Human Histology session
1st stage
2020-2021
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Histology of cardiovascular system (Part 1)

Introduction

Histology Definition

Histology is the study of the microscopic anatomy (microanatomy) of cells and tissues. Every cell of tissue type is unique, based on the many functions an organism carries out. Histology uses advanced imaging techniques to analyze and identify the tissues and structures present. Both light microscopy and specialized systems such as electron microscopy are used to visualize the tiny structures present in specially prepared tissue samples. The histology of different tissues can be used to identify unknown tissues, provide clues to the function of tissue or cells, or even identify disease in the cells of an organism.

Cardiovascular system

* Human cardiovascular system, organ system that transport blood through vessels to and from all parts of the body, carrying nutrients and oxygen to tissues and removing carbon dioxide and other wastes. It is a closed tubular system in which the blood is propelled by a muscular heart. Two circuits, the pulmonary and the systemic, consist of arterial, capillary, and venous components.

Functions of Cardiovascular system

* Circulates OXYGEN and removes Carbon Dioxide.
* Provides cells with NUTRIENTS.
* Removes the waste products of metabolism to the excretory organs for disposal.
* Protects the body against disease and infection.
* Clotting stops bleeding after injury.
* Transports HORMONES to target cells and organs.
* Helps regulate body temperature

The Heart

The heart is a muscular pump that propels blood at high pressure round the body through blood vessels. The heart contracts rhythmically, and autonomously.

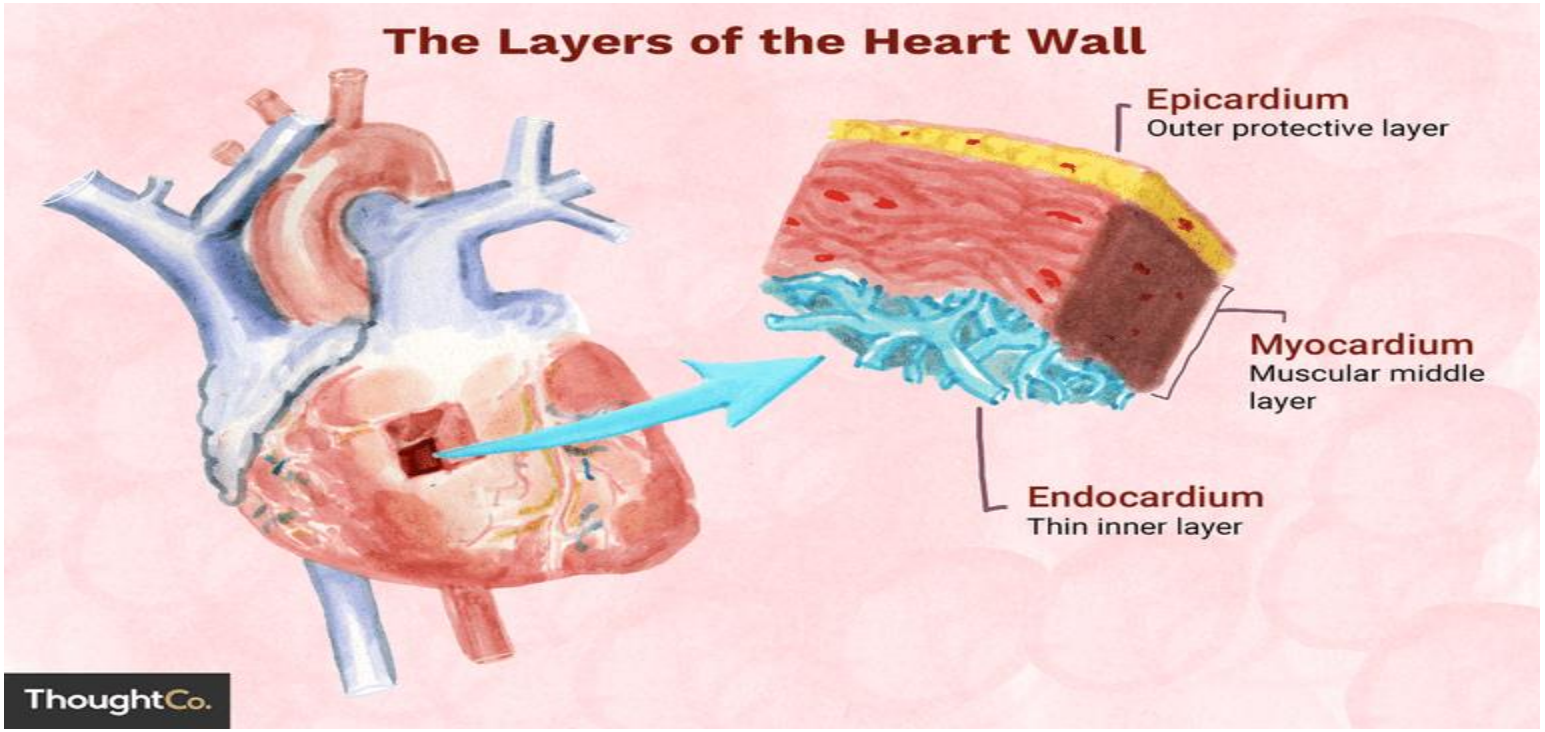
Contractions begin at the apex of the heart and spreads through to postero-basal region. As with the rest of circulatory system ,the heart has three layers:

Epicardium(tunica adventitia)

myocardium(tunica media)

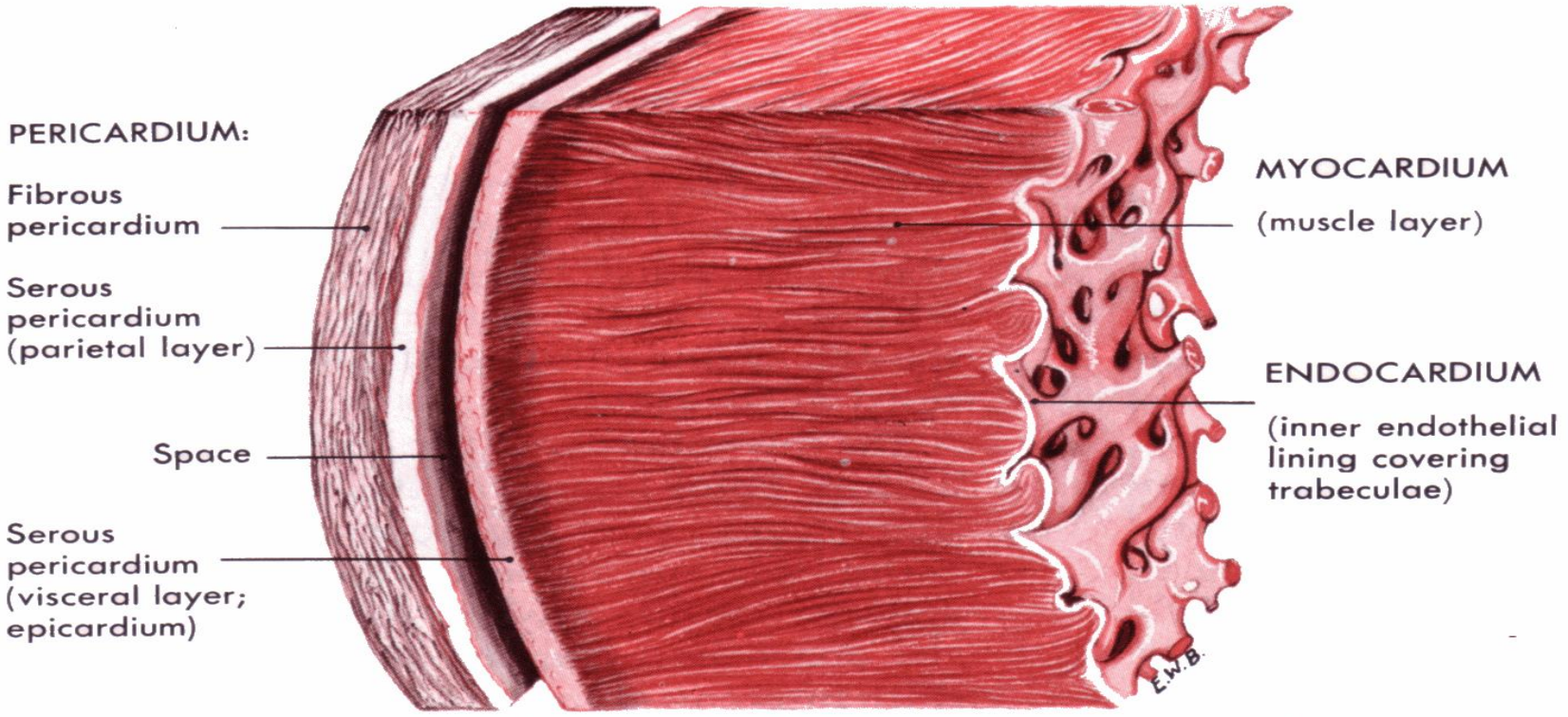
Endocardium (tunica intima)

Purkinje fibers, which lie in the endocardium.


The Layers of the Heart Wall
Epicardium
Outer protective layer
Myocardium
Muscular middle layer
Endocardium
Thin inner layer
ThoughtCo.

Heart covering

* The membrane that directly surrounds the heart and defines the pericardial cavity is called the **pericardium** or **pericardial sac**. The pericardium, which translates as “around the heart,” consists of two distinct sub layers: the strong outer fibrous pericardium and the inner serous pericardium. The fibrous pericardium is made of tough, dense connective tissue that protects the heart and maintains its position in the thorax. The more delicate serous pericardium consists of two layers: the parietal pericardium, which is fused to the fibrous pericardium, and an inner visceral pericardium, or **epicardium**, which is fused to the heart and is part of the heart wall. The pericardial cavity, filled with lubricating serous fluid, lies between the epicardium and the pericardium.



Section of the heart wall showing the components of the outer pericardium (heart sac), muscle layer (myocardium), and inner lining (endocardium).

Heart Layers

* **Tunica Adventitia (epicardium)** contains fibroelastic connective tissue, blood vessels, lymphatics and adipose tissue.
* **Tunica media** (**myocardium)** is the largest of the three layers, and contains cardiac muscle fibers, and loose connective tissue that contains lots of capillaries.

Histology of myocardium

* The myocardium consists of 2 cell types
* -contractile cells
* -conducting cells
* Individual cells branch and join neighboring cells end to end at junctions called intercalated disks.
* **Intercalated disks**

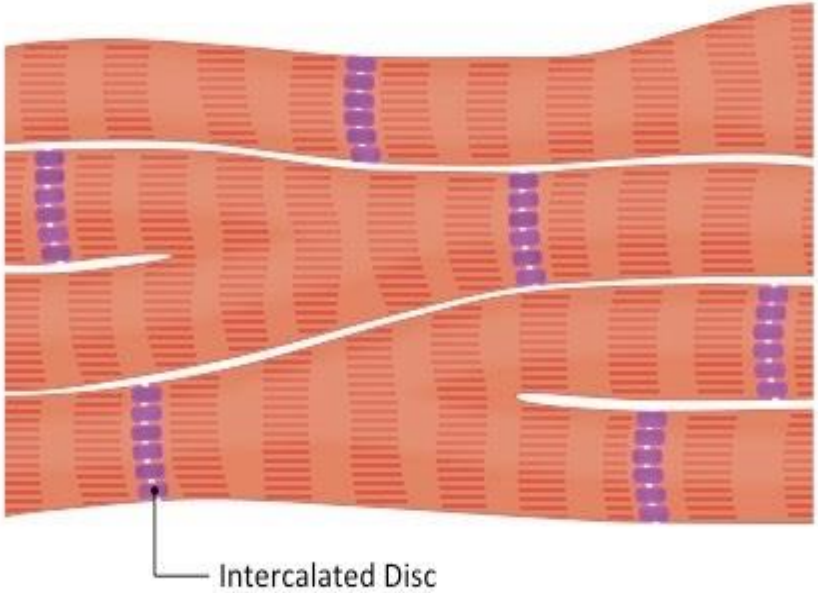
Consist of desmosomes and gap junctions

Desmosomes are protein complexes that bind adjacent cells together allowing force generated in one cell to be transferred to the adjacent cell.

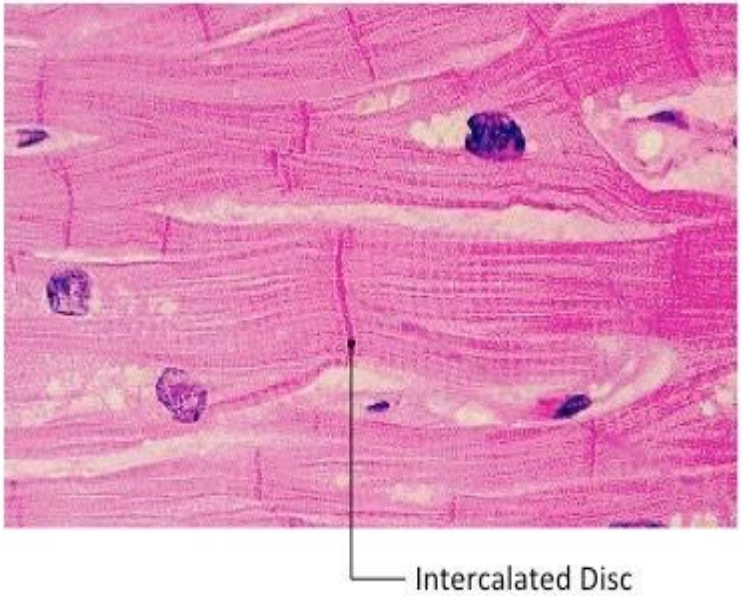
Histology of myocardium

* Gap junctions are protein complexes that form pores between adjacent cells which electrically connect adjacent cells to one another as ions able to pass freely between cells (electrical synapse) allow action potentials to spread rapidly from cell to cell so that the heart muscle cells contract almost simultaneously.

Cardiac Muscle Diagram



Cardiac Muscle Microscopy



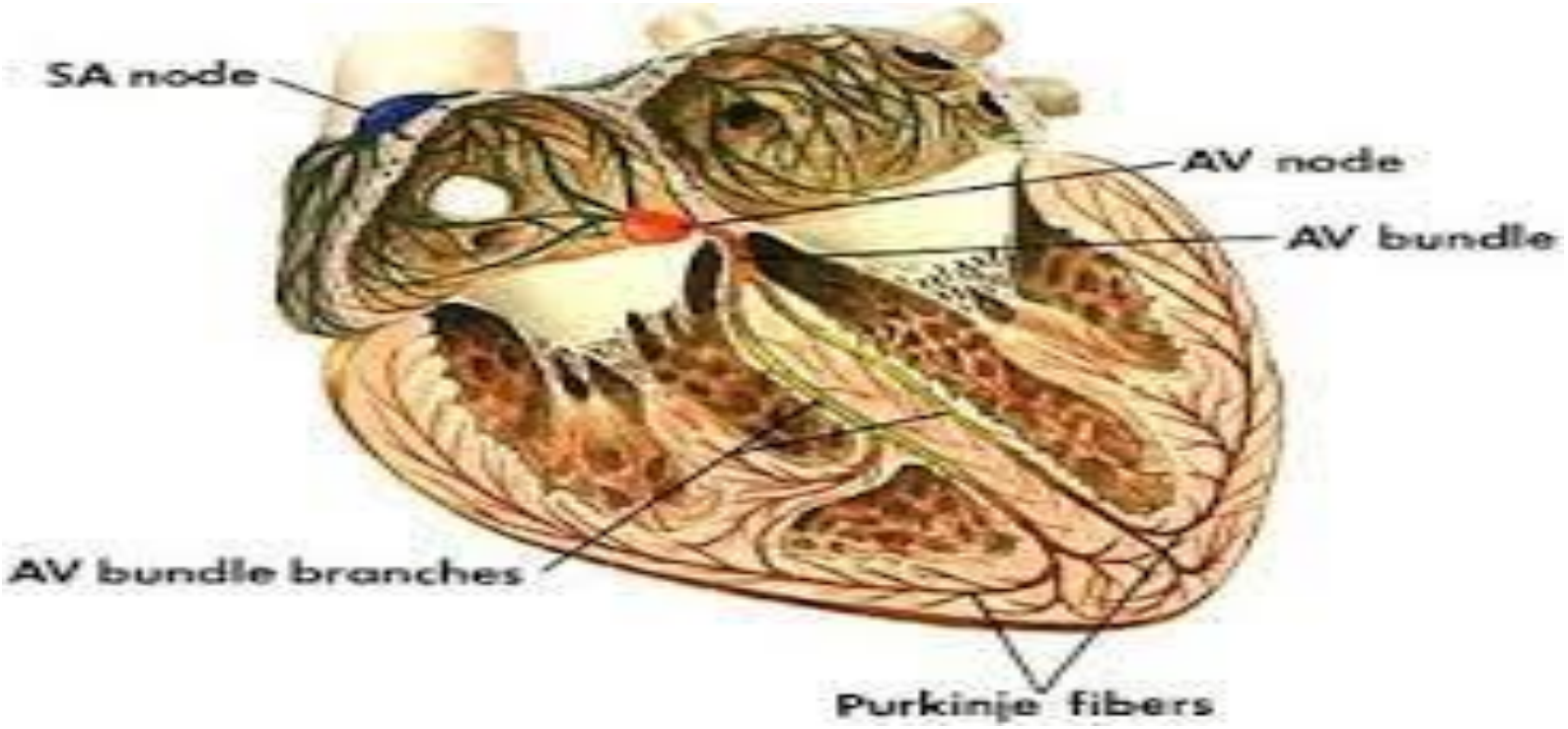
Tunica intima (Endocardium)

The endocardium lines the atria and ventricles and covers the heart valves. There is a small layer of loose connective tissue (containing elastic and collagen fibers) and some adipose tissue.

Purkinje fibers

The **Purkinje fibers** are located in the inner ventricular walls of the heart,just beneath the endocardium in a space called the subendocardium. The Purkinje fibers are specialized conducting fibers composed of electrically excitable cells. They are larger than cardiomyocytes with fewer myofibrils and many mitochondria. They conduct cardiac action potentials more quickly and efficiently than any other cells in the heart. Purkinje fibers allow the heart's conduction system to create synchronized contractions of its ventricles, and are essential for maintaining a consistent heart rhythm.

Purkinje fibers



* Thanks a lot for attention

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