelium. The bases of the valves are attached to the fibrous skeleton.
2. **Semilunar valves:** (aortic and pulmonary valves) are similar in structure to the A-V valves, but they have thinner central core.
3. All cardiac valves are avascular.

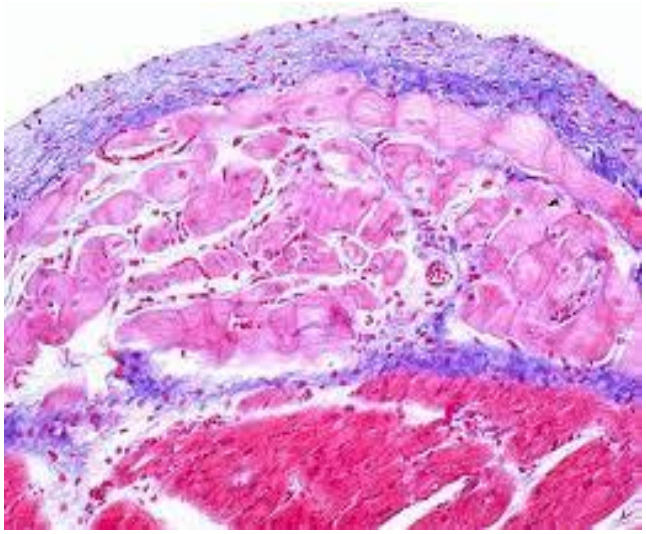

C
C
CT
En
V
M

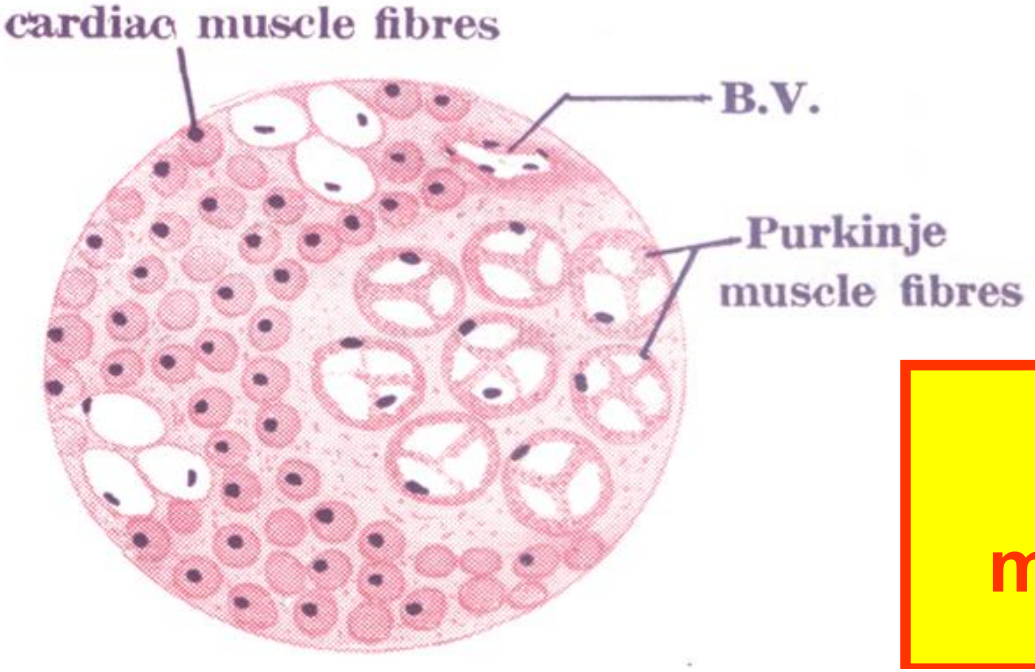
Purkinje fibers

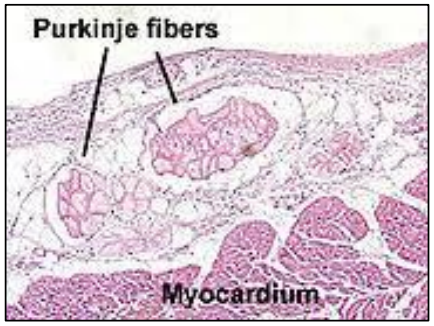
- Are modified cardiac muscle cells, electrically excitable cells, also called conducting myofibers.
- They are distal branch es of atrioventricular node bundles to both ventricles.
- These modified cardiac fibers lie beneath the endocardium.
- Histologically: The fibers are larger than cardiac muscle fibers, have one or two peripheral nuclei and lightly stained glycogen filling most of the cytoplasm consequently, Purkinje fibers have a clear empty appearance in most preparations.
- The Purkinje fibers conduct the electrical impulses for heart's contraction.
- Function to determine heart rate and to coordinate contraction of the heart.


Sinoatrial (SA) Node
Atrioventricular (AV) Node
Right Bundle Branch
Purkinje Fibres
Bundle of His
Left Bundle Branch
Left Anterior Division
Left Posterior Division

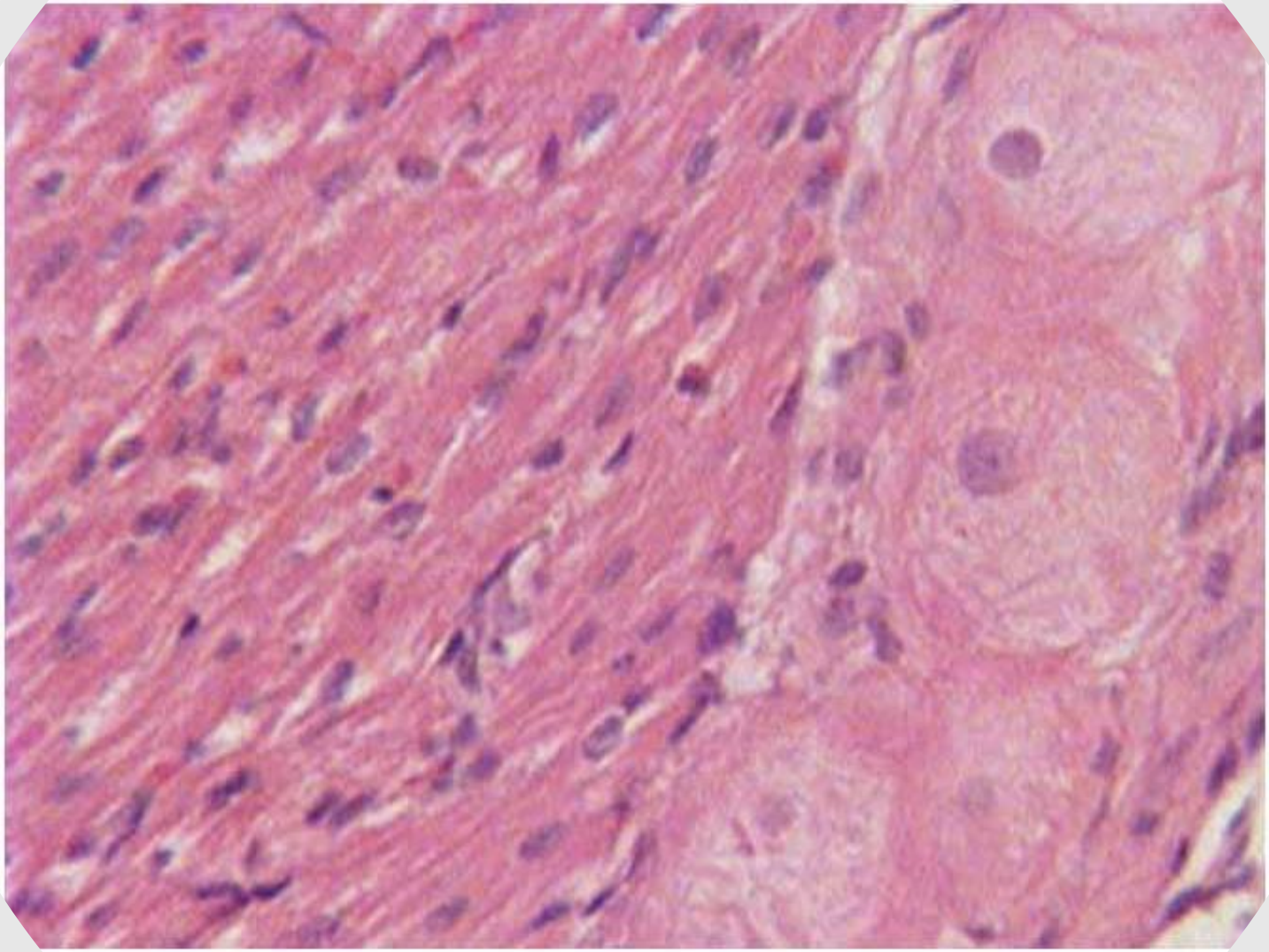








T.S. in moderator band




I love Histology!

REFERENCES:

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ELSEVIER'S INTEGRATED HISTOLOGY (2007) 1ST EDITION.