Toppersnotes
Unleash the topper in you

A to Z

NURSING OFFICER EXAM

For All State NHM, CHO & Nursing Officer Exams

Volume - 1

SIERRA INNOVATIONS

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1 CHAPTER Cell

The cell of the human body is Eukaryotic (Parenchyma) plant cell prokaryotic.

Robert Hook (1665) :-

- Father of cytology – Robert Hook
- Write about cells in a book – micrographic discover double dead cells and also discover double glass microscopes.
- Dead Cell is seen as a jail so called cell.

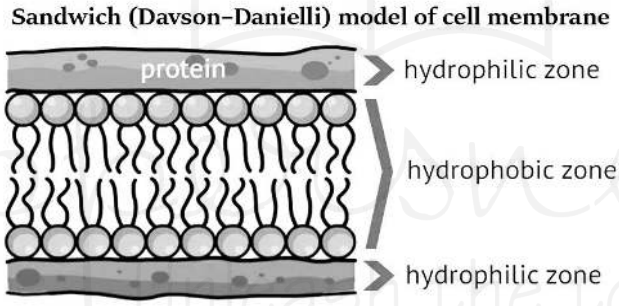
Cell :-

- Size : 10-20 U
- Cell Consist of 3 part
  - ✓ Cell membrane
  - ✓ Cytoplasm
  - ✓ Nucleolus

Cell Membrane :-

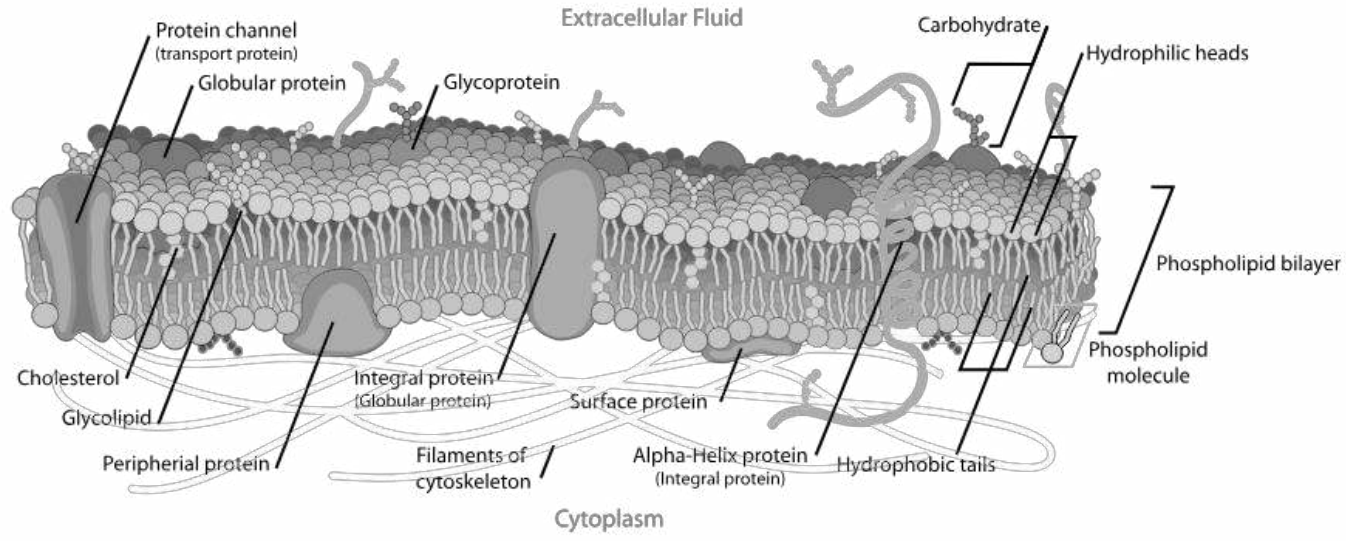
- Cell is Semipermeable / selective permeative membrane biologer Structure
- Thickness – 70-100 A^O ($A^O = 10^{-10}$m) Armstrong
- Consist of Fat, Protein, Carbohydrate & PO4 group

1. Sandwich Model of Cell Membrane :-



1938 : Danniel and Davidson

2. Fluid Mosaic Model :-



Given by S.I. Singer and Nicolson

2. Cytoplasm / Biological Fluid of Body :-

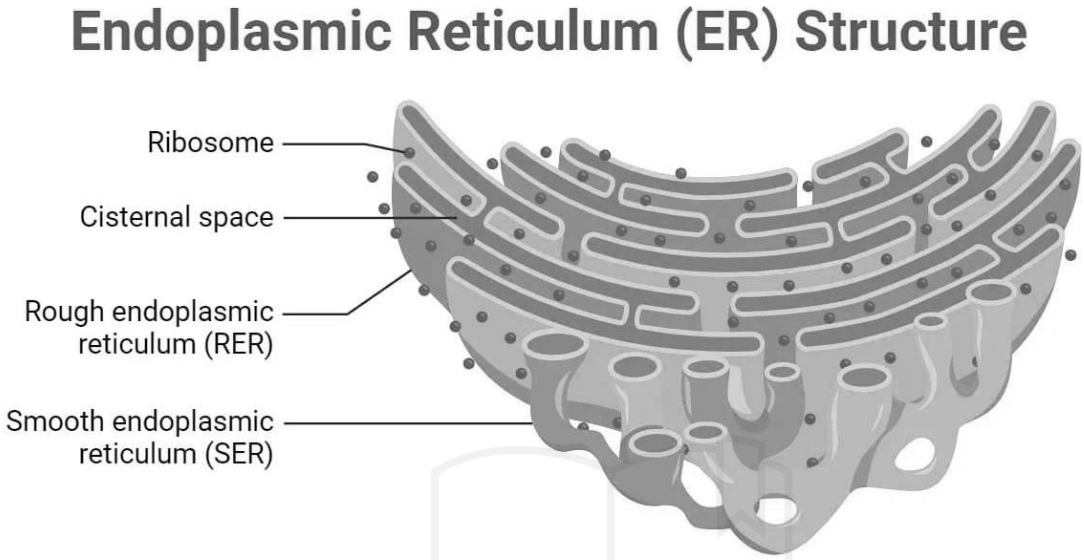
Assimilation :- Formation process of cytoplasm

- ✓ Cytoplasm (90%) = Cytosol (70%) +Organelle
- ✓ Nucleoplasm : Fluid in Nucleolus
- ✓ Protoplasm : Nucleoplasm + Cytoplasm

Cytoplasm is discovered by Rudolf von Kolliker

Cytoplasmic Organelles :-

1) Endoplasmic Reticulum :-



This are found in cell cytoplasm

Function:-

Protein synthesis

Fat synthesis

Steroid hormone synthesis (adrenal gland)

detoxification of drugs

- ➢ Normal Cell – ER
- ➢ Eye Cell – myceloid reticulum
- ➢ Skeletal muscle cell – Sarcoplasmic reticulum
- ➢ Neuron Nissel body / Nissel granules
- ➢ ER is discovered by porter

ER is two types

1) Rough ER :-

It contain ribosome in it surface so called rough ER

Function :-

Protein Synthesis

2) Smooth ER :-

It not contain ribosome on it surface so called smooth ER

Function :-

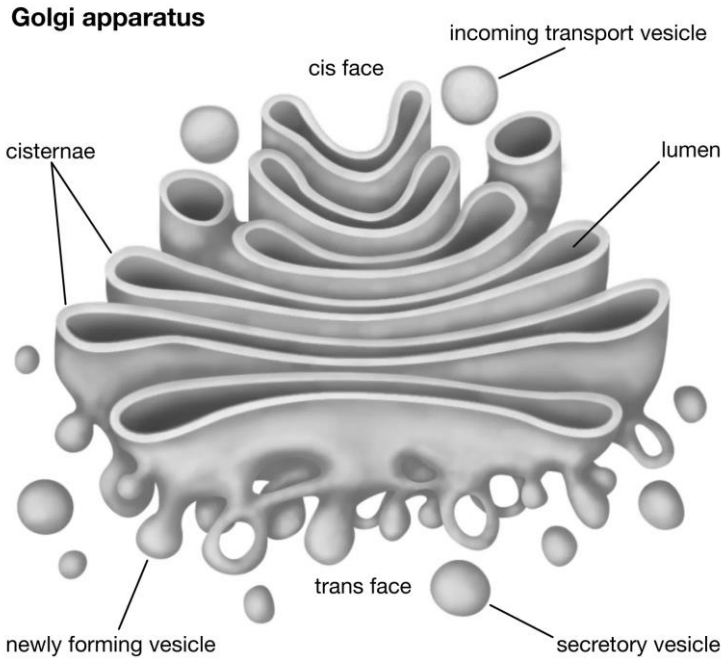
Fat Synthesis

- ➢ **RBC and spermatid not contain ER**
- ➢ **Cell work on Basic medium ie PH = 7.2**

Steroid hormone synthesis (adrenal gland)

Detoxification of drugs

2) Golgi Body :- (Golgi apparatus/Postman of cell)



It is transporter, packager and delivered the protein within cell body
It is also synthesis lysosome.

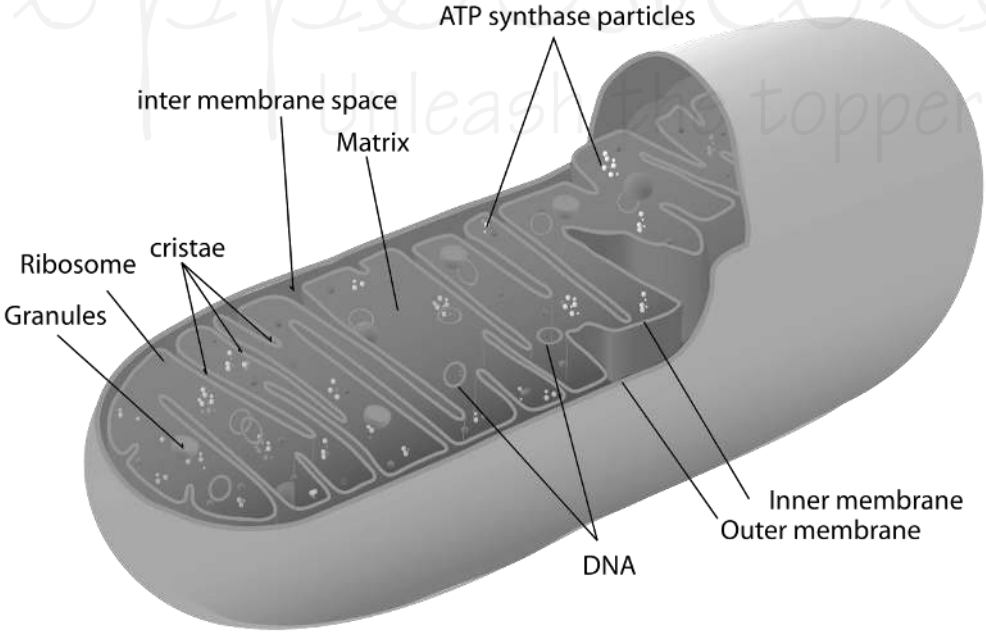
3) Lysosome :-

Suicidal bag of cell
It is synthesized by golgi body
PH of Lysosome is – 5 acidic only

Function :-

Lysosome contain proteolytic enzyme called lysosome hydrolytic enzyme which killed infection agent like bacteria virus so called defender of cell or shoulder of cell
During massive inflammation lysosome district own cell so called suicidal bag cell

4) Mitochondria :-



(Power house of cell)
C. Benda Discover mitochondria
Diameter – 0.5-2 U
Highest Mitochondria – Sperm and SA Node

Bilateral structure
It contain fluid called – Matrix
Phosphorylation enzyme which is responsible for ATP generation
DNA also found in mitochondria also have regeneration power (but not role in genetic transmission)
Enzyme – Cellular respiration/glycolysis

- **Mitochondria 1st organelles destruct in response of hypoxia**
- **During glycolysis – 1 molecule of glycogen enter in pathways**

Function :-
It is responsible for ATP generation so called power house of cell
Glycoses / cellular respiration / Kreb's cycle critic acid cycle (CAC) :-
Check post of body – lymphatic system
Aerobic glycolysis first product is pyruvic acid
Aerobic glycolysis end product = 38 ATP + Hs2O + CO2
Anaerobic glycolysis end product = Lactic Acid + 2 ATP

Electron transport system (ETS) :-
1) Embden Meyerhof pathway (EAP)
   Nicotinamide adenine nucleotide Phosphate ETS 3 ATP
   ($NADPH_2$)
2) $FADHS_2$ ETS 2 ATP
   (Flavin adenine dinuclectide)

5) Ribosome / Protein Factory / Cell Engine molecular machine :-

This are consist of protein and RNA this
40% RNA
60% Protein

Eukaryotic	Prokaryotic
80s	70s
60s 40s	50s 30s

Ribosome are two type

1) Bind Ribosome :-
Suspended in cytoplasm freely

Eukaryotic Cell contain 80s Ribosome

80s

60s 40s

Prokaryotic Cell contain 70s ribosome

70s

50s 30s

Functions :-

1) **Translation :-** It Translate M-RNA to Protein so help in protein synthesis
   R-RNA heterogenicity related disorder
   eg.Hepatitis – C (Cricket associated paralysis)
6) **Centrosome :-**
   The centrosome is a crucial organelle found in animal cells, acting as the main microtubule-organizing center (MTOC) and a key regulator of cell division. It's a non-membranous structure located near the nucleus,

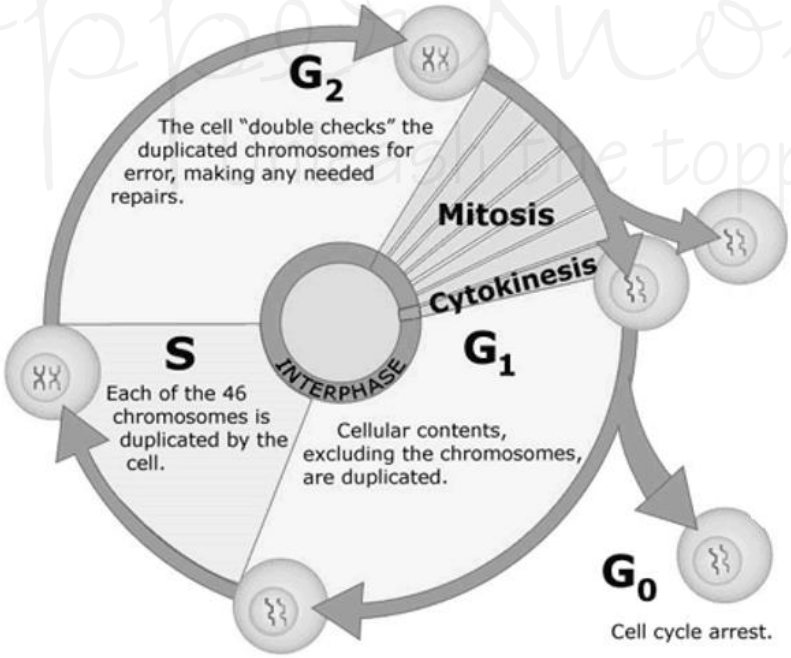
Function :-

It helps in cell division by mitigating chromosomes towards poles at anaphase of cell division.

- **Most common cancer of brain in adult – Glioma (Headache)**
- **Glioma is malignant but not metastasis**
  Centrosome contain two centromere

★ **Neurons do not contain centrosomes, so the neuron is the only cell of the body which is non mitotic.**

Cell Cycle :-



The cell cycle is a series of events that take place in a cell leading to its division and duplication.

Interphase (90%)

1) G_1 – (90%)
2) S – Phase
3) G_2 – Phase

Mitosis – (10%)

1. Prophase (max)
2. Metaphase
3. Anaphase
4. Telophase

Interphase :-

G – phase :- It is two types

1. G_1 Phase -
2. G_O Phase (Resting Phase)

1) G_1 Phase :- (Growth – 1)

❖ **Cell spend its maximum time in this phase (90%) in this phase cell size, cytoplasm, protein are increased up to double**

2) G_O Phase :- (Resting Phase)
In this phase cell divided or in rest
eg. Neurons

3) S-Phase (Synthesis Phase)
In this phase DNA is synthesis which is required for cell division DNA Replication occurs.
- ✓ **Most common brain cancer in children**– Medulloblastomas
- ✓ **Most common childhood brain tumour is**– ependymomas

G_2 Phase :- In this phase all substances increase DNA replication. Cell produce protein to be used in cell division.

Mitosis Phase (M-Phase) :-

- ➢ **Normal Cell spend it 10% time in M-Phase**
- ➢ **Cancerous cell spend it maximum time in M-Phases**

M-Phase is 4 types :-

A) Prophase :-
Largest phase of M-Phase
In this phase, increase chromatin and disappear nucleolus

B) Metaphase :-
In this phase cell chromosome collect in center and divide by chromatid

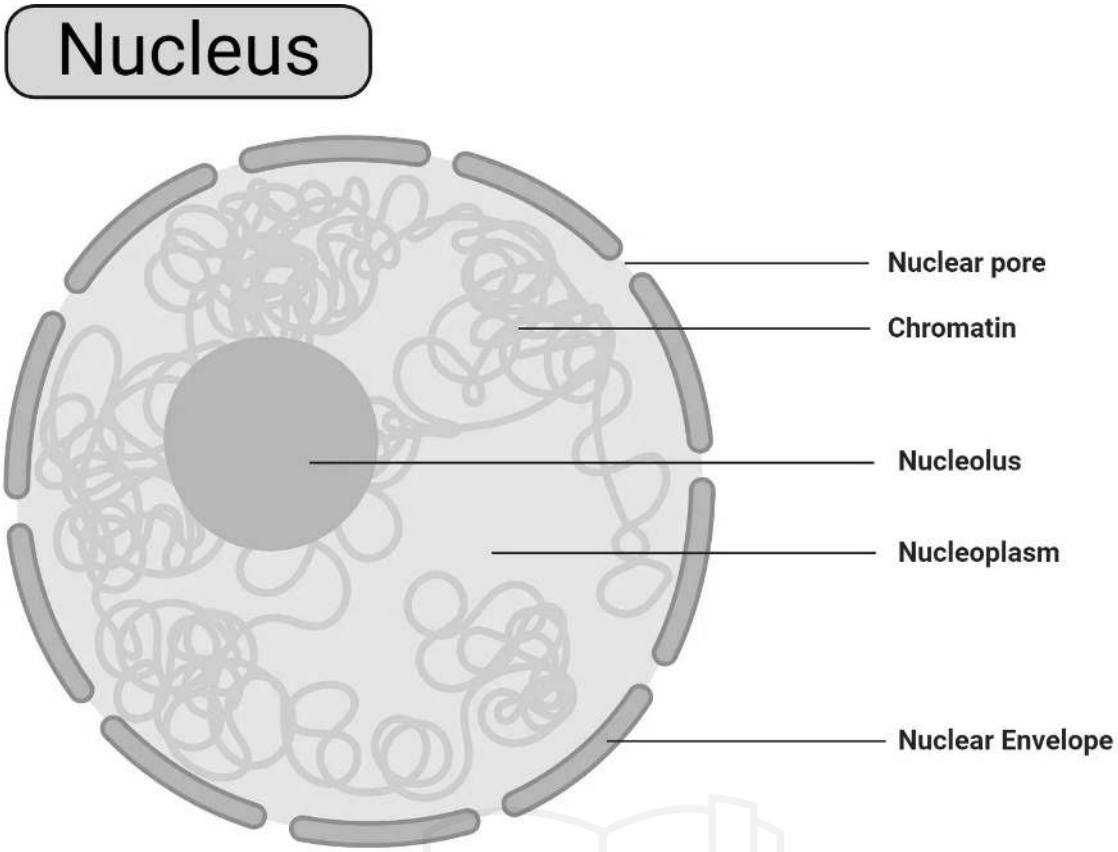
C) Anaphase :-
In this phase chromosome is migrate toward pole by help of centrosomes

D) Telophase :-
In this phase cell division is completed

7) Microtubule and Microfilament :-
Cytoskeletal / Cell Scaffold
Microfilament – 3-4 mm
Microtubule and microfilament help in cell movement with the help of this

8) Vacuoles :-
Storage of nutrient

3) Nucleolus :-
(Controller of cell / Brain of Cell)
Discover by Robert Brown
Largest Organelle of cell
Eukaryotes Cell – Center
Control whole cell and help in cell division
Nucleolus contain nucleoplasm



Protein Synthesis :-

When deficiency of protein in cell, Gene / codon give massage to nucleus contain DNA and size of DNA is large, so it can not cross membrane.

- DNA double helix change into single chain RNA & give massage to rough ER via M-RNA (Massager RNA)
- This massage read by T-RNA (translate / anticodon RNA)
- DNA to RNA = Transcription
- RNA to DNA = Reverse Transcription
- Rough ER make protein and Ribosome change into protein
- After that Golgi body receive this protein and pack deliver and transport the protein to definitive organics

Toppersnotes Unleash the topper in you

2 CHAPTER Tissue

- Group of Cell is known as tissue
  Name given by – Grew
  Scientific study of tissue = Histology
- **Function :-** Secretion, absorption, excretion& protection of body

4 Type Of Tissue :-

1. Epithelial tissue
2. Connective tissue
3. Nervous tissue
4. Muscle tissue

1.) Epithelial tissue :-

↓ ↓

Upon Membrane

These are group of cell lies on the basement membrane called epithelial tissue

Types :-

A) Simple Epithelial tissue

B) Startified Epithelial tissue

A) Simple Epithelial tissue :-

- ✓ These are single layer of cell lies on the basement membrane

1. Simple squamous epithelial tissue :-

- ✓ These are found in Alveoli of lung of nephron (ascending loop of Henle)
- ✓ Endocardium of heart
- ✓ Endothelial lining of capillary – Nephron LOH

2. Simple cuboidal epithelial tissue :-

- ✓ Found in thyroid gland
- ✓ Prostate gland
- ✓ Nephron LOH, DCT, PCT

3. Simple Columnar epithelial tissue :-

- ✓ intestinal mucosal
- ✓ Trachea
- ✓ Fallopian tube
- ✓ Uterus

B) Stratified Epithelial tissue :-

- ✓ These are multiple layer of cell which are lies on basement membrane

These are 2 types :-

1. Stratified squamous epithelial tissue :-

- ✓ Keratinizing stratified squamous epithelial tissue
  - Epidermis layer of skin
- ✓ Non keratinizing stratified squamous epithelial tissue
  - Female vagina
  - Conjunctiva
  - Pharynx
  - Esophagus

- ✓ **Hair, Nail cartilage connects epidermis lens are avascular structure of body**
- ✓ **Epidermis is developed from ectoderm**

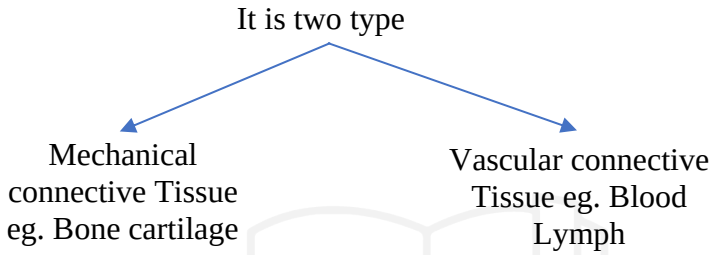
C) Transitional epithelial tissue :-

- Pear shape cell
- Multiple layer
  - ☞ Urinary bladder mucosa stretching power & contract
  - ☞ New born baby vagina

- ✓ **Fallopian tube contain simple columnar epithelial tissue**
- ✓ **Adult female vagina contain stratified squamous epithelial tissue (Non keratinising)**
- ✓ **Urinary bladder contain transitional epithelial tissue called urothelium**

2.) Connective Tissue :-

- ✓ Tissue which connect the body
- ✓ Highly abundant amount of tissue in body
- ✓ Provide support to body



- ➢ **Connective tissues are made up of collagen fiber, elastic fiber and reticular fiber.**
  - ✓ **Skin and blood vessels contain collagen – 1st protein**
  - ✓ **Lens contain collagen – IV Protein**
  - ✓ **Vit C is required for collagen fiber synthesis**
  - ✓ **Vit C deficiency cause scurvy (gum bleeding)**
  - ✓ **Vit C help in wound healing by collagen protein synthesis**

Connective tissue disorder :-

- ➢ MARFAN Syndrome
- ➢ Sjogern Syndrome
- ➢ Rheumatic arthritis
- ➢ Rheumatic Fever
- ➢ Systemic Lupus erythematous (SLE)
- ➢ Scleroderma – Hardening of Skin

1. MARFAN Syndrome :-

Connective tissue disorder in which abnormal synthesis of fibrillin 1st protein
It is genetic disease
S/S :-
M – Mitral Valve Stenosis
A – Aortic Aneurism
R – Retinal Deattachment (myopia)
F – Failure of heart
A – Aractodacty (long finger – Spider like finger)
N – Nine feet height

2. Sjogern Syndrome :-

It is a autoimmune disorder of connective tissue which affect moisture producing gland

S/S :-

Dry mouth

Dry Eye

3. Systemic lupus Erythematous (SLE)

It is Autoimmune disease

Connective tissue multisystem disorder

Type – III hypersensitivity reaction / Immune complex

C/S/S :-

Butter Fly rashes on face / malar rash

D/E :-

ANA Titer (Anti-Nuclear Antibody)– IOC (1:40)

RFT, CRP (0-3mgl)

RBC become lupus cause anomies

Erythema of palm (red)

CRP :-

It is protein released by liver

Absent CRP level indicate – liver failure

Rx :-

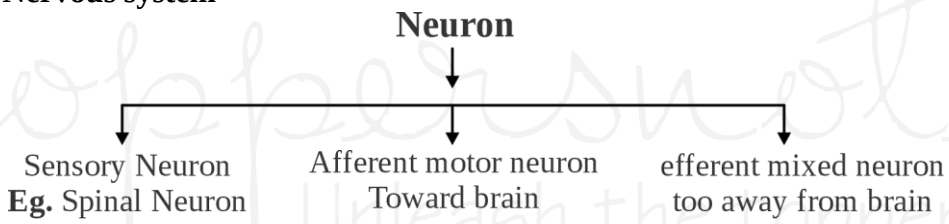
→ Steroid immunosuppressant – cyclophosphamide

→ Plasmapheresis, Vit C Diet rich

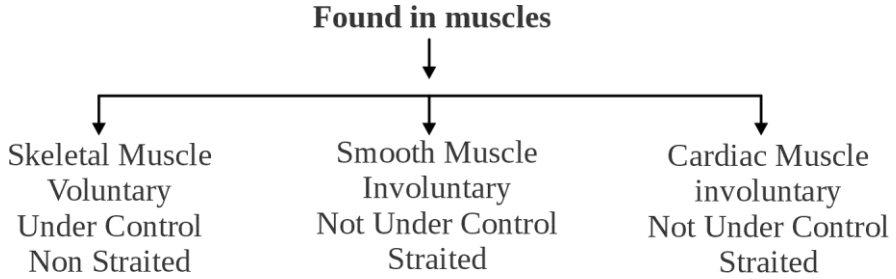
→ Sccmccu transplant in life threatening SLE

3) Nervous tissue :-

Found only in Nervous system



4.)Muscle Tissue :-



3 CHAPTER Blood

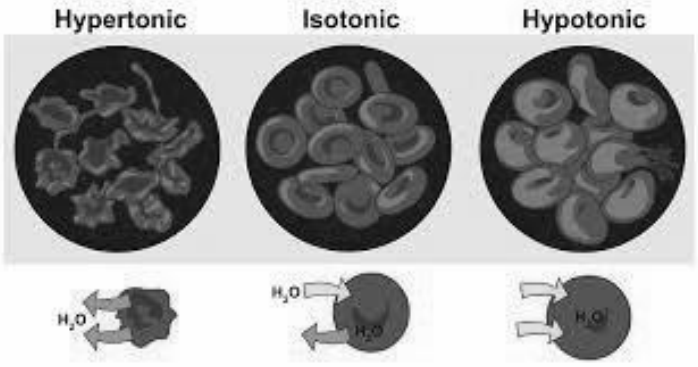
General Properties of Blood

Property	Value / Fact
Color	**Red** (due to Hemoglobin, respiratory pigment)
Nature	Vascular connective tissue
Total Volume	**5–6 liters** (≈ 7–8% of body weight, or 80 ml/kg)
pH	**7.35–7.45** → Slightly alkaline
Specific Gravity	**1.050–1.069**
Viscosity	**5× thicker than water**
Origin	Derived from **mesoderm**

Nursing Booster:

- Blood is slightly alkaline → essential for cell function.
- Most exams ask: **Normal blood volume = 5–6 L (≈ 7–8% of body weight).**

Behavior in Solution



- **Hypotonic solution:** RBC absorbs water → swells → ruptures → **Hemolysis**
- **Isotonic solution (0.9% NaCl):** No change
- **Hypertonic solution:** RBC shrinks (crenation)

Exam Booster:

- Question often asked: *"RBC in hypotonic solution undergoes → Hemolysis."*

Body Fluids Distribution

Age Group	% of Body Weight as Fluid
Adult	**60%**
Old age	**55%**
Newborn	**80%**

Nursing Booster:

- Body water % **decreases with age**.

Compartmental Distribution of Body Fluid

For an **adult male, 70 kg** body weight:

- **Total Body Fluid** = 60% of 70 = **42 liters**

Fluid Compartment	% of Total	Volume (Liters)
Intracellular Fluid (ICF)	70%	**28 L**
Extracellular Fluid (ECF)	30%	**14 L**

Mnemonic: *"I (ICF) hold more, E (ECF) holds less."*

Composition of Blood

Cellular Ratios

Ratio	Value
Platelets : WBC	**40 : 1**
RBC : WBC	**600 : 1**
RBC : Platelets	**10 : 1**

Nursing Booster:

- WBC count ↑ in newborns (11,000–17,000/cumm)
- WBC count ↑ in pregnancy (up to 20,000/cumm)

Plasma Proteins

Plasma = blood matrix, contains **3 major proteins**:

(a) Albumin

- **Normal:** 3–5 g% (≈ 54% of total plasma proteins)
- **Synthesis:** Liver (Hepatocyte ER)
- **Types:**
  - ✓ Pre-albumin (0.03 g/dl) → transports **T_3, T_4, Hb**
  - ✓ Albumin → transports **Na^+, K^+, Cl^-, bilirubin**
- **Functions:**
  - ✓ Maintains **osmotic pressure** at capillary end
  - ✓ Transports hormones & minerals

Exam Booster:

- ↓ Albumin → edema, jaundice (bilirubin transport failure).
- Most abundant plasma protein = **Albumin.**

(b) Globulin

- **Normal:** 2.3 g/dl (2nd most abundant protein)
- **Synthesis:** Plasma cells
- **A:G ratio:** Normal = 1.7:1 | Pregnancy = 1:1 (due to ↓ Albumin)
- **Functions:**
  - ✓ Forms **glycoproteins** (e.g., erythropoietin)
  - ✓ Forms **lipoproteins**

Lipoproteins:

Type	Normal	Function
HDL (Good cholesterol)	30–70 mg/dl	Transports fat **from blood → tissues**
LDL (Bad cholesterol)	≤130 mg/dl	Transports fat **from tissues → blood vessels**
VLDL	<200 mg/dl	Internal fat transport (liver → adipose tissue)
Chylomicrons	<200 mg/dl	External fat transport (intestine → blood)

Exam Booster:

- Estrogen & exercise ↑ HDL; smoking ↓ HDL → ↑ cardiac risk.
- Fat intake = triglycerides; stored as **triacylglycerol (TAC).**

(c) Special Plasma Proteins

Protein	Function	Normal	Clinical Note
Transferrin	Iron transport	3–4.5 mg/dl	Helps iron absorption in GIT
Ferritin	Iron storage (mainly in liver, 2–4 g)	F: 12–300 ng/ml, M: 150–300 ng/ml	Best test for **community anemia**
Ceruloplasmin	Cu^{2+} transport	–	Deficiency → **Wilson's disease** (Cu^{2+} deposits in liver, kidney, brain → failure + Kayser–Fleischer ring in eye)
Haptoglobin	Binds free Hb → prevents kidney loss	–	Low in **hemolysis**
Fibrinogen	Clotting factor I	0.3 g% (300 mg/dl)	1st clotting factor, prevents **rouleaux** formation

Exam Booster:
- Wilson's disease → **Kayser–Fleischer ring** (brown ring at corneal limbus).
- Serum ferritin = **best test for detecting anemia** at community level.

Fat Metabolism
- Dietary fat intake = **triglycerides**
- Stored in adipose tissue as **TAC (Triacylglycerol)**
- **Bile salts** emulsify fat → water soluble → absorption

Newborn vs Adult Fat:
- **Newborn:** Brown fat (thermogenesis)
- **Adult:** Yellow fat (energy storage)

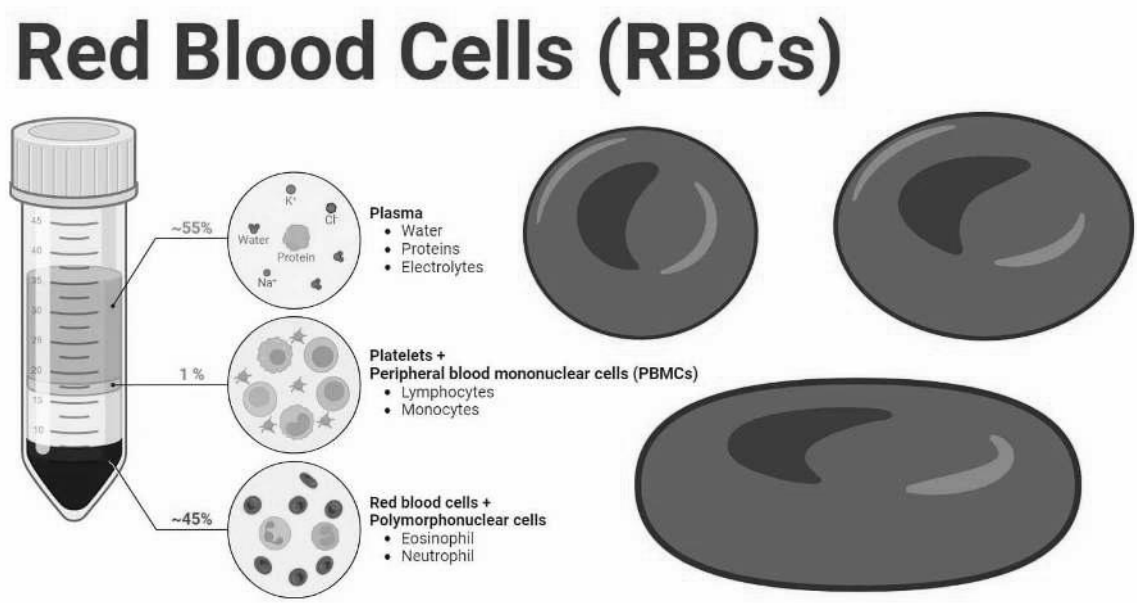
Blood Donation & Transfusion

Process	Safe Volume
Blood Donation	7 ml/kg body weight
Blood Transfusion	10 ml/kg body weight

Exam Booster:
- Donor: Max **350–450 ml** in one sitting.
- Frequent exam Q: "Safe limit for transfusion = **10 ml/kg**."

Blood Cells

RBC (Erythrocytes)



Feature	Normal Value / Fact
Count (Female)	4.5–5.5 million/cumm
Count (Male)	5.5–6.5 million/cumm
Newborn	6.8 million/cumm
Lifespan	120 days (adult), 60–80 days (newborn)
Size	7.2 μ (normocytic)
Shape	Biconcave, disc-shaped
Erythropoiesis Time	7 days
Nucleus	Absent (limits lifespan)

Booster:

- Newborn → ↑ RBC count, ↓ lifespan, immature liver → **risk of physiological jaundice.**

Abnormalities

- **Anisocytosis** → abnormal size
- **Poikilocytosis** → abnormal shape
- **Spherocytosis** → spherical RBC

RBC Membrane Special Features

- **Proteins:** Spectrin, Ankyrin (maintain shape)
- **Antigens:** ABO & Rh blood group determinants
- **Enzyme:** G6PD (metabolizes drugs like aspirin, quinine, gentamicin, amikacin)
  - ✓ Deficiency → **drug-induced hemolysis**
  - ✓ Also associated with **Von Gierke's disease** (glycogen metabolism defect).

Booster:

- Hemoglobin = **best buffer in blood**.
- Glutathione protein maintains normal Hb (35 ± 2% inside RBC).

Erythropoiesis

Definition: Formation & maturation of RBC.

- **Hormone:** Erythropoietin (from kidney, afferent arteriole → in response to hypoxia).
- **Time:** 7 days.

Sites of RBC Formation

Stage	Site
Fetus (0–3 months)	Yolk sac (mesoderm)
Fetus (4–6 months)	Liver & spleen
Fetus (7 months–birth)	Red bone marrow of long bones (tibia, femur, radius, ulna)
Birth–18 years	Red bone marrow of long bones
>18 years	Red marrow of flat bones (sternum, vertebrae, ribs)

Booster:

- If bone marrow destroyed → **liver & spleen re-activate** as erythropoietic organs.

Spleen

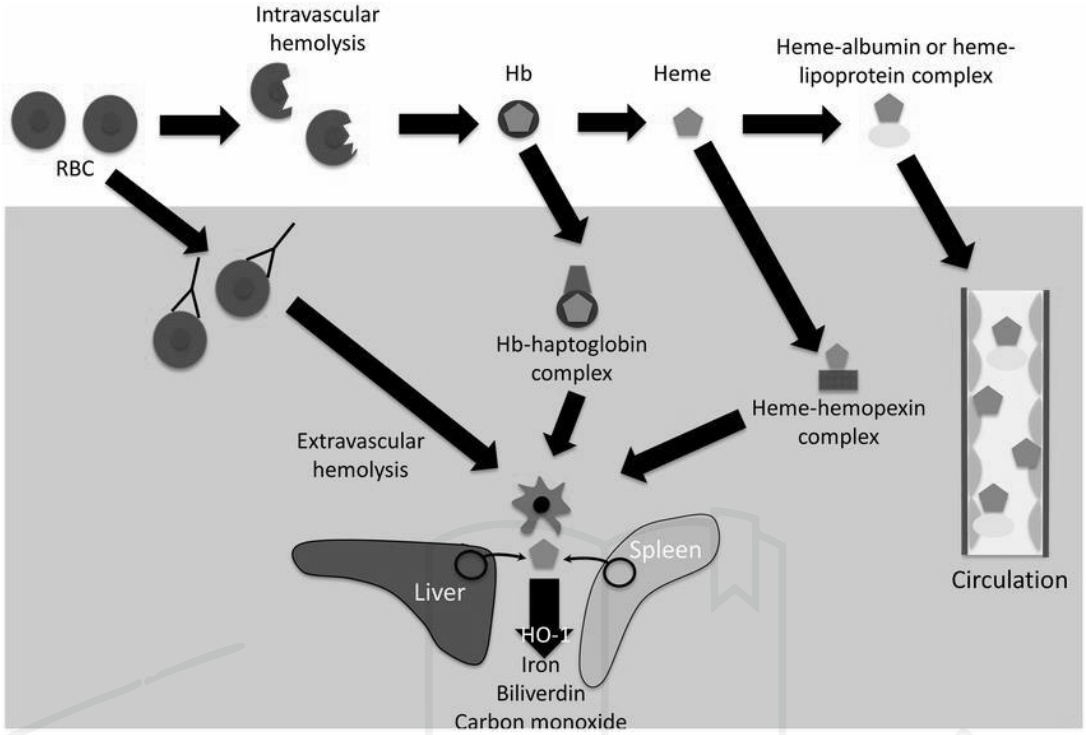
- Largest **lymphatic organ**
- Location: Below **9th–11th ribs**
- Stores ~**240 ml RBC** ("blood bank of body")

- **Red pulp:** venous sinuses (RBC destruction)
- **White pulp:** WBCs (immune function)
- Removes old (>120 days) or fragile RBC → "**Graveyard of RBCs**"

Booster:

- Contains **reticuloendothelial cells** → phagocytose abnormal RBCs.

Hemolysis & Jaundice



Types of Jaundice

Type	Cause	Key Lab Finding
Pre-hepatic	Hemolysis (Rh/ABO incompatibility, sickle cell anemia)	↑ Indirect (unconjugated) bilirubin
Hepatic	Hepatitis, cirrhosis, ↓ UDPGT enzyme	↑ Indirect bilirubin
Post-hepatic	Obstruction (stone in bile duct, tumor)	↑ Conjugated bilirubin

Syndromes

- **Crigler–Najjar Syndrome:** Complete absence of UDPGT → ↑ unconjugated bilirubin → needs **liver transplant**.
- **Gilbert's Syndrome:** Partial deficiency of UDPGT → mild unconjugated hyperbilirubinemia.
- **Dubin–Johnson Syndrome:** Autosomal recessive, obstruction in bile excretion → ↑ conjugated bilirubin (liver black).
- **Rotor Syndrome:** Similar to Dubin–Johnson but without liver pigmentation.

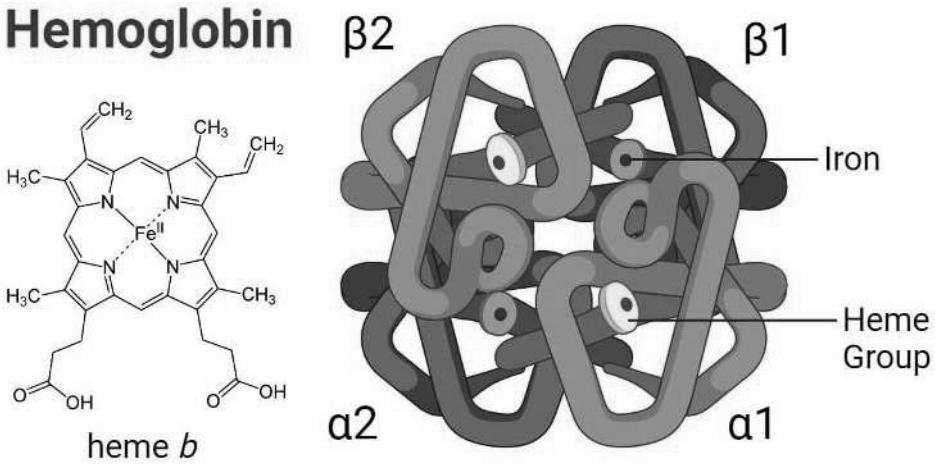
Normal Values:

- Indirect bilirubin = 0.3–1 mg/dl
- Conjugated bilirubin = 0.1–0.2 mg/dl

Diagnostic Tests

- **Bilirubin (urine):** Fouchet's test, Ehrlich's test, Smith's test
- **Bile salt:** Hay's test
- **Ketone in urine:** Rothera's test
- **Phenylketonuria:** Guthrie test (blood)

Hemoglobin (Hb)



- Hemoglobin = **respiratory pigment** in RBC.
- Each RBC contains Hb = **35 ± 3% of weight**.
- **Iron form in Hb:** Ferrous (**Fe^{2+}**)
- **Dietary iron:** Ferric (**Fe^{3+}**) → reduced to Fe^{2+} by **HCl + Vitamin C** (acidic medium).

Nursing Booster:

- Give oral iron **before meals**, with lemon/orange juice (Vitamin C).
- **Contraindicated with milk.**
- Iron syrup → give slowly → prevents **green/black teeth discoloration**.
- Best Vitamin C source = **Amla (Indian gooseberry).**

Normal Hemoglobin Levels

Group	Hb Value
Male	14–16 g/dl
Female	12–14 g/dl
Newborn	18–20 g/dl
4-month-old baby	~10 g/dl

Iron & Oxygen Transport

- **1 g Hb = 3.34 mg iron**
- **50% of body iron** is in blood
- **1 Fe^{2+} ion = carries 4 O_2 molecules**
- **1 g Hb = carries 1.34–1.36 ml O_2**
- **100 ml blood = 19–21 ml O_2 capacity**
  Saturation (SpO_2): Oxygen carrying capacity of Hb
- SpO_2 = **6th vital sign**

Binding Affinity of Hemoglobin

Gas	Compound	Affinity vs O_2
O_2	Oxyhemoglobin (HbO_2)	1×
CO_2	Carbaminohemoglobin (Hb–NHCOOH)	20×
CO	Carboxyhemoglobin (HbCO)	**200× stronger than O_2**
Reduced Hb	Hb without O_2	–

Nursing Booster:

- CO poisoning → **HbCO** (deadly, binds 200× stronger than O_2).

Abnormal Hemoglobin

Methemoglobin (HbOH)

- Fe^{2+} oxidized → Fe^{3+}
- Cause: **cyanide poisoning, ionized drugs**
- Antidote: **Amyl nitrite**
- Result: Hb cannot carry O_2 → hypoxia

Note: Hb also transports **T_3, T_4, glucose, nitric oxide (NO)**.

- NO acts as **vasodilator** → aids pulmonary gas exchange.

Types of Hemoglobin

Type	Description
HbF (Fetal)	↑ O_2 affinity, present till ~4 months age
HbA (Adult)	Normal adult hemoglobin
HbS (Sickle Hb)	Mutation: Glutamic acid → Valine (6th position, β-chain) → Sickle Cell Anemia
HbC	Variant, may cause hemolytic anemia
HbE	Mutation: Glutamic acid → Lysine (25th position, β-chain)

Exam Booster:

- HbF > HbA in O_2 affinity.
- HbS = **Sickle cell anemia** → Hemolytic anemia.
- Best buffer in blood = **Hemoglobin.**

RBC Indices & Related Tests

RBC Indices

- **MCV (Mean Cell Volume):** 84–94 fL → Avg. size of RBC
- **MCH (Mean Corpuscular Hb):** 27–32 pg → Hb per RBC
- **MCHC (Mean Corpuscular Hb Conc.):** 35 ± 3% → % of Hb in RBC
- **Color Index (CI):** 0.85–1.15 (≈ 1:1) → Hb level vs RBC count
  - ✓ **Low CI** = Hypochromic anemia
  - ✓ **High CI** = Hyperchromic anemia

Hematocrit (PCV)

- **High PCV (↑):**
  - ✓ Dehydration
  - ✓ Diabetes insipidus
  - ✓ Dengue, Burns
  - ✓ Polycythemia vera
  - ✓ COPD / Kidney hypoxia
  - ✓ High altitude
- **Low PCV (↓):**
  - ✓ Pregnancy (normal >30%)
  - ✓ Anemia
  - ✓ Malnutrition
  - ✓ Acute Myeloid Leukemia

Polycythemia Vera

- Bone marrow cancer → ↑ RBC
- PCV >70%
- Thick blood → clot risk

ToppersNotes Unleash the topper in you

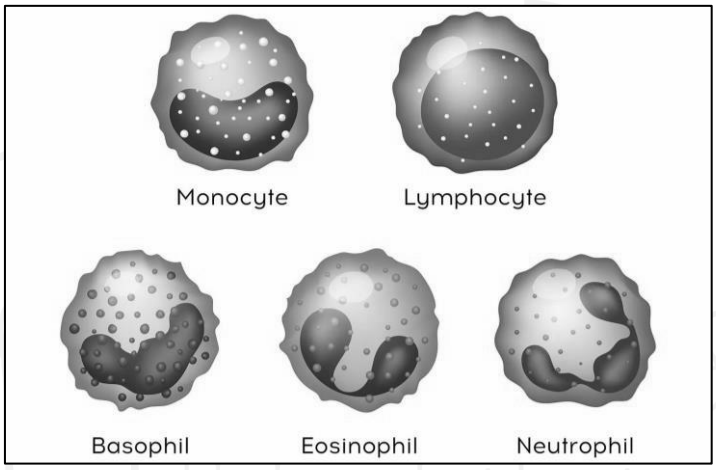
ESR (Erythrocyte Sedimentation Rate)

- **Normal:**
  - ✓ Male → 10–15 mm/hr
  - ✓ Female → 10–30 mm/hr
  - ✓ Newborn → 0–2 mm/hr
- ↑ **ESR:** Pregnancy, Anemia, TB, RA, SLE, Asthma, Multiple myeloma
- ↓ **ESR:** Polycythemia vera, Sickle cell, Leukemia, CHF
  - ✓ **Zeta potential ↓ → ESR ↑**
  - ✓ **Fibrinogen ↑ → ESR ↑**
  - ✓ Test discovered by **Edmund Biernacki**

Nursing Booster Points

- **MCV:** 84–94 fL
- **MCHC:** 35 ± 3%
- **CI normal:** ≈ 1
- **PCV >70% = Polycythemia vera**
- **ESR ↑ = Inflammation**
- **ESR ↓ = Polycythemia / Sickle c**

WBC / Leukocytes



- Leuko = **colourless**
- **Nucleated blood cells**
- **Largest blood cells**
- **Least numerous blood cells**
- Function → **Body defenders (immunity)**

Normal Count

- Adult: **4,000 – 11,000 / cumm**
- Newborn: **11,000 – 17,000 / cumm**
- Pregnancy: **up to 20,000 / cumm**

WBC Disorders

Leukopenia (WBC < 4,000 /cumm)

Causes:

- Starvation
- Typhoid fever
- Viral infections
- Protozoal infections