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## Pumping organ (The heart)

- located in chest cavity
- enclosed in a double membranous sacs (pericardial cavity) → contains pericardial fluid.
- Pericardium → protects heart from over-extension.  
(walls of heart)

Epicardium      Myocardium      Endocardium

- walls of left ventricle are three times thicker than that of right ventricle.
- made up of special types of muscles → cardiac muscle.
  - contain myofibrils & filaments of myosin & actin.
  - branched cells
  - successive cells are separated by junctions.
  - intercalated disc.
- Tricuspid valve:-
  - 3 flaps.
  - attached with fibrous cords.
  - ↓ chordae tendinae.
  - ↓ to papillary muscles.
  - extension of walls of right ventricle

Chambers { upper → thin walled atria.  
lower → thick walled ventricles

- Heart acts as double pump

venae cavae. deoxygenated B → right atrium → T.C.V. → right ventricle.

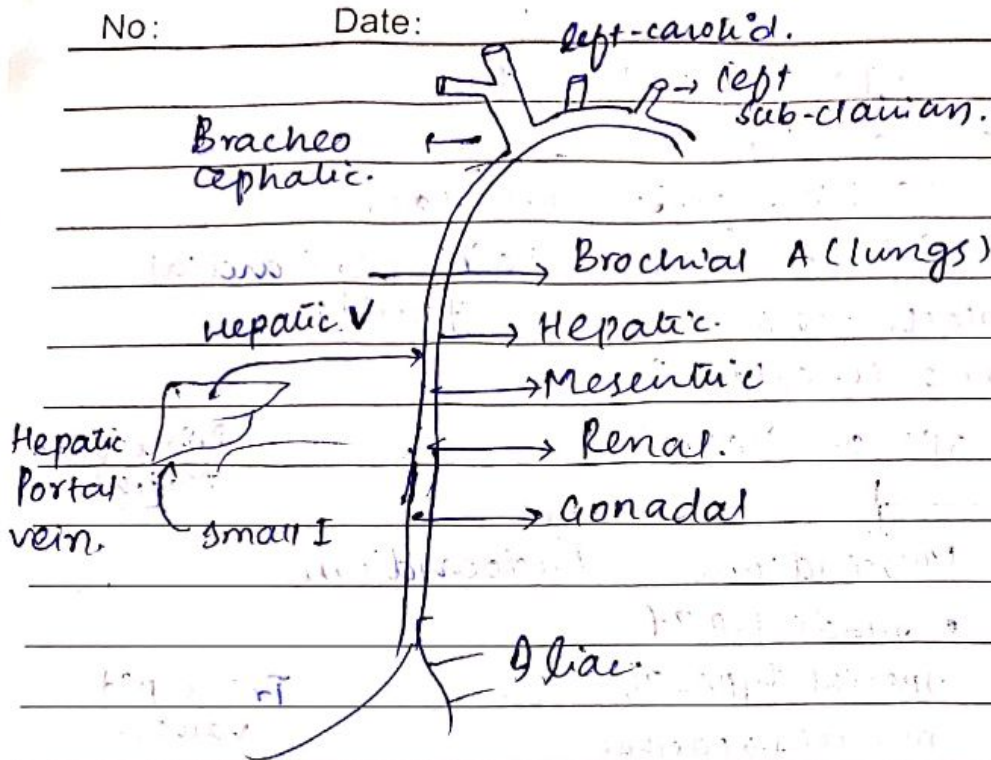
left atrium ← oxygenated pulmonary veins. ← lungs ← left & right pulmonary arteries.

left ventricle → aorta → body (except lungs)



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## The Cardiac Cycle:-

### Diastole (Relaxation Phase):- (0.4 sec)

vena cava  $\xrightarrow{0.0}$  right atrium  
 pulmonary vein  $\xrightarrow{0.8}$  left atrium. walls are relaxed.

- SL valves closed ~~ADABB~~
- AV valves open.

### Atrial systole:- (0.1 sec)

Atria contract

ventricles are relaxed.

SL valves closed.

AV valves open.

### Ventricular systole: (0.3 sec).

ventricles contract

plubb sound.

AV valves closed.

SL valves open.

At. start  $\rightarrow$  SL valves open.

At end  $\rightarrow$  SL valves close

$\hookrightarrow$  DUBB  
 sound.

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### Mechanism:-

SA node → at upper end of right atrium.

↓  
send impulse

↓  
atrial muscles.

↓  
atria contract.

consists of:

- small number of diffusely oriented cardiac fibres.

myo  
fibrils

few nerve  
endings

from autonomic  
N.S.

### Impulses

↳ musculature  
of atrium &

to atrioventricular  
node

↳ interventricular  
septum.

→ myocardium of  
ventricle.

• delay → 0.15 sec (from SA → AV)

### Electrocardiogram:-

Electrodes → on skin → opposite sides of heart

↓ Electrocardio gram { electric potential can be  
recorded.

- to diagnose abnormalities in rhythmicity & conduction

### Artificial Pacemakers:-

- initiating the impulses which trigger heart beat rate.



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## Blood Vessels:

### i) Arteries:

Blood → away from heart → body.

layers:

outer middle inner.

- C.T
- Elastic fibers.
- Thick muscular tissue of elastic fibers.
- epithelium.

• contraction of smooth muscles of arteries.

↓  
nervous & endocrine sys.

• muscle contract (vasoconstriction)  
↓  
reduce the flow of blood.

• muscle relaxed (vasodilation)  
↓  
more blood flows.

[arteries divide → capillaries]

### Atherosclerosis:

athere → porridge

sclerosis → hardening

Atheroma: deposition of hard yellow plaque of lipid material → innermost layer of arteries.  
due to high cholesterol

### Arteriosclerosis:

degenerative arterial change

thickening of middle layer of arteries

### Atherosclerosis:

- narrowing / hardening of arteries
- risk of formation of thrombus.



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### Capillaries:-

→ walls → only one cell thick.

→ permeable

↳ water & dissolved substances pass in and out exchanging

• oxygen • CO<sub>2</sub> • dissolved food • excretory products

→ liver → every cell is in direct contact with it

→ Diameter:-

nervous stimulation → contraction

(chemicals) Histamines → dilation.

### Exchange of Materials:-

- Active transport & diffusion:-  
cells of cap → interstitial fluid → body cells.
- Intracellular spaces:-
- endocytosis & exocytosis:-

capillaries join → veins → venules.

### Veins:- Body → Heart.

• 3 layers (same as arteries)

Middle → thin & slightly muscular with few elastic fibers.

• SL valves. → prevent back flow of blood.

• Veins join → large veins → vena cava

### Blood Pressure:-

aorta > arteries > arterioles > capillaries > venules > veins

• generated by ventricle systole

vena  
cavae



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### Thrombosis :-

solid mass/plug of blood constituents in a blood vessel.

- may block the vessel / dislodged & carried to some other location in circulatory system  
↓  
Embolus.

### Thrombus Formation :-

- i) Irritation / Infection of lining of B.V
- ii) Reduced rate of blood flow,  
long periods of inactivity
- iii) Pneumonia, tuberculosis, emphysema.

### Myocardial infarction :-

- Blockage by embolus causes necrosis / damage to portion of heart muscles.
- disruptions of control system of heart with accompanying arrhythmias, especially ventricular fibrillation.

### Cerebral infarction :-

normal flow of blood is blocked by embolus in a blood vessel in the brain. causes death of neural tissue called stroke.



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## Red Blood cells (Erythrocytes)

- most numerous of cells in blood.
- a cubic mm

male 4 - 4 1/2 million.

5 - 5 1/2 million female.

- have nucleus → when formed.
- lost before they enter circulatory system.
- 95% of RBC's → haemoglobin.
- 5% of RBC's → enzymes, salts & other proteins.
- don't divide → once mature.
- formed in → Red bone marrow of short bones.  
such as sternum & vertebrae.
- formed in → Liver and spleen → embryonic life.
- life span → four months.  
↳ after it → breaks and disintegrates in liver & spleen.

## White Blood Cells (Leucocytes).

- colourless → don't contain pigments.
- 1 mm<sup>3</sup> of blood → 7000 - 8000
- much larger than RBC's.
- on basis of shape of nucleus / density of granules in cytoplasm.

protects the body against foreign invaders and use circulatory system

Grouped in 2 types → five types

### Granulocytes

neutrophils eosinophils basophils

- formed in Red Bone Marrow.

### Agranulocytes

Monocytes

Lymphocytes

- formed in lymphoid tissue such as those of lymph nodes, spleen, tonsils, adenoids & thymus.



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### (A) Monocytes:-

- stay 10-20 hours in blood then enter tissues and become tissue macrophages performing phagocytic function.

### (B) Lymphocytes:- (T & B)

- lifespan = months/ even years.  
depends on body's need.

### (C) Neutrophils & Monocytes:-

- travel through capillaries & reach site of wound when bacteria present
- feed on bacterial invaders/foreign cells such as cancer cells.
- die in the process → bodies are accumulated → form pus at infection site.

### (D) Basophils:-

- produce heparin.  
Inhibits blood clotting.
- produce histamine.  
precipitate.

in allergic reactions      in response to tissue damage and microbial invasion.

## PLATELETS:-

• They are not cells

- fragments of large cells → megakaryocytes

- no nucleus      • no pigment

- fibrinogen (soluble plasma protein) → fibrin (insoluble) → threads enmesh RBCs & platelets in the area of damaged tissue → forming blood clot.  
↳ temporary seal to prevent bleeding



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## RBCs:

(Erythrocytes)

- Biconcave disc without nucleus.
- 8  $\mu\text{m}$  in diameter.
- 5000000 /  $\text{mm}^3$ .
- Transport  $\text{O}_2$  &  $\text{CO}_2$  (small amount).

## Platelets:

- Membrane bounded cytoplasmic fragments of cells in bone marrow megakaryocytes.
- 250000 /  $\text{mm}^3$
- involved in blood clotting.

## White Blood cells:-

(7500 per  $\text{mm}^3$ )

### 1. Neutrophils.

- twice the size of RBCs.

- nucleus:-

→ 2-5 lobed.

→ 62% of WBCs

→ phagocytosis

### 2. Eosinophils

- twice the size of RBCs.

→ bilobed.

→ 2% of WBCs

→ Inactivates inflammation

producing subs.

attack parasites.

### 3. Basophils

- twice the size of RBCs.

→ bilobed. ✓

→ less than 1%.

→ Heparin

↳ prevent blood clots

→ Histamine

causes inflammation

## Agranulocytes.

### Monocytes

2-3 times larger than RBCs.

- nucleus

round → lobed.

• 3% of WBCs.

• produce macrophages → phagocytosis

### Lymphocytes.

- slightly larger than RBCs.

- nucleus.

nearly fills the cell.

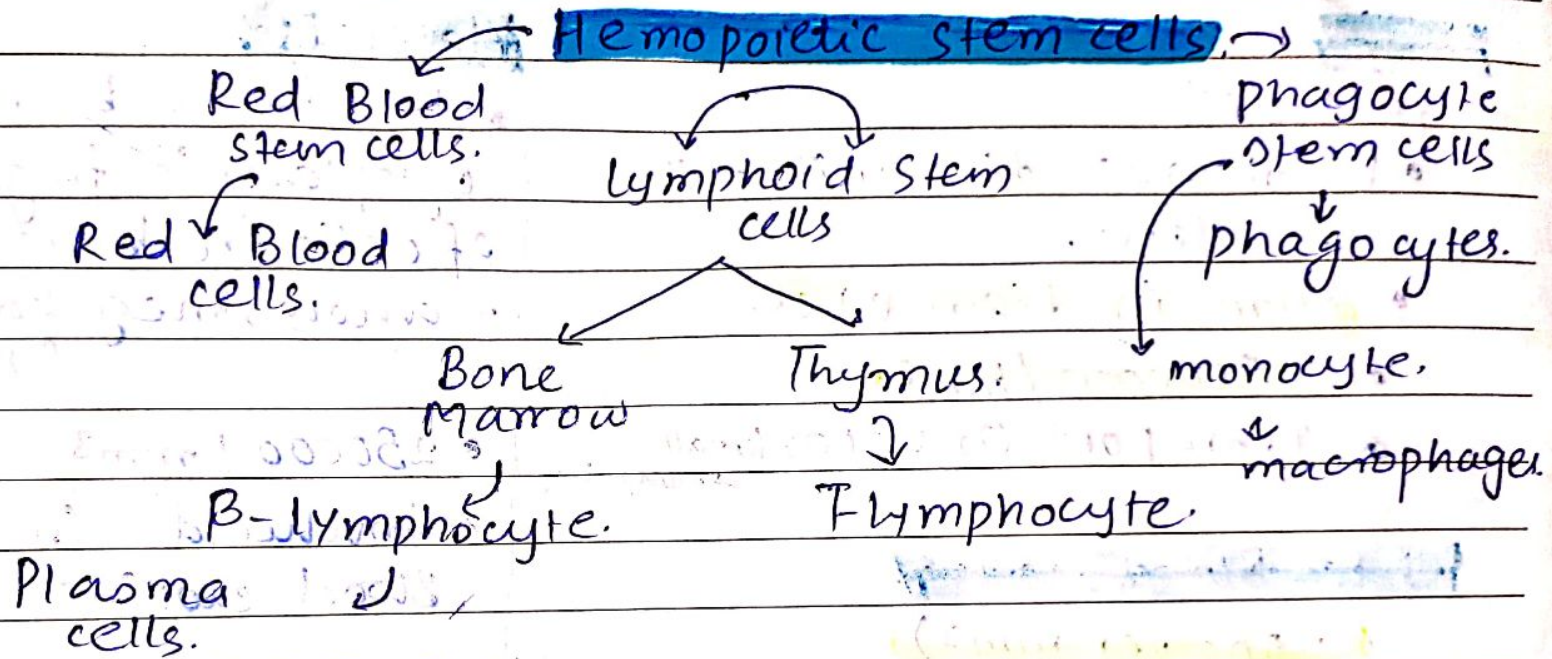
• 32% of WBCs

• produce immune response by producing antibodies.



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**Presented By**

**Saeeda Maryam.**

**Remember in Your Prayers.**