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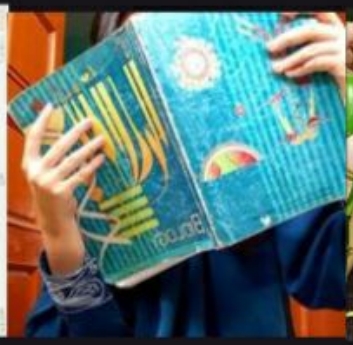
NEET SLAYER



Body fluids and Circulation Handwritten Notes

Human Physiology

For pdf, join my telegram channel
link in description

CHAPTER=18 BODY FLUIDS AND CIRCULATION

Nutrients, O_2 and other essential substances → Living Cells → Waste or harmful substances.

→ We need efficient mechanisms.

① Sponges, Coelenterates → Circulate water through their body cavities.

② High Organisms, Humans → Blood, lymph (tissue fluid)

* Blood → Special Connective Tissue.
  - Fluid Matrix → Plasma
  - Formed Elements

① Plasma → Straw Coloured
→ Viscous fluid
→ 55% of blood.

→ Plasma without clotting factors → Serum.

Plasma
- Small amount of minerals, Na^+, Ca^{2+}, Cl^-, Mg^{2+}, HCO_3^-.
- 90-92% Water
- Glucose, amino acids, lipids.
- 6-8% proteins
  - Albumins → Osmotic Balance
  - Globulins → Defence mech.
  - Fibrinogen → Blood Clotting, (coagulation) present in inactive form

→ Majority of plasma protein produced in liver.

* Formed elements → 45% of blood.
  - Erythrocytes
  - Leucocytes
  - Platelets

① Erythrocytes or Red Blood Cells? →

→ Most abundant
→ 5 to 5.5 millions of RBC mm^{-3}
→ formed in red bone marrow (adults), Liver (embryonic Stage) (Yolk Sac (foetus))
→ devoid of nucleus (most of mammals) and mitochondria
→ biconcave in shape (mature), Circular (immature)
→ Red coloured, Fe containing Hb.
→ Healthy individual → 12-16 gm Hb in every 100 ml of blood.
→ Transport of respiratory gases.
→ average life span → 120 days.
→ destroyed in spleen (graveyard of RBC's)

② Leucocytes or WBC's :→

→ Colourless. → Nucleated. → Short lived.
→ lack of Hb. → 6000-8000 mm^{-3}

WBC's

Granulocytes			Agranulocytes	
Neutrophils	Eosinophils	Basophils	Lymphocytes	Monocytes
→ 60-65% of total WBC's (Most abundant) → Phagocytic	→ 2-3% resist infections. → also associated with allergic reactions	→ Least (0.5-1%) → secreates histamine serotonin heparin ↓ involved in inflammatory rx^{n}.	→ 20-25% B T → immune response of body.	→ 6-8% → Phagocytic.

③ Platelets (Thrombocytes)

→ cell fragments from megakaryocytes (special cells in bone marrow)
→ 1,50,000 - 3,50,000 platelets mm^{-3}
→ coagulation / clotting of Blood.
→ Reduction can lead to clotting disorders, excessive loss of blood from body.

Blood Groups → ABO
→ Rh

Carl Landsteiner

* ABO Grouping :→

→ based on presence or absence of two surfaces antigens → A, B
→ plasma contains two natural antibodies (proteins in response to antigens).
→ A, B, AB, O.
→ Blood transfusion (Safely).

Blood Group	Antigens on RBC's	Antibodies in Plasma	Donor's Group
A	A	anti-B	A, O
B	B	anti-A	B, O
AB	A, B	nil	AB, A, B, O
O	nil	anti-A, B	O

→ Universal Donor = O → Universal Recipient = AB

* Rh Grouping :→

→ present in 80% of human (Rh^+)
→ Rh^- → antigen absent
→ $Rh^+ \rightarrow Rh^- \rightarrow$ will form specific antibodies.

→ Rh -ve mother — Rh+ foetus
1st pregnancy.

① Two bloods are well separated by placenta.

② During delivery exp. of maternal blood to small amount of Rh^+ blood from foetus.

→ Mother → antibodies against Rh antigen.

→ Subsequent Pregnancies.

Antibodies → can destroy foetal RBC's in Rh^+

fatal / severe anaemia / Jaundice

Erythroblastosis foetalis.

→ Avoid by administering anti-Rh anti-bodies to mother after delivery of first child.

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*Coagulation of Blood.

Injury or Trauma

↓

Coagulation Mechanism

↓

Dark Reddish brown Scum

↓

Clot or Coagulation

(Network of threads called fibrins)

(dead and damaged formed elements are trapped)

Inactive Fibrinogen $\xrightarrow{\text{Thrombin}}$ Fibrins

(Thromboplastin / plasma)

Prothrombin

→ called cascade process. involving no. of factors present in the plasma in an inactive state.

→ Injury / Trauma → Platelets → Mech. of Coagulation.

→ Certain factors present at the site of injury also initiate coagulation. (Ca^+, K^+ ions)

* **Lymph (Tissue Fluid)** (Blood - formed elements - large proteins)

Blood → Water + Small water sol. substance.

↓

Out into the spaces b/w cells of tissues leaving larger protins and most of the formed elements in blood vessels.

↓

Fluid is called Tissue or Interstitial fluid.

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* **Circulatory Pathways.**

Open	Closed
Arthropods, Molluscs	Annelids, Chordates
Heart ↓ Large Vessels ↓ Open Spaces or body Cavities (Sinuses)	Closed network of blood vessels ↓ More advantageous.

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* **Vertebrates** → Muscular Chambered Heart

① Fishes (2 chambered) → Atrium, Ventricle.

② Amphibians and Reptiles (except crocodile) → 3 chambered ↓ 2 atria, 1 Ventricle.

③ Crocodiles, Birds, Mammals. ↓ 4 chambered Heart → 2 Atria, 2 Ventricle.

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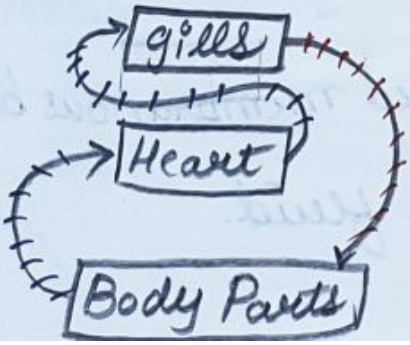
* **Fishes** → Heart → deoxygenated blood. ↓ Oxygenated by gills. ↓ Body Parts (deoxygenated) ↓ Heart



Single Circulation

No mixing.

* **Amphibians and Reptiles**

Gills / Lungs / Skin

oxy. blood → Left atrium

Other body Parts → deoxy. blood → Right atrium

Incomplete Double Circulation

Mixed up in single Ventricle

↓

Mixed Blood.

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* **Birds and Mammals.**

oxy. blood → Left atria → Left Ventricle

deoxy blood → Right atria → Right Ventricle

No mixing occurs

Double Circulation

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* **Human Circulatory System**

or blood Vascular system.

↓

consist of a muscular chambered heart

↓

Network of closed branching blood vessels and blood.

* **Heart** :→
  - Mesodermally derived.
  - Thoracic Cavity (btw. the two lungs)
  - Slightly tilted to the left
  - Size of a Clenched fist.

* **Pericardium** :→ protected by double walled membranous bag

↳ enclosing the pericardial fluid.

* **Chambers** :— Two small upper chambers = Atria.
↳ Two larger lower chambers = Ventricles.

* **Inter-atrial Septum** :— (Thin, muscular wall)
↳ Separates right and left atria.

* **Inter-Ventricular Septum** :— Separates left and right ventricles.

* **Atrio-Ventricular Septum** :— Thick fibrous tissue.
↳ Separates atrium and Ventricle.

Tricuspid Valve	Bicuspid / Mitral Valve
Three muscular cups b/w right atrium and right ventricle.	2 muscular cups b/w left atrium and left ventricle

Semilunar Valves :— Opening of right and left ventricles into pulmonary artery and aorta.
→ Valves prevent any back flow.

⇒ **Heart** → Made up of Cardiac Muscles.

Walls of Ventricles are much thicker than that of atria.

* **Nodal Tissue** :— (Special Cardiac musculature) distributed in heart.

→ Upper right corner of right atrium = Sino-atrial Node.

→ Lower left corner of right atrium close to atrio-Ventricular septum = Atrio-Ventricular Node.

* Bundles of Nodal fibres

Atrio-Ventricular Bundle (AV Bundle)
passes through AV Septa
↓
emerge on the top of Inter-Ventricular Septum

↙ Left Bundle ↘ Right Bundle.

→ These branches gives minute fibres throughout the Ventricular musculature of respective sides and are called purkinje Fibres.

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* Auto exitable (generate action potential without external stimuli.) (myogenic)

* No. of Action Potential :→

→ SAN = 70-75 beats/min (Max.)
(resp. for intiating and maintaing rhythmic contractile activity of heart)

→ Called as Pacemaker / Heart of Heart

→ Heart → 70-75 b/min.
avg. 72 b/min.

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* Cardiac Cycle

4 Chambers ⟶ Relaxed State (Joint Diastole) (50%)

Bicuspid & Tricuspid ⟶ Open

Pulmonary Veins
↓
Left atria.
↓
Left Ventricle.

Vena Cava
↓
Right atria
↓
Right Vent.

→ Semilunar Closed.

→ SAN → action potential → atria undergo simultaneously contraction. (atrial systole) 0.1 sec

Mummy

↓

increase flow of blood into Ventricles by 30%.

→ AV Node and AV bundle.

↓

Bundle of His

↓

To entire Ventricular musculature

Action potential ↓

↓

Ventricular muscles Contract (Ventricular systole)

coincide

Atria → relax (diastole)

⟹ Ventricular Systole — bro kaam par (0.3sec)

↓

(Lub) Closure of tricuspid and bicuspid. — Bhen Ka gale band

↓

Ventricular pressure ↑↑ — Kaam

↓

Semilunar Valves Open — Bahar se kaam ke aaya

↓

Ventricles Relax (diastole) — Relax (0.5 sec)

↓

Ventricular Pressure ↓↓ — Relax

↓

(Dub) Closure of Semilunar Valves. — Ghar Band

↓

Ventricular pressure ↓↓, So, tricuspid and bicuspid Valves are opened by increasing atrial pressure.

↓

Blood moves freely into Ventricles

↓

Ventricles and atria again relaxed (diastole.)

→ Clinically repeated → Cardiac Cycle.

Systole Diastole

Both atria and Ventricles

→ Cardiac Cycle → 72 times/min.

↳ duration of one = 0.8 second.

Stroke Volume → Blood pumped out by each Ventricle during Cardiac cycle. (Approx. 70mL).

Cardiac Output → Stroke Vol. X Heart Rate.

5000mL or 5L.

Body can alter stroke Volume, heart Rate.

Hence, Cardiac Output.

Two Prominant Sounds

Lub

Closure of Tricuspid and Bicuspid Bhen kagate >

Dub

Closure of Semilunar Valves

→ Sthetoscope

→ Clinical diagnostic Significance.

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* Electrocardiograph (ECG)

pip... pip... pip... peeeee → Cardiac Arrest

→ Electrocardiogram

→ Graphical representation of electrical activity of heart during C.C.

3 electrical leads.

→ One to each wrist and left ankle.

→ For detailed evaluation → Multiply leads to chest Region

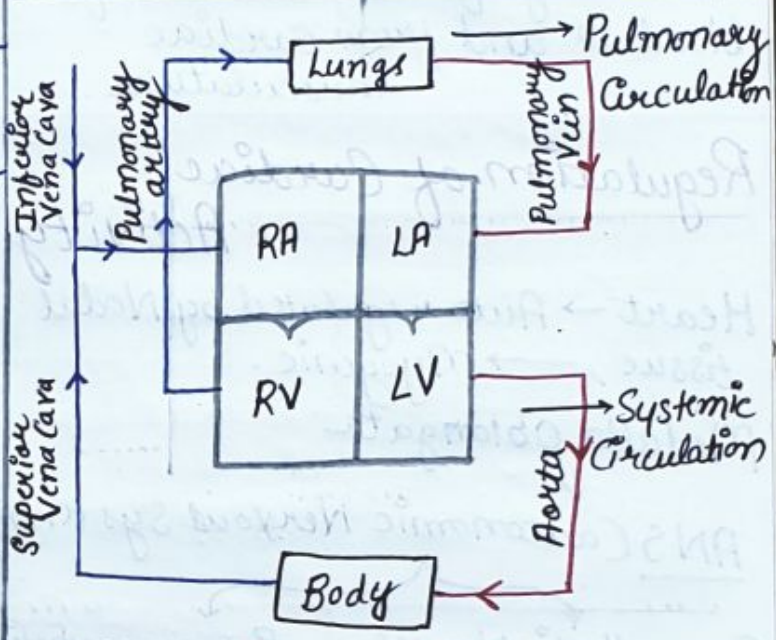
P-Wave

→ Electrical exitation (or depolarisation) of atria.
→ Contraction of both atria.

QRS Complex

→ Depolarisation of ventricles, initiates ventricular contraction.
→ Contraction starts after Q and beginning of systole.
→ T Wave → Return of Ventricles excited to normal state (Repolarisation)
→ End of T Wave → End of Systole.
→ No. of QRS complexes → Heart beat rate of individual
→ Any deviation is shape → Abnormality or disease.
→ Great Clinical Significance.

Artery	Vein
Carry blood away from Heart	Carry blood towards heart.
Tunica media thick	Tunica Media thin
Deep	Superficial
Carry Oxygenated blood (except pulmonary artery)	Carries deoxygenated blood (except pulmonary vein)
Valves present	Valves present.
Blood flow discontinous	Blood flow continuous.



→ Largest Artery → Aorta
→ Largest Vein → Vena Cava

Double Circulation

Blood → Blood Vessels (arteries, Veins) → 3 layers

① Tunica Interna → Inner lining of squamous epithilium.

② Tunica Media → Middle layer of smooth muscle, and elastic fibres.
→ Comparitively thin in Veins.

③ Tunica Externa → External layer of fibrous connective tissue.

Pathway of Blood →
Artery → Arteriole → Cappillaries → Venules → Veins.

Systemic Circulation →
① provides nutrients, O_2, and other essential substances.
② Take CO_2, other harmful substances away for elimination.

Hepatic Portal System

→ Unique Vascular Connection b/w digestive tract an liver.

→ Hepatic Portal Vein

↓

Carries blood from intestine to liver

↓

then, systemic circulation

→ Special Coronary system of blood vessels present in our body exclusively for circulation of blood to and from cardiac musculature.

Regulation of Cardiac Activity

Heart → Auto regulated by Nodal tissue, → Myogenic.

Medulla Oblongata

↓

ANS (Autonomic Nervous System)

Sympathetic Nerves	Parasympethetic neural signals
Heart Beat ↑↑	Heart Beat ↓↓
Cardiac Output ↑↑	Cardiac Output ↓↓

Hormone

Adrenaline → Heart Rate ↑↑

Thyroxine → Heart Rate ↓↓

Tachycardia → High Heart Beat 90<

BradyCardia → <60

Disorders of Circulatory System

① High BP (Hypertension) →

Normally → (120/80) → 80 mm Hg (diastolic)

120 mm Hg (Systolic) → pumping pressure

Resting pressure

Hypertension → (140/90) or higher

mm Hg → millimeters of mercury pressure

Hypertension → Heart diseases and affect Vital Organs, like brain Kidney

② Coronary Artery Disease → (CAD) / Atherosclerosis.

→ affect Vessels that supply blood to Heart muscle.

→ Caused by deposition of Calcium, fat, Cholestrol, fibrous tissues

↓

make lumen of artery narrower.

③ Angina → (Angina Pectoris)

→ Symptom - Acute Chest pain.

→ O_2 don't reach heart muscle

→ More common among middle aged and elderly.

→ Occur due to condition that affect blood flow

④ Heart failure →
When Heart is not pumping sufficient blood.

Main Symtom → Congestion of Lungs
↓
Congestive Heart failure

⑤ Cardiac Arrest →
Heart Stops beating.

⑥ Heart Attack / Myocardial infection →
→ Death of Myogenic tissue, by inadequate blood supply