

Chapter 5: Transport and Distribution of Nutrients and Oxygen: **CIRCULATION (p. 80)**

* Activity 1 : Book p. 82 - 83

I.

- The circulatory system includes the **heart** and the **blood vessels**.
- The heart is made up of **muscles** called **myocardium**.
- It is made up of 2 main parts: left and right, separated by a wall called *septum*.

II. Blood Vessels:

ARTERIES (have a thick wall)	
Aorta	Pulmonary Arteries
Transport the oxygenated blood (rich in O ₂) from the heart (left ventricle) to the organs.	Transport the carbonated blood (rich in CO ₂) from the heart (right ventricle) to the lungs.
<ul style="list-style-type: none"> ▪ Les Coronary vessels (arteries): blood vessels that supply the cells of heart with oxygen and nutrients. 	

VEINS (have thinner wall)	
Vena Cava <i>(Superior and Inferior)</i>	4 Pulmonary Veins
Transport the carbonated blood (rich in CO ₂) from the organs to the heart.	Transport the oxygenated blood (rich in O ₂) from the lungs to the heart.

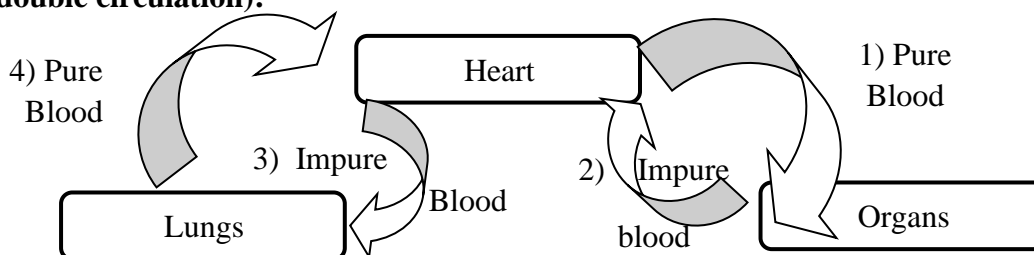
Capillaries (very thin wall)	
Capillaries have very thin wall which is permeable.	Found at the level of the cells to allow the exchange of gases and nutrients between the blood and the cells.

III. Double Circulation of Blood:

There are two types of circulation:

Systematic circulation	Small or pulmonary circulation
Blood leaves the heart towards the organs where it distributes O ₂ + nutrients, collects the wastes and returns from the organs to the heart.	Blood leaves the heart towards the lungs to get rid of CO ₂ and to become enriched in O ₂ , then it returns from the lungs to the heart.

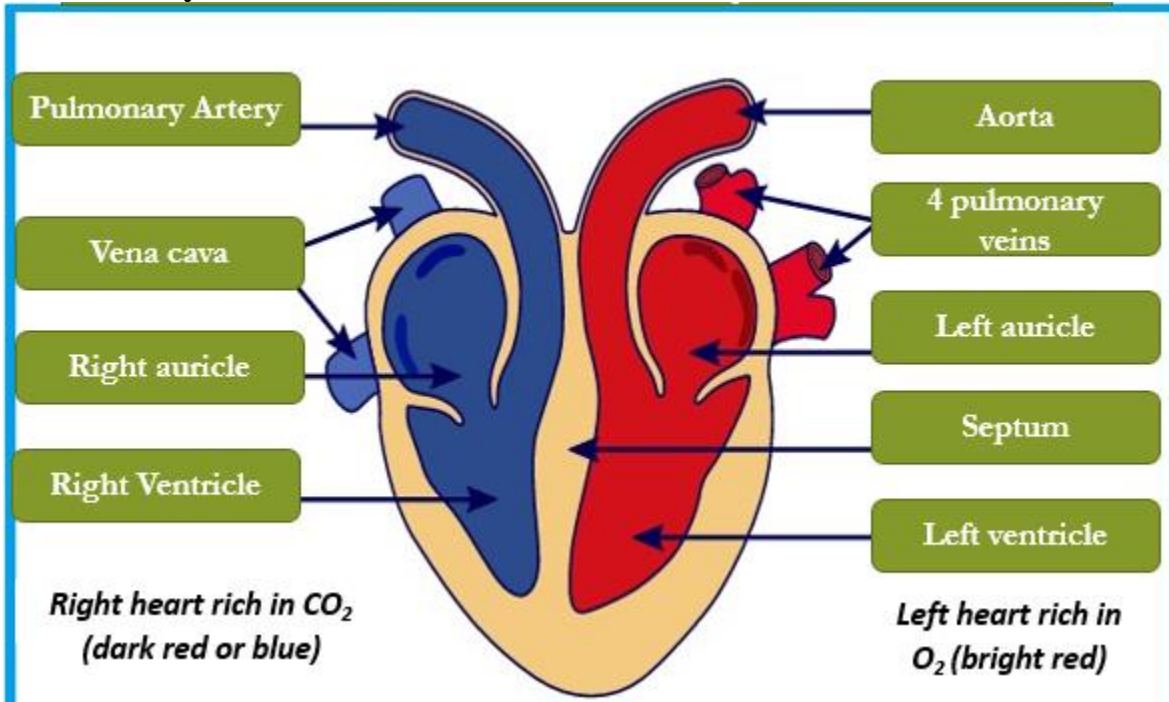
In summary (double circulation):



- **The pure or purified blood:** Blood rich in O₂ and nutrients. (Color : Bright red)
- **The impure blood:** Blood rich in CO₂ and other wastes. (Color : Dark red)

* **Activity 2:** Book p. 84 - 85

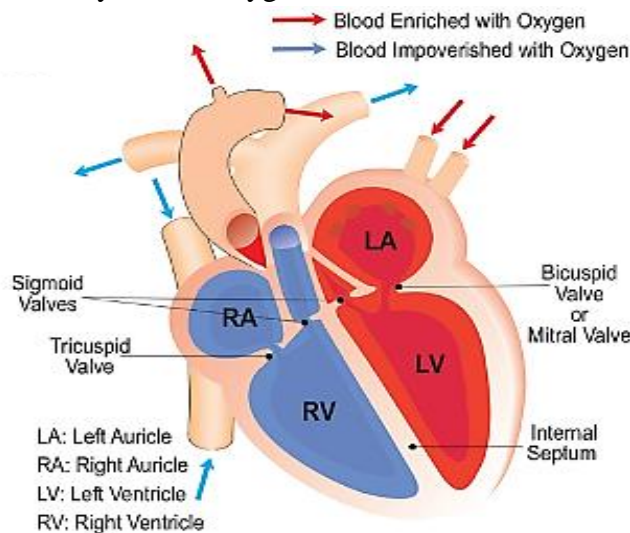
IV. Heart Anatomy:



Do not forget the bicuspid and tricuspid valves as well as the sigmoid valves.

The stages of circulation:

- 1) At the level of right atrium (auricle), the lower and upper vena cava bring the carbonated blood to the right heart.
- 2) From the right ventricle, the pulmonary artery carries the carbonated blood from the heart to the lungs.
- 3) At the level of the left atrium comes the 4 pulmonary veins which bring oxygenated blood to the left heart.
- 4) From the left ventricle, the aorta artery carries oxygenated blood from the heart to the organs.



V. The Valves:

Definition : membranous structure that directs blood and prevents its backflow.

Part of the heart	Valves	Direction of Blood flow
Left Heart	Bicuspid valve or mitral	L.A. → L.V.
	Sigmoid valve	L.V. → aorta
Right Heart	Tricuspid valve	R.A. → R.V.
	Sigmoid valve	R.V. → pulmonary artery

!! Interstitial Lymph : clear and colorless liquid of the blood plasma bathing the cells of the body.

* Activity 3: Book p. 86 - 87

VI. The heart frequency:

Definition : number of heartbeats in one minute.

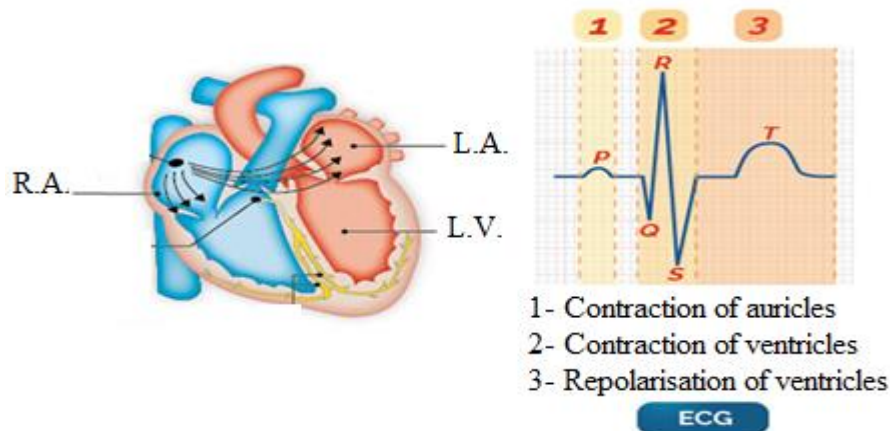
$$f = \frac{1}{T} = \frac{1}{0.8 \text{ s}} \times 60 = 75 \text{ beats/min.}$$

VII. Cardiac Activity:

We detect the cardiac activity by :

- MRI
- Stethoscope
- Electrocardiograph : apparatus that gives information about the activity of the heart, the electrocardiogram

Normal electrocardiogram:



Phase (P)	Auricular Systole	0,1 s
Phase (Q, R, S, T)	Ventricular Systole	0,3 s
Phase (constant)	Diastole	0,4 s
Cardiac Revolution (cycle)	$0,1 + 0,3 + 0,4 = 0,8 \text{ s}$	
Cardiac Frequency	$f = \frac{1}{T} = \frac{1}{0,8 \text{ s}} \times 60 = 75 \text{ beats/min.}$	

There are 3 phases of the cardiac cycle (revolution):

1) Auricular Systole (P) : 0,1 seconds.

The auricles contract, the blood is pushed into the ventricles, the tricuspid and bicuspid valves open, and the sigmoid valves are closed.

2) Ventricular Systole (Q, R, S, T): 0,3 seconds.

At the beginning:

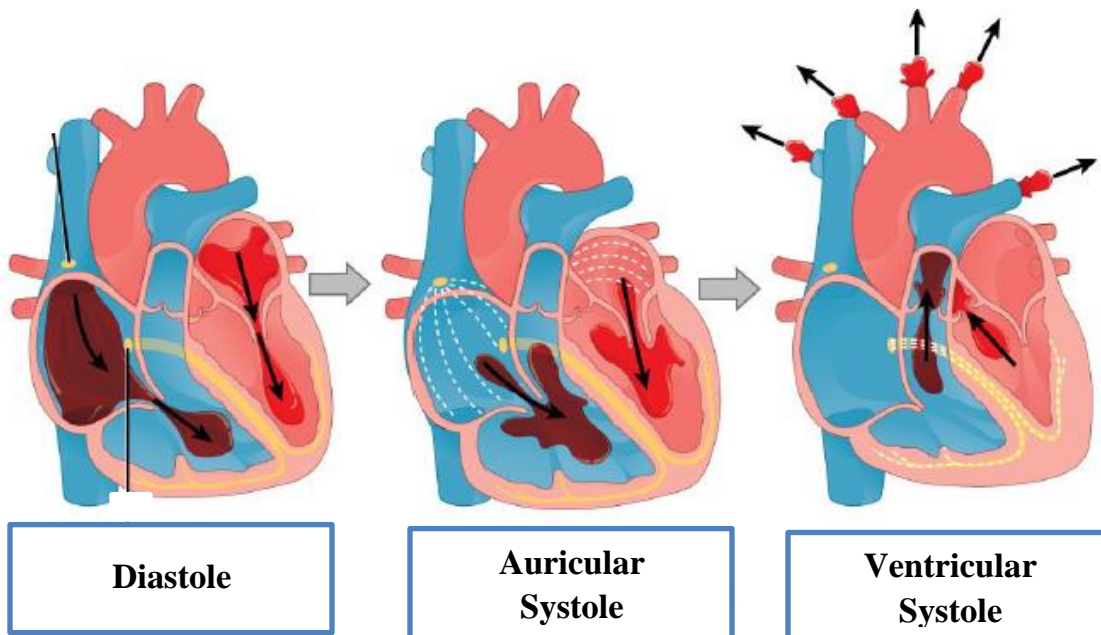
- The 2 ventricles contract and the 2 and the sigmoid valves open.
- The 2 valves bicuspid and tricuspid close → *1st sound of the heart*

At the end :

- The blood is pushed in the arteries, the sigmoid valves close. → *2nd sound of the heart*

3) Diastole: 0,4 seconds.

The cardiac muscle is relaxed, the auricles are filled with blood by the veins, and the auriculo-ventricular valves open.

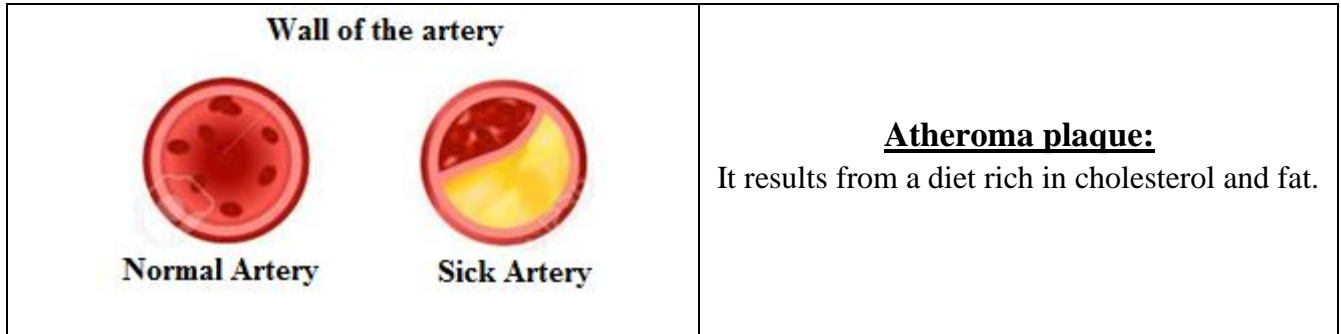


* Activity 4: Book p. 88 - 89

Cardiovascular diseases:

- Diseases related to the heart and blood vessels.
- **Clot** : a small mass of coagulated blood.

- **Arteriosclerosis:** arterial disease characterized by a deposit of cholesterol or atheroma on the wall of the artery.



- When a coronary vessel gets blocked, the heart will be deprived of O₂ and nutrients → which cause the **myocardial infarction**

Myocardial infarction: results from a poor blood supply to the cardiac muscle.

INFARCTION	
<i>Main risk factors (Causes)</i>	<i>Clinical signs of infarction</i>
<ul style="list-style-type: none"> ○ Tobacco / Smoking ○ Unbalanced diet ○ Alcohol ○ Drugs ○ Stress ○ Hypertension: high blood pressure 	<ul style="list-style-type: none"> ○ Pressure in the center of the chest ○ Pain in shoulders, neck or arms ○ Sweating – Nausea – Vomiting ○ Fatigue

- **How to prevent cardiovascular diseases?**

Risk Factors	Prevention
1 – Hypertension	1 – Monitor blood pressure
2 – Stress	2 – Avoid stress
3 – Heredity	3 - _____
4 – Diabetes	4 – Diet poor in sugar
5 – Obesity	5 – Diet poor in fat and sugar
6 – Tobacco	6 – Avoid smoking
7 – Unbalanced diet	7 – Eating balanced diets