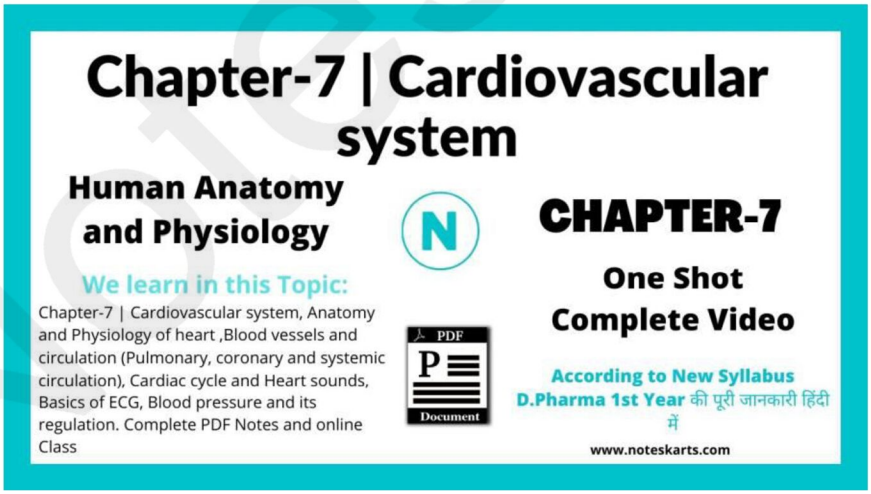
Chapter-7
Human Anatomy & Physiology

D.Pharma 1st Year Notes

Chapter- 7

Cardiovascular system

- **Anatomy and Physiology of heart**
- **Blood vessels and circulation (Pulmonary, coronary and systemic circulation)**
- **Cardiac cycle and Heart sounds, Basics of ECG**
- **Blood pressure and its regulation.**



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Cardiovascular system:

- The cardiovascular system consists of the blood, the heart and blood vessels.
- The heart beats about 100,0000 times every day.
- Which adds up to about 35 million beats in a year and approximately 2.5 billion times in an average lifetime.

Anatomy of heart:

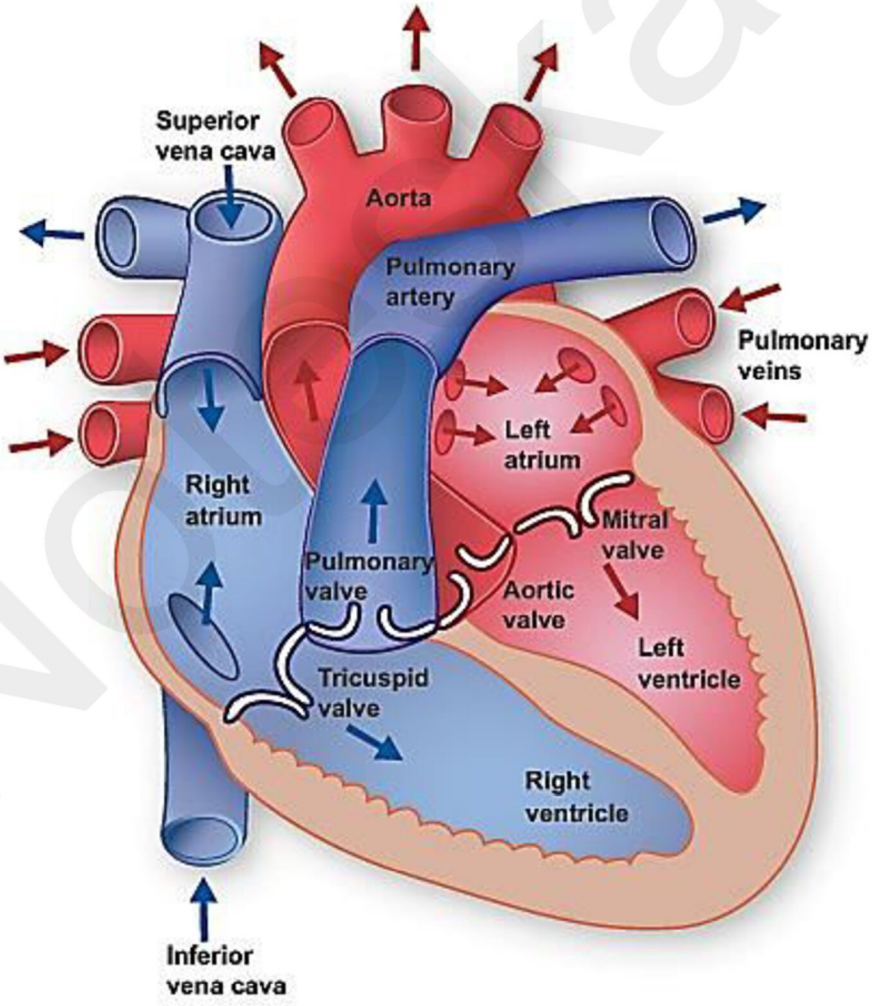
- The heart is located in the mediastinum about two thirds of its mass is to the left of the midline.
- It apex is the pointed inferior part its base is the broad superior part.
- The heart shape is relatively small roughly the same size (but not the same shape) as our closed fist.
- It is about Long-12cm & Wide- 9cm
- Its Broadest point and 6cm thick with an average mass of 250g in adult female and 300g in adult males.
- The heart chambers include two superior chambers the right and left atria and two inferior chambers the right and heart include the auricles (Flaps of each atrium that slightly increase their volume).
- The coronary sulcus between the atria and ventricles and the anterior and posterior sulci between the ventricles on the anterior and posterior surfaces of the heart respectively.
- The right atrium receive blood from the superior vena cava, inferior vena cava and coronary sinus. It is separated internally from the left atrium by the interatrial septum which contains the fossa ovalis. Blood exits the right atrium through the tricuspid value.
- The right ventricle receives blood from the right atrium. It is separated internally from the left ventricle by the interventricular septum and pumps blood through the pulmonary valve into the pulmonary trunk.
- Oxygenated blood enters the left atrium from the pulmonary veins and exits through the bicuspid (mitral) valve.
- The left ventricle pumps oxygenated blood through the aortic valve into the aorta.

- The thickness of the myocardium of the four chambers varies according to the chamber's function. The left ventricle with the highest work load has the thickest wall.
- The fibrous skeleton of the heart is dense connective tissue that surrounds and supports the values of the heart.

Chambers of the Heart:-

The heart has four chambers.

1. Right atrium: Receives deoxygenated blood from the body.
2. Right ventricle: Pumps deoxygenated blood to the lungs.
3. Left atrium: Receives oxygenated blood from the lungs.
4. Left ventricle: Pumps oxygenated blood to the body.



Valves:

The heart contains four main valves that prevent the backflow of blood:

1. **Tricuspid Valve:** Located between the right atrium and right ventricle.
2. **Pulmonary Valve:** Located between the right ventricle and the pulmonary artery.
3. **Mitral Valve (Bicuspid Valve):** Located between the left atrium and left ventricle.
4. **Aortic Valve:** Located between the left ventricle and the aorta.

Layers of the Heart Wall

1. **Endocardium**: The innermost layer, lining the chambers and valves. It is composed of endothelial cells and provides a smooth surface for blood flow.
2. **Myocardium**: The middle, muscular layer responsible for the contractile force of the heart. The myocardium is thicker in the left ventricle due to the higher pressures needed to pump blood throughout the body.
3. **Epicardium**: The outermost layer, which is also part of the pericardium (the double-walled sac that encloses the heart). The epicardium provides a protective layer and is involved in producing the pericardial fluid that lubricates the heart's movement.

Blood vessels:

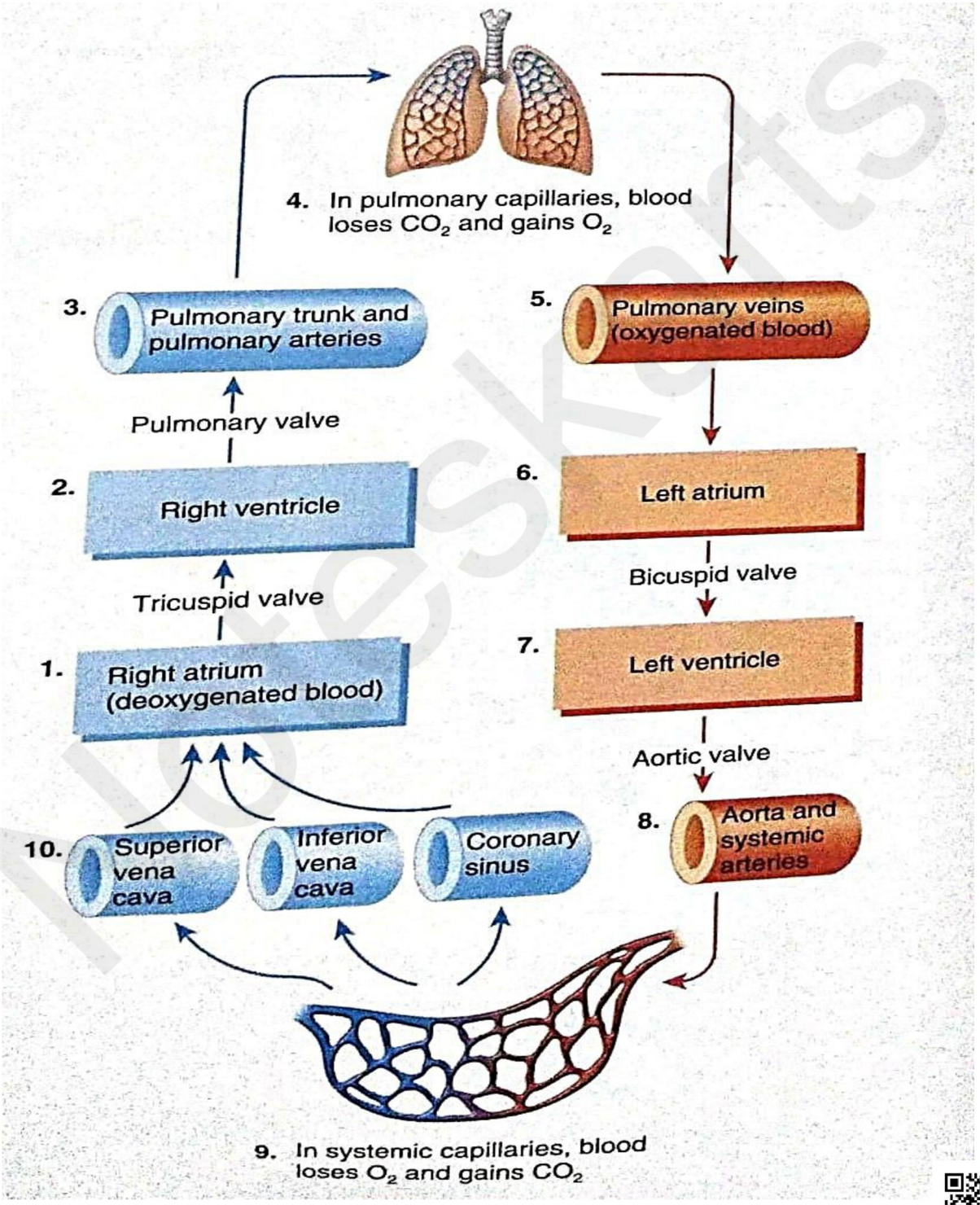
- A vessel in the human or animal body in which blood circulates.
- They help deliver oxygen to vital organs and tissues, and also remove waste products.
- The vessels that carry blood away from the heart are called arterioles.
- Your body contains about 60000 miles of blood vessels.

There are three types of blood vessels:-

1. **Arteries:** they carry blood away from your heart.
2. **Veins:** They carry blood back toward your heart.
3. **Capillaries:** The smallest blood vessels, connect arteries and veins.

Pulmonary Circulations/ Systemic Circulations:

- The left side of the heart pumps oxygenated blood into the Systemic Circulations to all tissue of the body except the air sacs (alveoli) of the lungs.
- The right side of the heart pumps deoxygenated blood into the pulmonary circulation to the air sacs (alveoli) of the lungs.

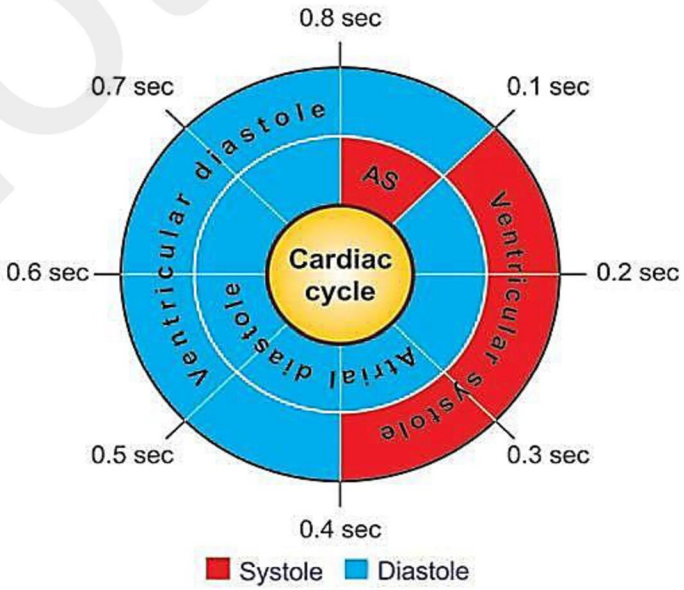


Coronary Circulation:

- Nutrients are not able to diffuse quickly enough from blood in the chambers of the heart to supply all the layers of cells that make up the heart wall.
- For this reason the myocardium has its own network of blood vessels.
- The coronary arteries branch from the ascending aorta and encircle the heart like a crown encircles the head.
- The right and left coronary arteries deliver blood to the heart. The coronary veins drain blood from the heart into the coronary sinus.

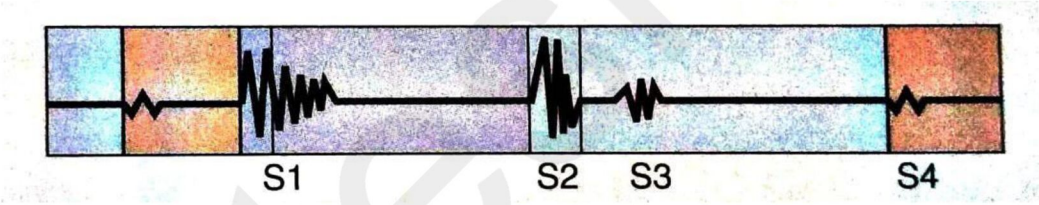
Cardiac cycle:

- A single cardiac cycle includes all the events associated with one heartbeat/min 72-75.
- A cardiac cycle lasts 0.8 sec.
- A cardiac cycle consists of systole and diastole of the atria plus systole and diastole of the ventricles.
- There are typical changes in pressure and blood flow during the cardiac cycle in large veins such as the vena cava.
- Such oscillations in pressure and flow may, at times, be transmitted to more peripheral vessels.
- There are three positive pressure waves (a, c, v) in the central veins corresponding to changes in pressure changes in the atria. Thea wave is caused by atrial contraction at end diastole.



Heart sounds:

- The sound of the heart beat comes primarily from blood turbulence caused by the closing of the heart values. Smoothly flowing blood is silent.
- There are four heart sounds but in a normal heart only the first and second heart sounds (S1 and S2) are loud enough to be heard through a stethoscope.
- The timing of heart sounds relative to other event in the cardiac cycle.
- The first sound (S1) which can be described as a Lubb sound is louder and a bit longer than second sound.
- S1 is caused by blood turbulence associated with closure of the AV values soon after ventricular systole begins.
- The second sound (S2) which is shorter and not as loud as the first sound can be described as a Dupp sound.



Basics of ECG (Electrocardiogram) :-

- They generate electrical currents that can be detected at the surface of the body. An ECG is recording of these electrical signals.
- The ECG is a composite record of action potentials produced by all the heart muscle fibers during each heart beat.
- There are two ways to learn ECG interpretation — Pattern recognition (the most common) and understanding the exact electrical vectors recorded by an ECG as they relate to cardiac electrophysiology — and most people learn a combination of both.

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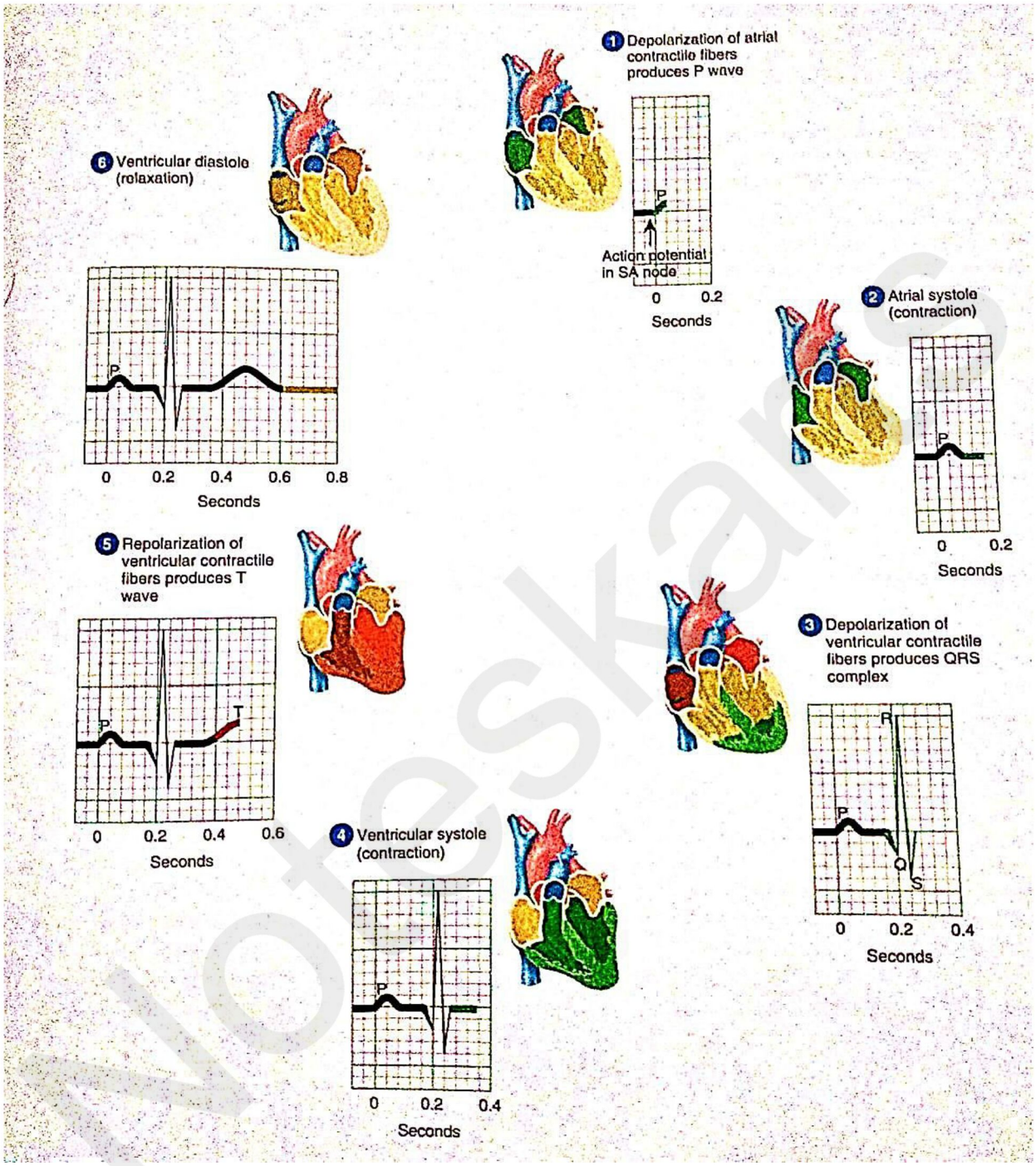

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Blood pressure and its regulation

Blood pressure:

- Blood pressure is the pressure of blood pushing against the walls of your arteries. Arteries carry blood from your heart to other parts of your body.
- Your blood pressure normally rises and falls throughout the day.
- Blood pressure is determined both by the amount of blood your heart pumps and the amount of resistance to blood flow in your arteries.
- The more blood your heart pumps and the narrower your arteries, the higher your blood pressure.
- A blood pressure reading is given in millimeters of mercury (mm Hg). It has two numbers.

    1. **Systolic pressure.** The first, or upper, number measures the pressure in your arteries when your heart beats.
    2. **Diastolic pressure.** The second, or lower, number measures the pressure in your arteries between beats.

Human Anatomy and Physiology

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