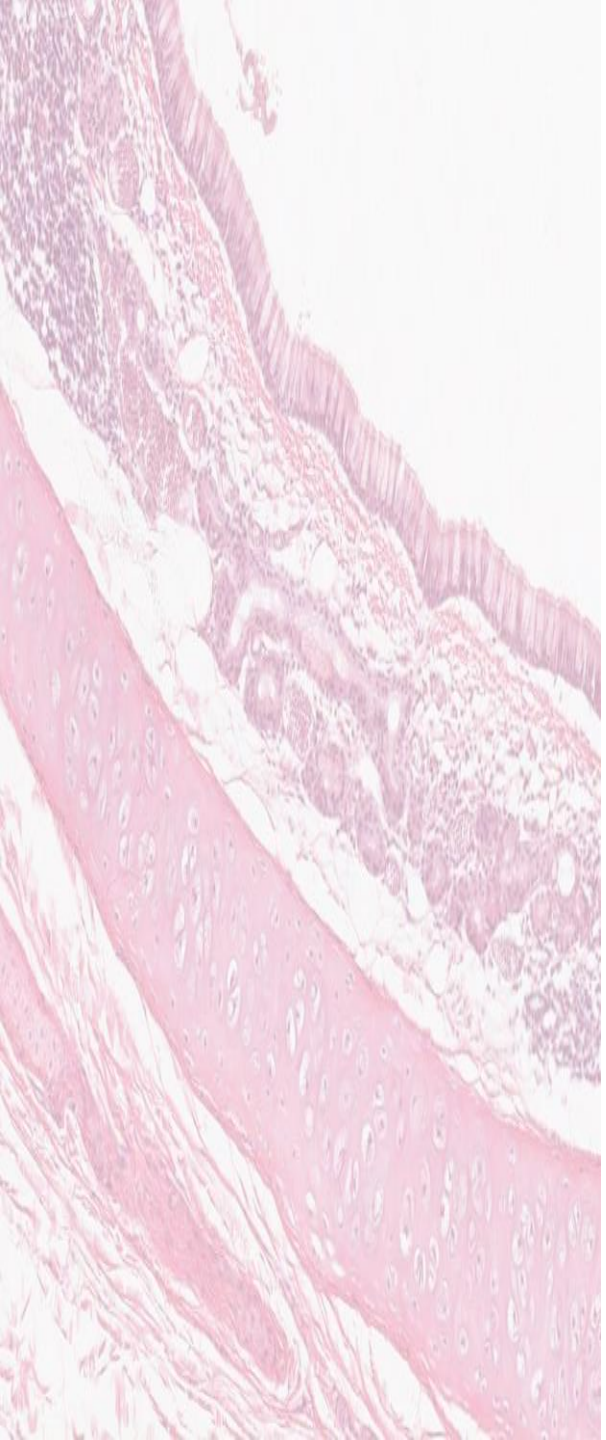

جامعة الملك سعود
King Saud University

436
MEDICINE
KING SAUD UNIVERSITY

WALL OF THE HEART AND CARDIAC VALVES

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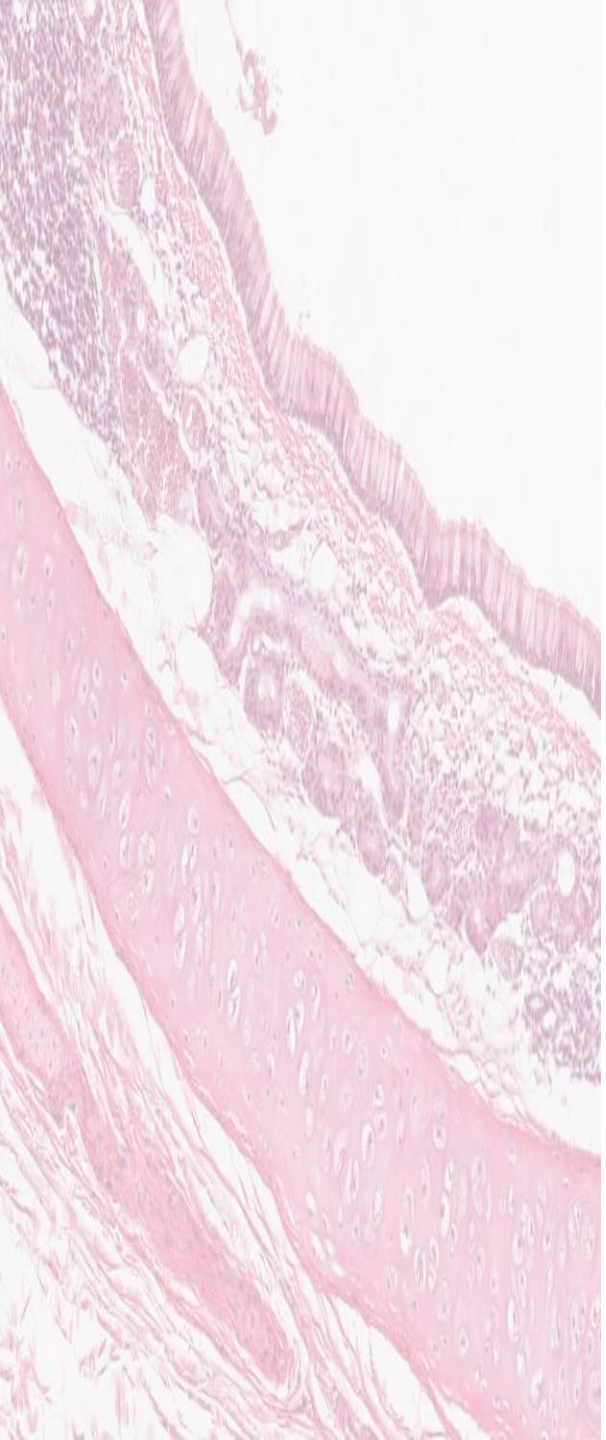
Revised by
شوق الأحمري & طراد الوكيل



وَمَن يَتَوَكَّلْ عَلَى ٱللَّهِ فَهُوَ حَسْبُهُۥٓ

Objectives:

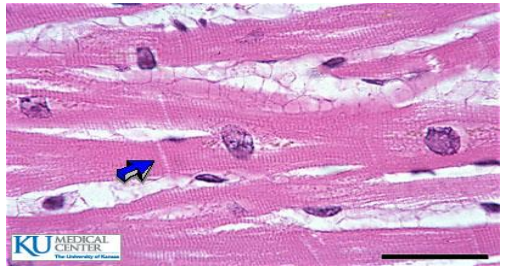
The microscopic structure of:

- ✓ Wall of the heart.
  - Endocardium
  - Myocardium
  - Epicardium
- ✓ Cardiac valves.

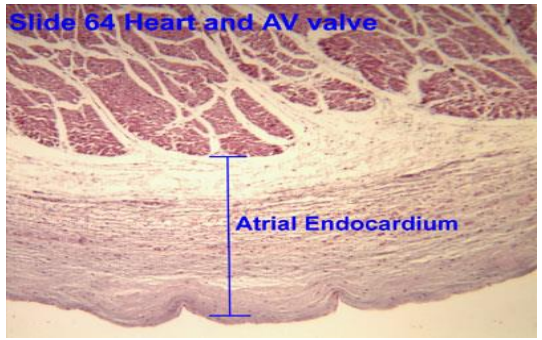
WALL OF THE HEART

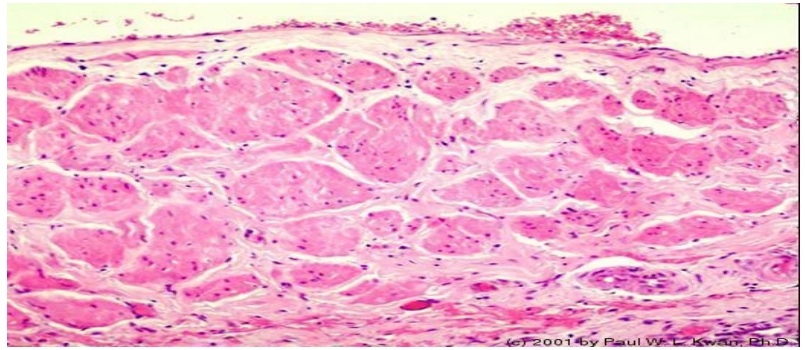
The wall of heart is composed of:

- Endocardium
  - Endothelium
  - Convictive tissue
    - Dense C.T. layer
    - Subendothelial C.T.
    - Subendocardial layer
- Myocardium
- Epicardium
  - Mesothelium
  - C.T. layer



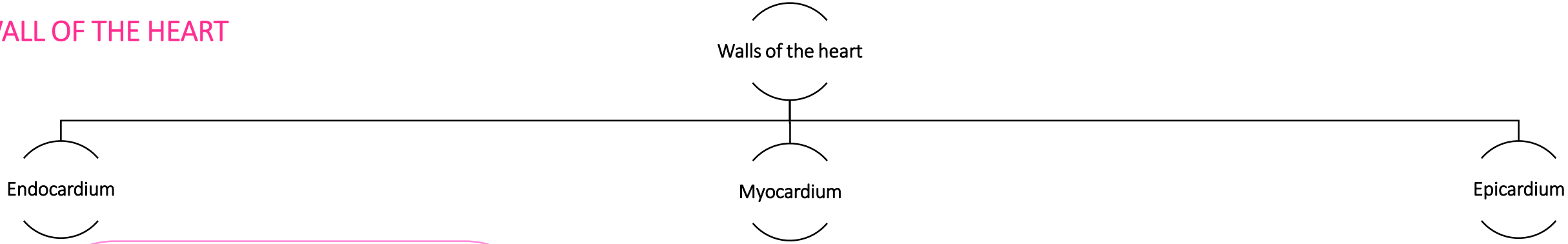
The inner layer should be very smooth (for the lumen of the heart) so it is endothelium.





the organ should be covered in a membrane, as the pleura covers the lung, the epicardium covers the heart, it is the visceral layer.

WALL OF THE HEART



- The innermost layer
- Bloodstream flow in this layer

Is formed of:

A- Endothelium:

Simple squamous epithelium.

B- Convictive tissue:

There are three different layers of C.T :

- Subendothelial C.T (Lose C.T rich in elastic fiber & collagen fiber)
- Dense C.T. layer (Rich in collagen fiber Type I)
- Subendocardial layer:
  - Loose C.T. layer that contains Purkinje fibers, small blood vessels and nerves.
  - It attaches to the endomysium of the cardiac muscle. (penetrates)

•t is the middle layer.
•It is the most thick layer.
•It contains:

A- Bundles of cardiac muscle fibers.

B- Endomysium (loose C.T & it's in continuation with the Subendocardial layer of the endocardium).

(Visceral layer of pericardium)
Is formed of:

A- Mesothelium:

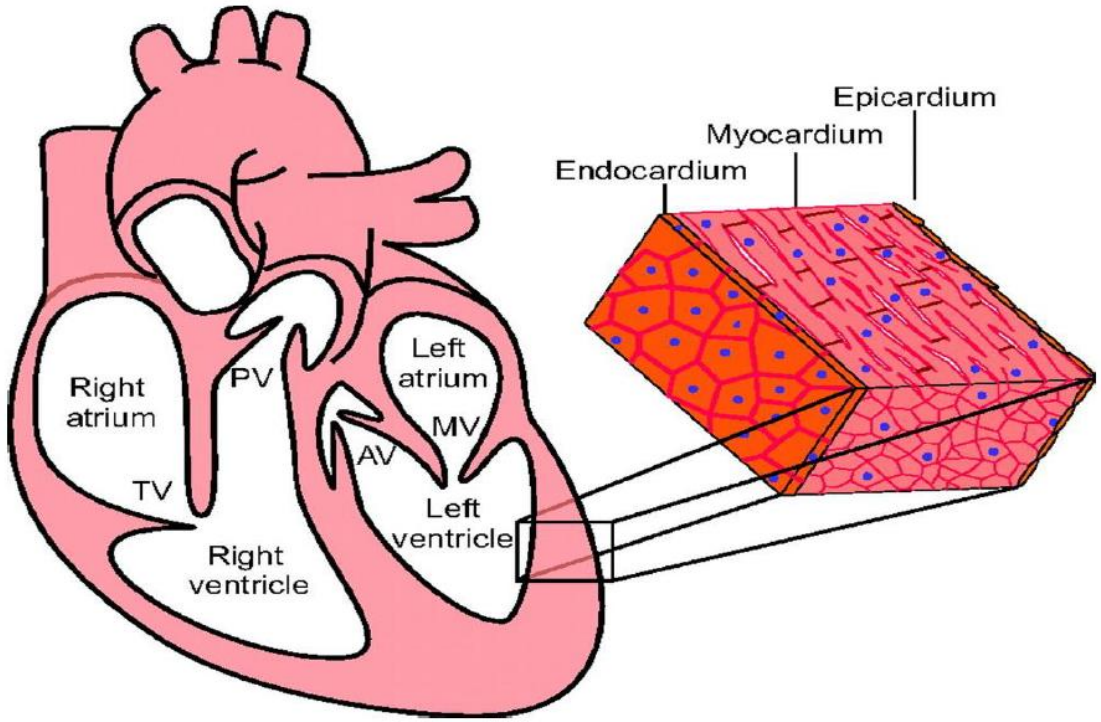
Simple squamous epithelium.

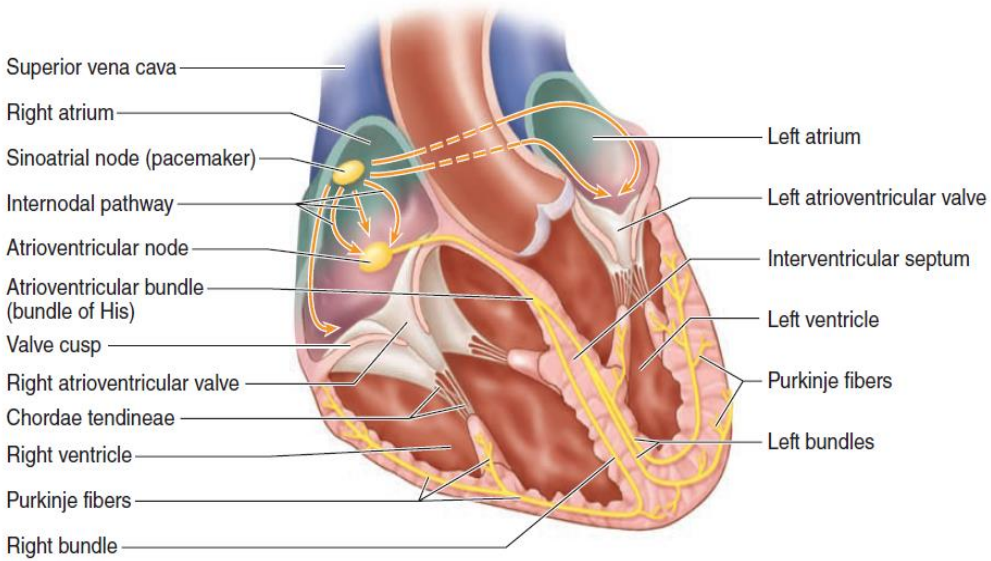
B- Subepicardial C.T. layer:

Loose C.T. contains the coronary vessels, nerves, ganglia & fat cells.

do not get confused between the epicardium and the pericardium .
Pericardium is formed of a fibrous layer and a serous layer , and since it's serous layer it's composed of a partial and a visceral layer
* remember the pleura ? * .
the epicardium is simply the visceral layer of the serous pericardium

different layers of the heart wall





Important features of the heart

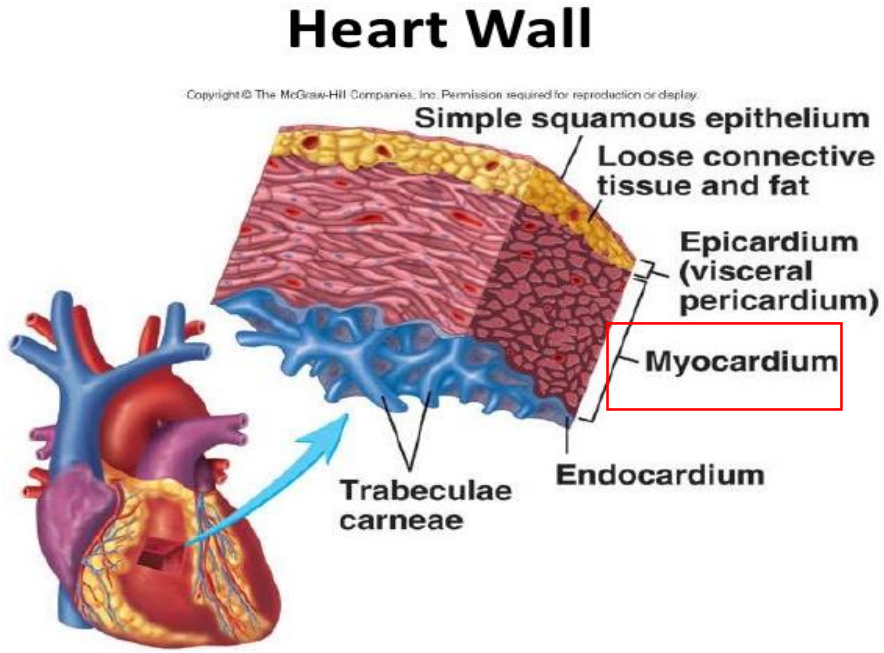
As seen in the diagram, the human heart has two **atria** and two **ventricles**. The myocardium of the ventricular walls is thicker than that of the atria. The **valves** are basically flaps of connective tissue anchored in the heart's dense connective tissue, or **cardiac skeleton**, concentrated in the regions shown in white. This fibrous tissue includes the chordae tendineae, cords that extend from the cusps of both atrioventricular valves and attach to papillary muscles, preventing the valves from turning inside-out during ventricular contraction. Valves and cords are covered by the nonthrombogenic endothelium.

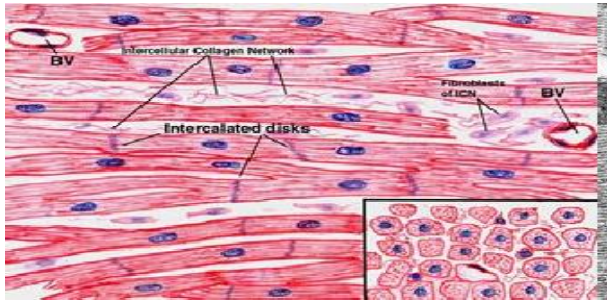
Shown in yellow are parts of the cardiac **conducting system**, which initiates the electrical impulse for contraction (heartbeat) and spreads it through the ventricular myocardium. Both the **sinoatrial (SA) node (pacemaker)**, in the right atrial wall, and the **atrioventricular (AV) node**, in the floor of the right atrium, consist of myocardial tissue that is difficult to distinguish histologically from surrounding cardiac muscle. The AV node is continuous with specialized bundles of cardiac muscle fibers, the **AV bundles** (of His) that run along the interventricular septum to the apex of the heart, where they branch further as **conducting (Purkinje) fibers** that extend into myocardium of the ventricles.

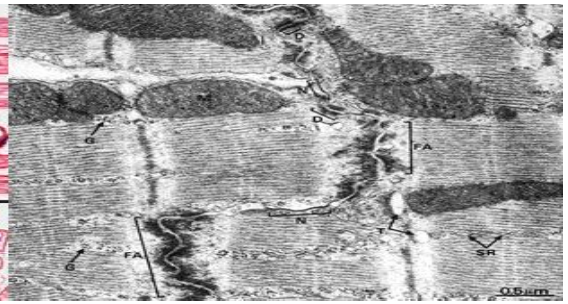
CARDIAC MUSCLE

- ✓ Found in the myocardium.
- ✓ Striated and involuntary.

L.M. Picture of Cardiac Muscle Fibers	E.M. Picture of Cardiac Muscle Fibers
✓ Cylindrical in shape. ✓ Intermediate in diameter between skeletal and smooth muscle fibers. ✓ Branch and anastomose. ✓ Covered by a thin sarcolemma. ✓ Mononucleated. Nuclei are oval and central. ✓ Sarcoplasm is acidophilic and shows non-clear striations (fewer myofibrils). ✓ Divided into short segments (cells) by the intercalated discs.	✓ Few myofibrils. ✓ Numerous mitochondria. ✓ Less abundant SR. ✓ T-tubules come in contact with only one cisterna of SR forming "Diads" (not triads). ✓ Glycogen & myoglobin. ✓ Intercalated discs: are formed of the two cell membranes of 2 successive cardiac muscle cells, connected together by junctional complexes (desmosomes and gap junctions).





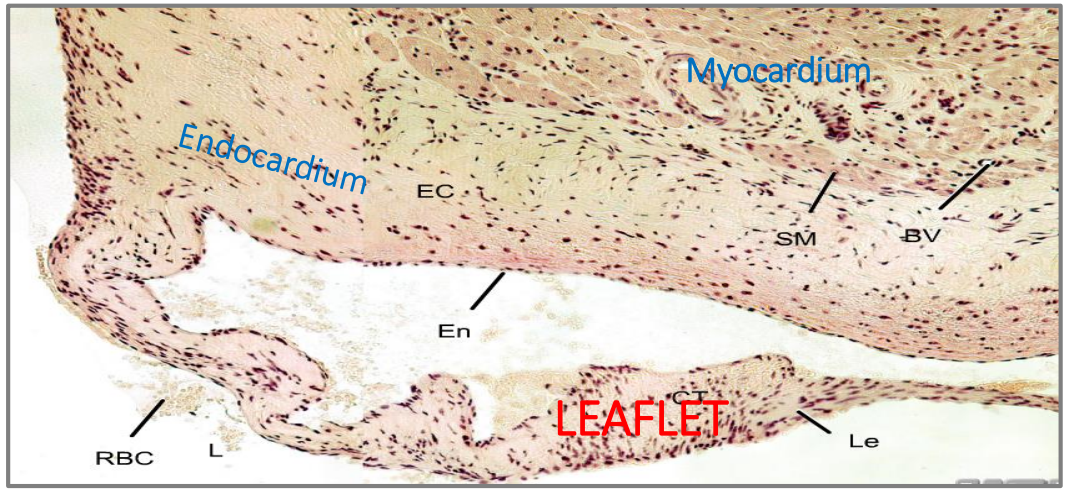


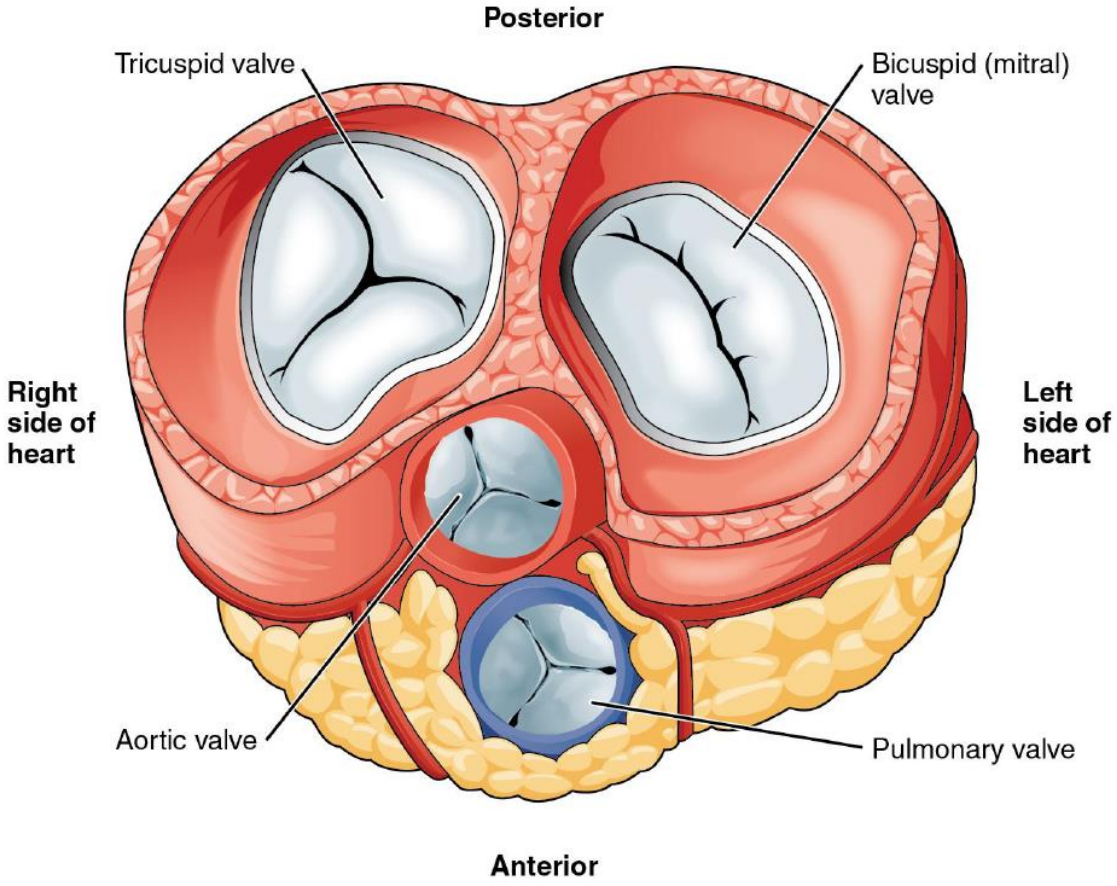
Gap junctions are the channels between the cells because we want the impulses to reach the all the cells at the same time.

Desmosome كأنها دباسة

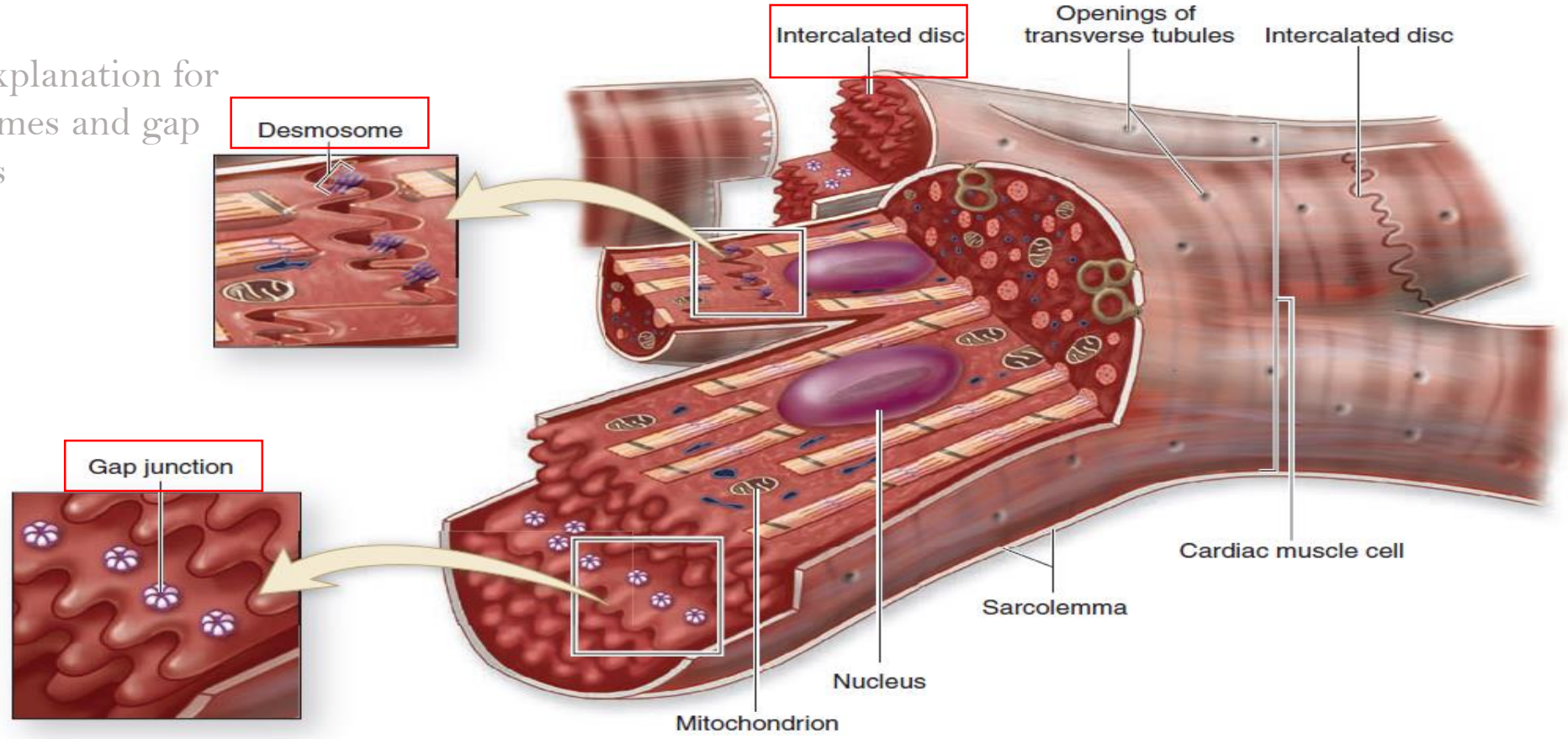
HEART VALVES(CARDIAC VALVES)

LEAFLET (CUSP) OF HEART VALVE	
Formed of :	characteristics
(1) A core of Dense irregular C.T. The central part of the core is dense fibrous C.T. and covered by loose C.T.	Leaflets are normally AVASCULAR, but blood capillaries can be found only in the base or root of the leaflet. It doesn't need blood capillaries because the cusp is surround by blood stream in the heart .
(2) This core is covered by: Endocardium (simple squamous epithelium)	





Extra Explanation for desmosomes and gap junctions



The diagram of cardiac muscle cells indicates characteristic features of this muscle type. The fibers consist of separate cells in a series with interdigitating processes where they are held together. These regions of contact are called the **intercalated discs**, which cross an entire fiber between two cells. The transverse regions of the steplike intercalated disc have abundant **desmosomes** and other adherent junctions for firm adhesion, while longitudinal regions of the discs contain many physiologically important **gap junctions**.

Cardiac muscle cells have central nuclei and myofibrils that are less dense and less well-organized than those of skeletal muscle. Also, the cells are often branched, allowing the muscle fibers to interweave in a more complicated arrangement within fascicles that produces an efficient contraction mechanism for emptying the heart.

So briefly , desomsomes are the structures by which two adjacent cells are attached. and the **gap junctions** allow the communication and passage of impulses between cardiac muscle cells.

Wall of the heart

Endocardium

- Endothelium
  - Simple squamous epithelium
- Sub-endothelial C.T.
- Dense C.T. Layer
  - It attaches to the endomysium of the cardiac muscle
- Sub-endocardial layer
  - Loose C.T. layer
    - Nerves
    - Purkinje fibers
    - Small blood vessels

HEART VALVES (CARDIAC VALVES)

Each leaflet (cusp) (AVASCULAR) of heart valve is formed of:

- A core of Dense irregular C.T. (Covered by endocardium)

Myocardium

1- The middle layer
2- The thickest layer
3- Contains cardiac muscle cells with endomysium (loose C.T)

Cardiac Muscle Fibers (Striated and involuntary)

L.M. Picture

1- Cylindrical
2- Intermediate in diameter
3- Branched and anastomose
4- Covered by a thin sarcolemma
5- Mononucleotide (oval and central)
6- Sarcoplasm is acidophilic and shows non clear striations
7- Divided into short segments by intercalated discs

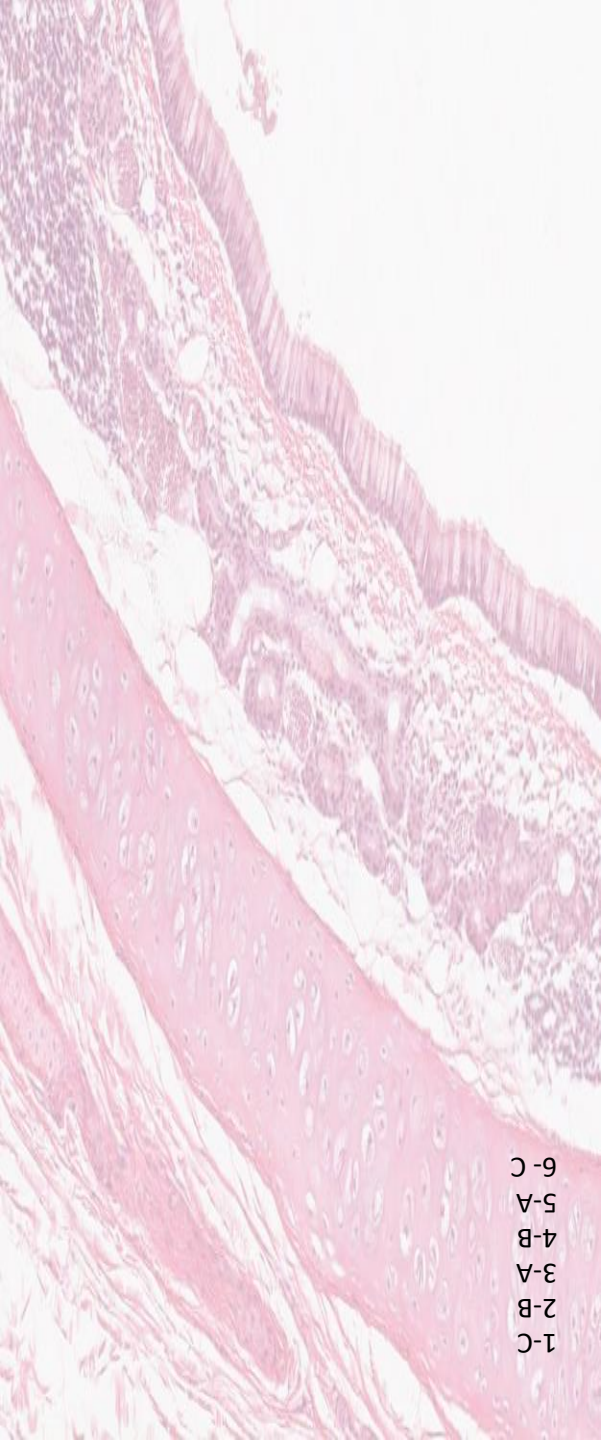
E.M. Picture

1- Few myofibrils
2- Numerous mitochondria
3- Less abundant Sarcoplasmic Reticulum
4- T-tubules come in contact with only one cisterna of SR forming (diads)
5- Glycogen & myoglobin
6- Intercalated discs

Epicardium

(Visceral layer of pericardium)

- Mesothelium
  - Simple squamous epithelium
- Subepicardial C.T. Layer
  - Loose C.T
    - The coronary vessels
    - Nerves
    - Ganglia
    - Fat cells



MCQ :

1- what's the type of epithelium found in endothelium and mesothelium are :
A- simple cuboidal epithelium
B-simple columnar epithelium
C-simple squamous epithelium
D- all above

2- Endothelium and Mesothelium are found in :
A-Endocardium-Epicardium
B-Endocardium-Epicardium
C-Epicardium-myocardium
D-Endocardium-myocardium

3- Purkinje fibers are found in :
A-Endocardium
B-Epicardium
C-Myocardium
D-all above

4 -Coronary vessels are found in :
A-Endocardium
B-Epicardium
C-myocardium
D-all above

5- the core of the valves is covered by:
A-Endocardium
B-Epicardium
C-myocardium
D-all above

6- The most thick layer in the wall of the heart is :
A-Endocardium
B-Epicardium
C-myocardium
D-all above

1-C
2-B
3-A
4-B
5-A
6- C

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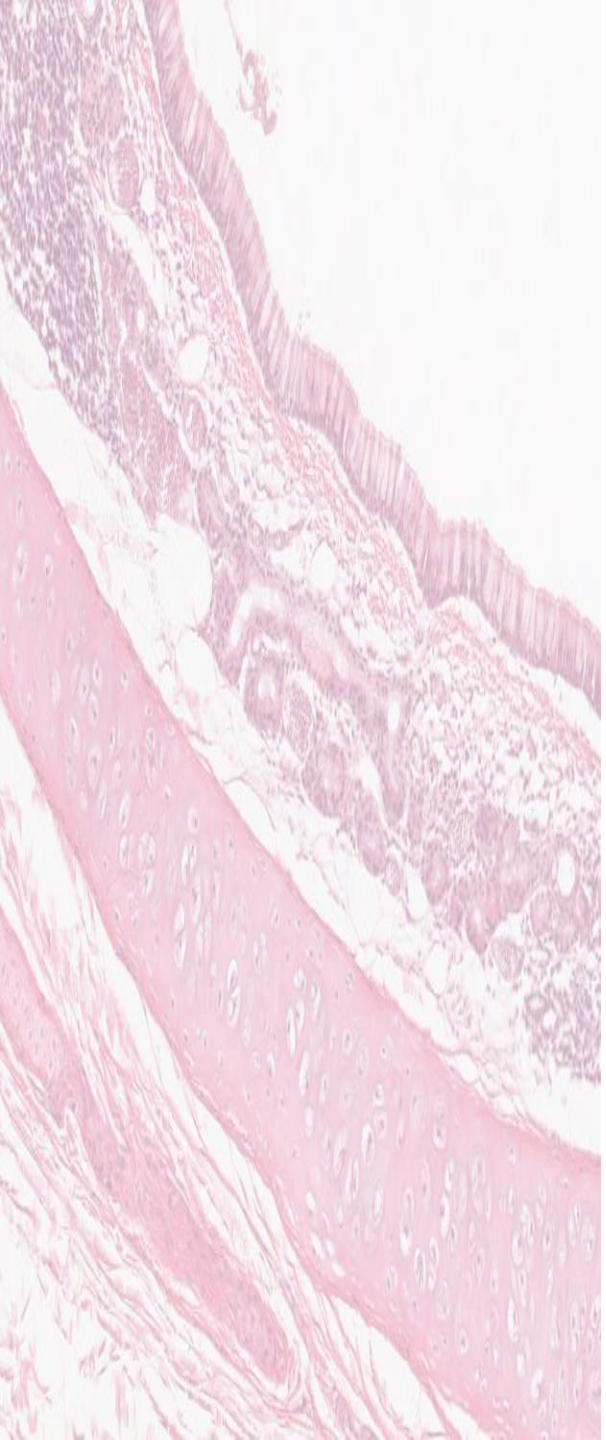

Thank you & good luck

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