

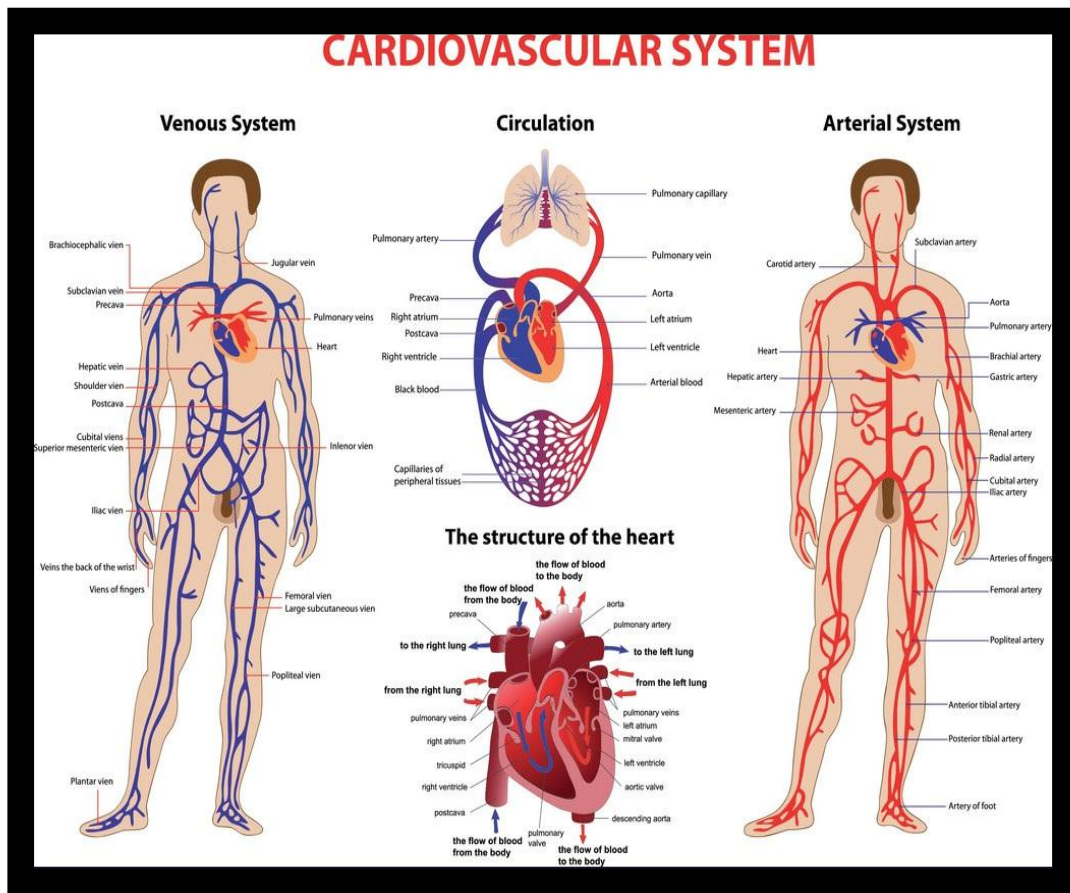
Lec.7

PHYSIOLOGY

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Cardiovascular System

The cardiovascular system can be thought of as the transport system of the body. This system has three main components: the heart, the blood vessel and the blood itself. The heart is the system's pump and the blood vessels are like the delivery routes. Blood can be thought of as a fluid which contains the oxygen and nutrients the body needs and carries the wastes which need to be removed. The following information describes the structure and function of the heart and the cardiovascular system as a whole.

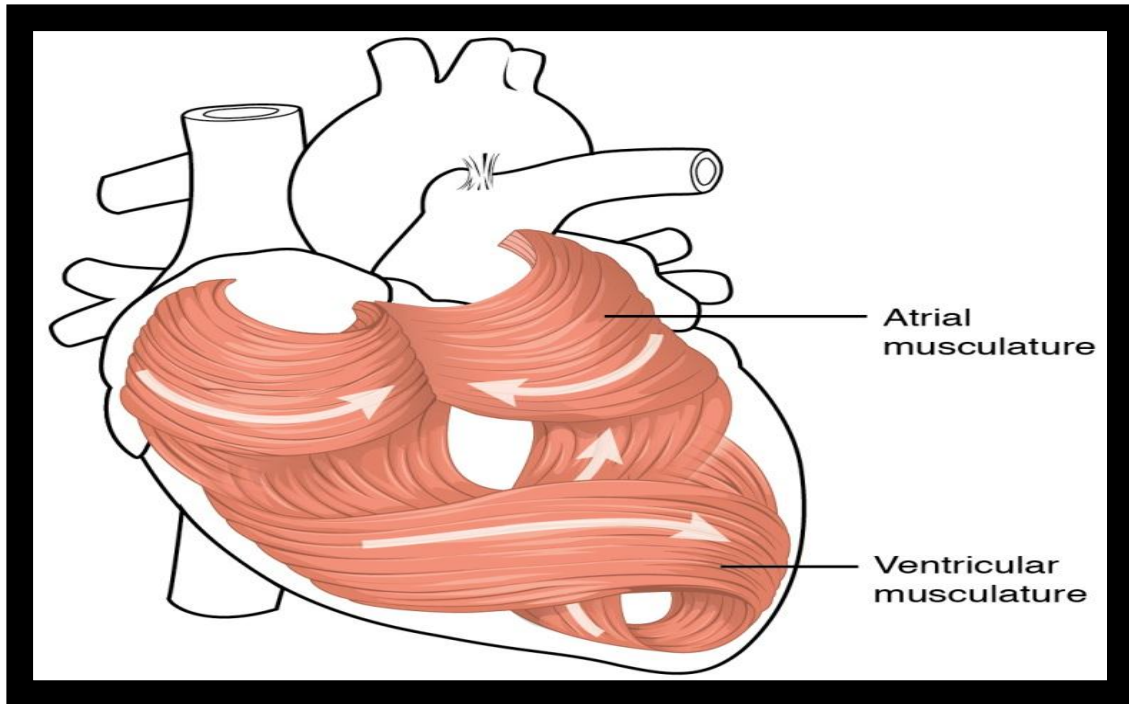


Physiology of Cardiac Muscle

The heart is composed of three major types of cardiac muscle:

- 1- Atrial muscle
- 2- Ventricular muscle.
- 3- Specialized excitatory and conductive muscle fibers.

The atrial and ventricular types of muscle contract in much the same way as skeletal muscle, except that the duration of contraction is much longer. Conversely, the specialized excitatory and conductive fibers contract only feebly because they contain few contractile fibrils; instead, they exhibit either automatic rhythmical electrical discharge in the form of action potentials or conduction of the action potentials through the heart, providing an excitatory system that controls the rhythmical beating of the heart.



Anatomy of the Heart

The heart is located in the chest, directly above the diaphragm in the region of the thorax called mediastinum, specifically the middle mediastinum. The normal human heart varies with height and weight (Table 1.1). The tip (apex) of the heart is pointed forward, downward, and toward the left. The (inferior) diaphragmatic surface lies directly on the diaphragm. The heart lies in a double walled fibroserous sac called the pericardial sac, which is divided into

- (a) Fibrous pericardium.
- (b) Serous pericardium.

The fibrous pericardium envelops the heart and attaches onto the great vessels. The serous pericardium is a closed sac consisting of two layers – a visceral layer or epicardium forming the outer lining of the great vessels and the heart, and a parietal layer forming an inner lining of the fibrous pericardium. The two layers of the serous pericardium contain the

pericardial fluid, which prevents friction between the heart and the pericardium. The wall of the heart is composed of three layers:

- (a) Epicardium;
- (b) Myocardium.
- (c) Endocardium.

The epicardium is the outer lining of the cardiac chambers and is formed by the visceral layer of the serous pericardium. The myocardium is the intermediate layer of the heart and is composed of three discernible layers of muscle that are seen predominantly in the left ventricle and inter-ventricular septum alone and includes a subepicardial layer, a middle concentric layer and a subendocardial layer. The rest of the heart is composed mainly of the subepicardial and subendocardial layers. The myocardium also contains important structures such as excitable nodal tissue and the conducting system. The endocardium the innermost layer of the heart is formed of the endothelium and subendothelial connective tissue.

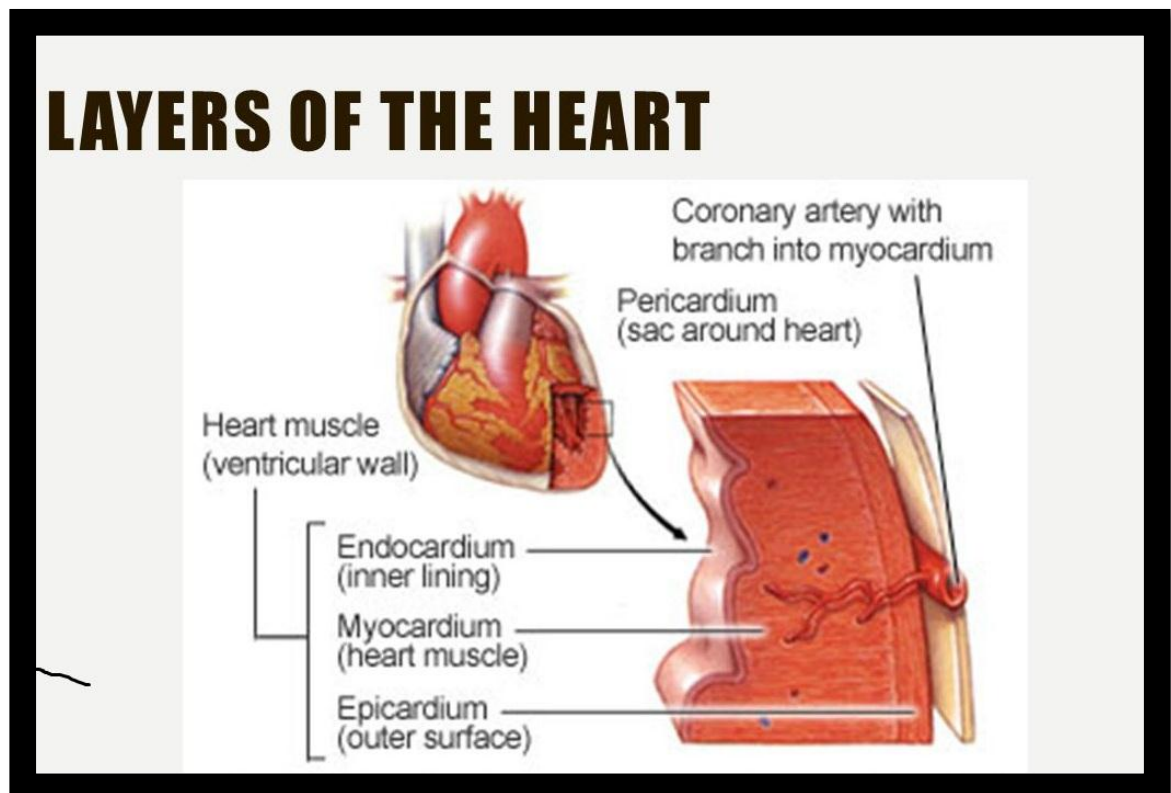


Table 1.1 Anatomical facts about the human heart

Normal human heart varies with height and weight

Weighs approximately 300–350 grams in males

Weighs approximately 250–300 grams in females

Right ventricle thickness is 0.3–0.5 cm

Left ventricle thickness is 1.3–1.5 cm

Divided into four distinct chambers

Composed of three layers (epicardium, myocardium and endocardium)

Contains two atria (left and right)

Contains two ventricles (left and right)

Contains four valves (aortic, mitral, tricuspid, pulmonary)

Chamber and Valves

The heart is divided into four distinct chambers with muscular walls of different thickness. The left atrium (LA) and right atrium (RA) are small, thin walled chambers located just above the left ventricle (LV) and right ventricle (RV), respectively. The ventricles are larger thick-walled chambers that perform most of the work.

The atria receive blood from the venous system and lungs and then contract and eject the blood into the ventricles. The ventricles then pump the blood throughout the body or into the lungs. The heart contains four valves and the fibrous skeleton of the heart contains the annuli of the four valves, membranous septum, and aortic intervalvular, right, and left fibrous trigones. The right trigone and the membranous septum together form the central fibrous body, which is penetrated by the bundle of His. The fibrous skeleton functions not only to provide an

electrophysiological dissociation of atria and the ventricles but also provides structural support to the heart. Each of the four valves has a distinctive role in maintaining physiological stability.

