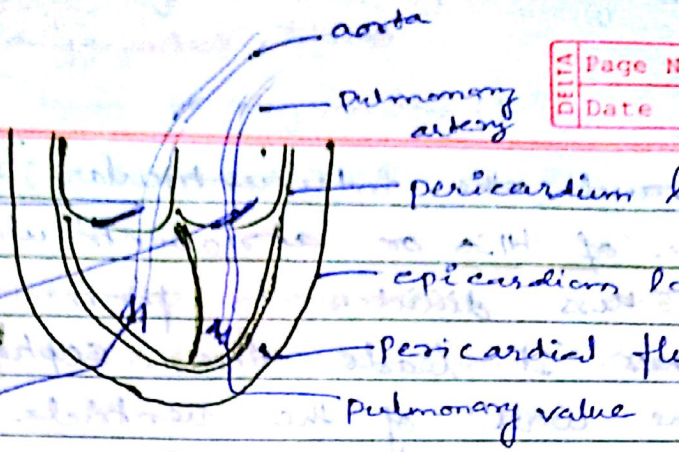
(8) Circulatory System (cardio)

Pulmonary circulation: The flow of blood from right ventricle to lungs and back to the left atrium is known as pulmonary circulation

Systemic circulation:- from left ventricles to all organs except lungs, and then back to the right atrium. The blood leaves the left ventricle through large artery called aorta. The aorta branches progressively into many arteries, then arterioles and finally capillaries.

Structure of heart:-

The heart is enclosed in a fibrous sac called pericardium; located in the chest. Another fibrous membrane is closely affixed called epicardium. Between these two is a fluid that helps as a lubricant in the movement of heart. The heart wall is made up of myocardium formed by cardiac muscle cell. The inner surface of the cardiac chambers is lined by endothelium.



The mammalian heart has 4 chambered. The right ~~aortic~~ Value is called the tricuspid value and the left is the bicuspid value also called the mitral value. The value are attached to the papillary muscle of ventricular values by fibrous strand called chordae tendinae. ~~The values are attached~~ Opening of the right ventricle into the pulmonary artery and left ventricle, into the aorta are guarded by pulmonary and aortic values resp. These are also known as Semi-lunar values.

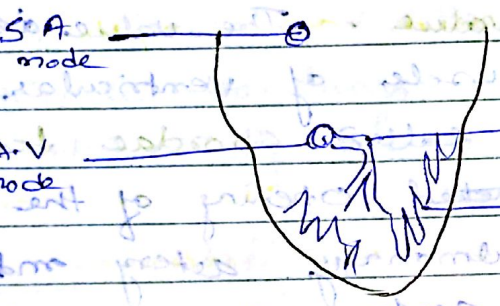
Cardiac muscle :

They have the property of both skeletal & smooth muscle. They are involuntary, branched, have striations.

Heartbeat coordination :

The SA node is the normal pacemaker for the entire heart. The action potential is initiated in the SA node From here the depolarisation spread to the entire left and right atria through the muscle cells. ~~action potential through the right atria,~~ Causes depolarisation of conducting system called the AV node, located at the base of the right atria. After the AV node is depolarised the

impulse travels the interventricular septum through the bundle of His or atrioventricular bundle. The bundle of His divides to form the right & left branches. It leades the septum, and enters the wall of the ventricle. These fibres then contact the Purkinje fibres. These are large conducting cells that distribute the impulse throughout the ventricle.



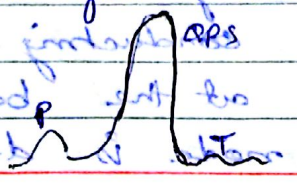
Electrocardiogram :-

It is a tool for evaluating Electric event within the heart. It is the measure of the current generated in the extracellular fluid by the changes occuring simultaneously in the various Cardiac cells.

P wave - It is the current flow during atrial depolarisation.

Q, R, S wave - It is the current flow during ventricular depolarisation

T wave - current flow during ventricular repolarisation



- Pulmonary artery is the only artery which carry deoxygenated blood
- Pulmonary vein – oxygenated blood

DELTA Page No. Date / /

Cardiac cycle : (0.8sec)

Systole – Ventricular contraction 0.3 sec

Diastole – Ventricular relaxation 0.5 sec

The cardiac cycle can be divided into 2 major phases – systole i.e ventricular contraction and diastole i.e ventricular relaxation. At an average heart rate of 72 beats / min each cardiac cycle lasts for 0.8 sec with 0.3s systole and 0.5s diastole.

(1) mid or late diastole – The left atrium & ventricle both relax. The atrium pressure is slightly less than ventricular pressure and hence the AV valve is forced open blood flows into the ventricle. As blood flows into ventricle during diastole, the aortic pressure is less as blood is moving out of the arteries. At the end of diastole the SA node discharges leading to atrial depolarisation and contraction. A little blood flows as a result from atrium to ventricle The amount of blood in ventricles at the end of ventricular diastole is known as End diastolic volume [EDV].

(2) Systole – From AV node, the wave of depolarisation passes into the ventricular tissues and the ventricular contraction starts. As ventricle contracts, the pressure rises and AV valves are closed. During this first half of systole

although ventricle is contracting all values remain closed. As the Ventricular Vol. remains Constt this period is known as Iso-Volumetric (Ventricular) Contraction. When finally the Ventricular pressure rises, the beyond the aortic pressure, the aortic Value opens and Ventricular ejection occurs. Blood is forced into the aorta, and pulmonary artery. The volume of blood ejected is called as Stroke Volume (SV). Not all the blood is ejected, the remaining volume of blood in ventricle, is called as End systolic Volume (ESV)

$$SV = EDV - ESV$$

(3) Early diastole - During Early diastole, the ventricle remains relaxing and the aortic and pulmonary values are closed. At this time the AV value are also closed thereby, the Volume of Ventricle becomes Constt. This period is known as iso-Volumetric (Ventricular) relaxation. As the Ventricular pressure falls below the atrial pressure, the AV value again opens and ventricular filling starts. The closing of AV Values during systole produces the LUB sound whereas the closure of pulmonary and aortic value produces the DUB sound

DELTA Page No. Date / /

Cardiac output - The cardiac output is defined as the volume of blood each ventricle pumps per minute.

$$CO = HR \times SV$$

HR – Heart beat per min

SV – Stroke volume

$$CO = 72 \text{ beats/min} \times 0.07 \text{ ℓ/min}$$

$$= 5.04 \text{ ℓ}$$

Thus, the total blood is pumped around the circuit once each min. During strenous exercise, the cardiac output may reach 35 ℓ/min.