

1.3. CIRCULATORY SYSTEM

☞ Circulatory system is a system in which oxygen, digested food and other nutrients transport to all part of body.

- ❖ All organism do not have specialized circulatory system.
- ❖ Small, single celled organism relies on simple diffusion to exchange material between the environment and their cells.
- ❖ Larger animals do not depend on simple diffusion because the surface area to volume ratio gets smaller as the result simple diffusion cannot reach the inner most volume.

☞ **CIRCULATION:** is the movement of blood and other fluid through blood vessels to all parts of the body.

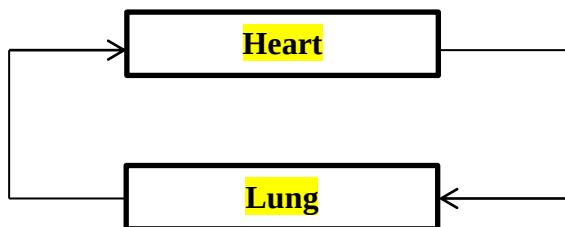
- ❖ The human transport system is the blood circulatory system
- ❖ It has three elements
 1. Heart (the pump)
 2. Blood vessels (the pipe)
 3. Blood (the medium)

A DOUBLE CIRCULATION

- ❖ The human circulatory system is known as a double circulation.
 - Very important in warm blooded animals like human being because it is very efficient.
- ❖ Double circulation is the two transport system of the body these are;

1. pulmonary circulation

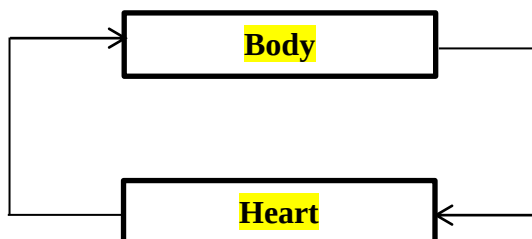
- ❖ The pathway of blood between heart to lung
- ❖ Blood flows from the heart to the lungs and back again
- ❖ Important to exchange oxygen and carbon dioxide



❖ **Right ventricle → pulmonary artery → lung → pulmonary vein → left auricle**

2. Systematic circulation

- ❖ the pathway of blood form heart to all part of the body and back again
- ❖ supply oxygen rich blood to all part of the body



- ❖ systematic circulation can be divided into:
 - **Hepatic circulation** the pathway of blood between heart to liver
 - **Renal circulation** the pathway of blood between heart to kidney
 - **Coronary circulation** the pathway of blood between heart to heart muscle
 - **Hepatic portal circulation** carries digestive nutrient from the digestive system to the heart through the liver.

1. BLOOD VESSELS

☞ **Blood vessel** are the pathways through which transportation of material takes place

- There are three main types of blood vessels
 - Arteries
 - Veins
 - Capillaries

Arteries	supply glucose and oxygen to:
Carotid artery	Head
Coronary artery	Heart muscle
Renal artery	Kidney
Hepatic artery	Liver
Mesenteric artery	SI and LI

☞ ARTERIES

- ❖ Carry blood away from the heart
- ❖ Thick and elastic wall
- ❖ Thick muscle layer
- ❖ Have elastic fiber
- ❖ Narrower lumen or central cavity
- ❖ Blood flow under high pressure
- ❖ Have no valves
- ❖ Have a pulse
- ❖ carry oxygenated blood (bright red in color) except
 - **Pulmonary artery** carry deoxygenated blood to lung
 - **Umbilical artery** carry deoxygenated from fetus to placenta
- ❖ Largest artery is called **aorta** while the smallest artery called **arterioles**

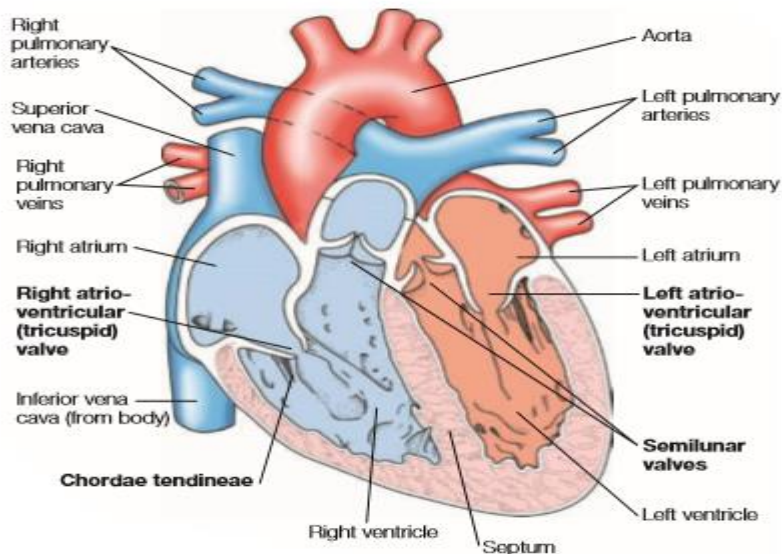
☞ VEINS

- ❖ Carry blood back to the heart
- ❖ Thin wall
- ❖ Thin muscle layer
- ❖ No elastic fiber
- ❖ wider lumen or central cavity
- ❖ Blood flow under low pressure
- ❖ Do not have a pulse
- ❖ Have valves (prevent the back flow of blood).
- ❖ Carry deoxygenated blood (deep purple - red color or dark red color)
 - **Pulmonary vein** return oxygenated back from lung to heart
 - **Umbilical vein** carries oxygenated blood placenta to fetus
- ❖ Largest vein is called **vena cava** while the smallest veins is called **venules**

☞ CAPILLARIES

- ❖ Narrow thin walled blood vessels
- ❖ Connects arteries and with veins
- ❖ Take blood to the tissue and cell
- ❖ Site of exchange of substance within the body
- ❖ Wall one cell thick
- ❖ Blood flow slowly
- ❖ Mix oxygenated and deoxygenated blood
- ❖ No valve

2. THE HUMAN HEART



- ❖ Hollow muscular organ locating in the thoracic cavity
- ❖ Made up of **cardiac tissue**
- ❖ It is a muscular blood pumping organ
- ❖ Surrounded by a double membrane called **pericardium**
- ❖ Human heart has four chamber
 - ✓ Two atria (auricles) upper chamber
 - ✓ Two ventricles lower chamber
- ❖ **The right auricle** receive **deoxygenated blood** from all part of the body through vena cava
- ❖ **The left auricle** receive oxygenated blood from lung through pulmonary vein
- ❖ **The right ventricle** pump deoxygenated blood to lung whereas **left ventricle** pump oxygenated blood to all part of the body
- ❖ **Left ventricle** is the thickest chamber of the heart because it pumps blood longer distance like:
 - ✓ Ears
 - ✓ Toes
 - ✓ Brain etc

- ❖ The left side of the heart separate from the right side by **septum**
- ❖ The muscle of the heart supplied oxygenated blood by **coronary artery**
- ☞ **Valves** the structure of the heart prevent the back flow of blood

Bicuspid (mitral) valves

- has two cusps
- The valve between left atrium and left ventricle
- Prevent the back flow of blood from left ventricle and left auricle

Tricuspid valve

- Has three cusps
- the valve between right atrium and right ventricle
- prevent the back flow of blood from right ventricle to right atrium

Semi-lunar valve

- Looks like half - moon
- Found at the opening of pulmonary artery and aorta
- Prevent the back flow of blood into ventricle

Bicuspid (mitral) valves

- has two cusps
- The valve between left atrium and left ventricle
- Prevent the back flow of blood from left ventricle and left auricle

Heart Valve	Location	Action
Tricuspid valve	Between right atrium and right ventricle	During ventricular contraction, it prevents blood from moving from right ventricle into right atrium.
Pulmonary valve	At entrance to pulmonary trunk	During ventricular relaxation, it prevents blood from moving from pulmonary trunk into right ventricle.
Mitral (bicuspid) valve	Between left atrium and left ventricle	During ventricular contraction, it prevents blood from moving from left ventricle into left atrium.
Aortic valve	At entrance to aorta	During ventricular relaxation, it prevents blood from moving from aorta into left ventricle.

- ❖ The contraction of the heart chamber is stimulated specialized tissue called **pacemaker**
- ❖ An instrument used to listen the heart beat is **stethoscope**
- ❖ An average heart rate of human being is **72 times** per minute.

❖ Systole

- The contraction of the heart chamber
- Force the blood out of the heart

❖ Diastole

- The relaxation of the heart chamber
- Fills the chamber of the heart with blood

☞ **Systolic blood pressure**

- Pressure formed by the contraction heart chamber
- Forced blood out into arteries
- Blood pressure at highest reading

☞ **Diastolic blood pressure**

- Pressure exerted by the relaxation of the heart chamber
- Blood pressure at lowest reading
- ❖ The normal blood pressure of human being is **120mmHg/80 mmHg**
- ❖ The **nominator** is systolic and **denominator** is diastolic Pressure

3. THE BLOOD

☞ **BLOOD** is a fluid tissue that carries nutrient, respiratory gases, metabolic wastes and other substances

☞ **Blood contains**

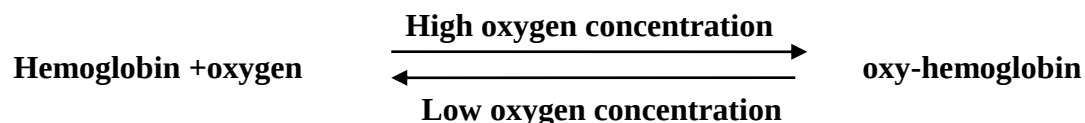
- 1) Plasma
- 2) Blood cells
 - Red blood cells
 - White blood cells
 - Platelets

☞ **PLASMA**

- ❖ A pale yellow liquid portion of the blood
- ❖ 90% of the plasma is water
- ❖ 10% consists dissolved and suspended substance
- ❖ Carries **nutrients, carbon dioxide, hormones, enzymes and nitrogenous wastes.**

☞ **RED BLOOD CELLS (ERYTHROCYTES)**

- ❖ They are more in number than other blood cells
- ❖ **Biconcave disk** shaped
- ❖ Mature RBC lacks nucleus
- ❖ Live 100-120 days in your body
- ❖ Worn out red blood cell destroyed and removed by **liver** and **spleen**
- ❖ Thin surface membrane for ease of diffusion
- ❖ Used to transport oxygen and carbon dioxide back into the lung
- ❖ Formed in the **bone marrow**
- ❖ Contain a red pigment called **hemoglobin**
- ❖ Hemoglobin contain iron, the lack of iron in diet cause **anemia**
- ❖ Hemoglobin is a complex protein which carries oxygen



☞ The following are some adaptation of RBC to carry oxygen:

- ❖ contain hemoglobin
- ❖ Does not have nucleus to carry more room for hemoglobin.
- ❖ Have biconcave disk shape increase surface area for diffusion of oxygen
- ❖ Thin surface membrane for ease of diffusion

☞ **WHITE BLOOD CELL (LEUCOCYTES)**

- ❖ Colorless, irregular shaped and nucleated
- ❖ Produced in **bone marrow, lymph nodes** and **spleen**
- ❖ Fewer in number than red blood cell
- ❖ Much bigger than red blood cell
- ❖ The life span is around 12- 20 days
- ❖ Form part of the body's defense system against microbes.
- ❖ White blood cell can be classified as:
 - **Phagocytes** a group of white blood cell that engulf and ingest infection microbes
 - **Lymphocytes** group which help to produce antibodies

☞ **PLATELETS (THROMBOCYTES)**

- ❖ Colorless and non-nucleated
- ❖ The life span is about 8 – 10 days
- ❖ **Important in blood to clot at the site of a wound**
- ❖ Prevents the body from bleeding to death from a simple cut
- ❖ Also protect the body from the entry of pathogen through open wound
- ❖ Protect the new skin from damage as it grows

Human blood group

ABO blood group system

- ☞ **Four major blood group in humans'**
- | | |
|----------------------|-----------------------|
| Blood group A | Blood group AB |
| Blood group B | Blood group O |

- ☞ **Antigens** are special protein which are found on the red blood cell

- Antigen allow cells to recognize each other
- Blood group determine by the type of antigen on the red blood cell
- **"A"** blood contain **"A"** antigen **"B"** blood contain **"B"** Antigen
- **"AB"** blood contain **"A"** and **"B"** antigen **"O"** blood **do not contain antigen**

- ☞ **Antibody** are protein which are produces the body to fight foreign antigen and found in the plasma of the blood

- Two type of antibodies against antigen. These are **anti-A** and **anti B** antibodies
- ❖ **Agglutination** is incompatibility of antigen and antibody in blood group
- ❖ Blood groups that mix without agglutination are called **compatibility**

Transfusion of blood group

Blood group	Antigen	Antibody	Can be transferred (donate) into	Can received blood from
A	A	Anti-B	A and AB	A and O
B	B	Anti-A	B and AB	B and O
AB	A and B	NONE	AB only	A, B, AB, O
O	NONE	Anti A and B	A, B, AB, O	O only

“Blood group AB” called **universal recipient** “Blood group O” called **Universal donor**

- ❖ There is another antigen found on the surface of RBC called **Rh antigen**
- ❖ A person who do have this antigen is called Rh⁺ (Rh positive)
- ❖ A person who do not have this antigenic called Rh⁻ (Rh negative)

☞ Rh system in relation to marriage

<u>Mother</u>	<u>Father</u>
➤ Rh ⁺	Rh ⁺ no problem
➤ Rh ⁻	Rh ⁻ no problem
➤ Rh ⁻	Rh ⁺ may be a risk
➤ Rh ⁺	Rh ⁻ no problem

COMMON PROBLEM OF CIRCULATORY SYSTEM

☞ ANEMIA

- ❖ Is caused few red blood cell or if the level of hemoglobin is less by
- ❖ Most commonly caused by the lack of iron in the diets
- ❖ Treated by eating iron rich diets such as liver, meat, egg, green leaf vegetable
- ❖ Girls are more likely to be anemic then boys because they lost iron in their menstrual bleeding

☞ HYPERTENSION

- ❖ High blood pressure above **140/90 mmHg**
- ❖ **Sphygmomanometer** is an apparatus which is used to measure the blood pressure of an individual.
- ❖ Caused by various reason such as
 - Age. Over weightiness
 - High consumption of salt
 - Drug addiction
 - Diabetics etc.
- ❖ Can be reduce and controlled by;
 - Eating less fat and salt
 - Regular exercise
 - Avoid use of drug etc