

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Physiology

الزتونة المنتظرة

في

الحيوان ✨



اللهم نسألك بأسمك الأكرم
الذي إذا دُعيت به أجبت
اللهم أنصر أخواننا في فلسطين
اللهم وحد صفهم وأجمع كلمتهم على الحق
اللهم عليك بالصهاينة المعتدين الغاصبين
اللهم أرنا بهم عجائب قدرتك واشف صدور
قوم مؤمنين يا ذا الجلال والإكرام

By : Ahmed Salah ✍️

☆ يلا بينا نفرم الحيوان يا دكترة 🤓
☆ هنبدأ ان شاء الله في فرع " Physiology "

Physiology

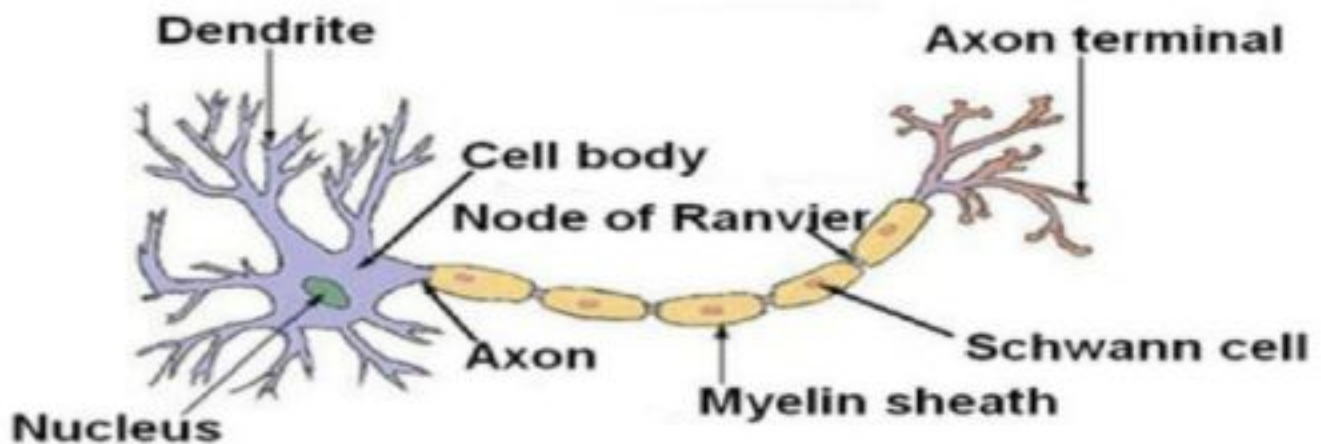
☆ Nervous system:

☆ Types of Nervous:

Sensory Neurons	Motor Neurons	Interneurons
Input from sensory organs to the brain and spinal cord.	Output from the brain and spinal cord to the muscles and glands.	Carry information between other neurons only found in the brain and spinal cord.



Structure of a Typical Neuron



☆ The cell body:

- Round , centrally located structure.
- Contains the cell Nucleus and DNA .
- Contains Nissle granules.
- No Centrioles.
- Controls protein manufacturing.

☆ Dendrites:

- information collectors.
- Receive inputs from neighboring neurons.
- No Nissle granules.
- if enough inputs the cell's Axon may generate an **Output**.

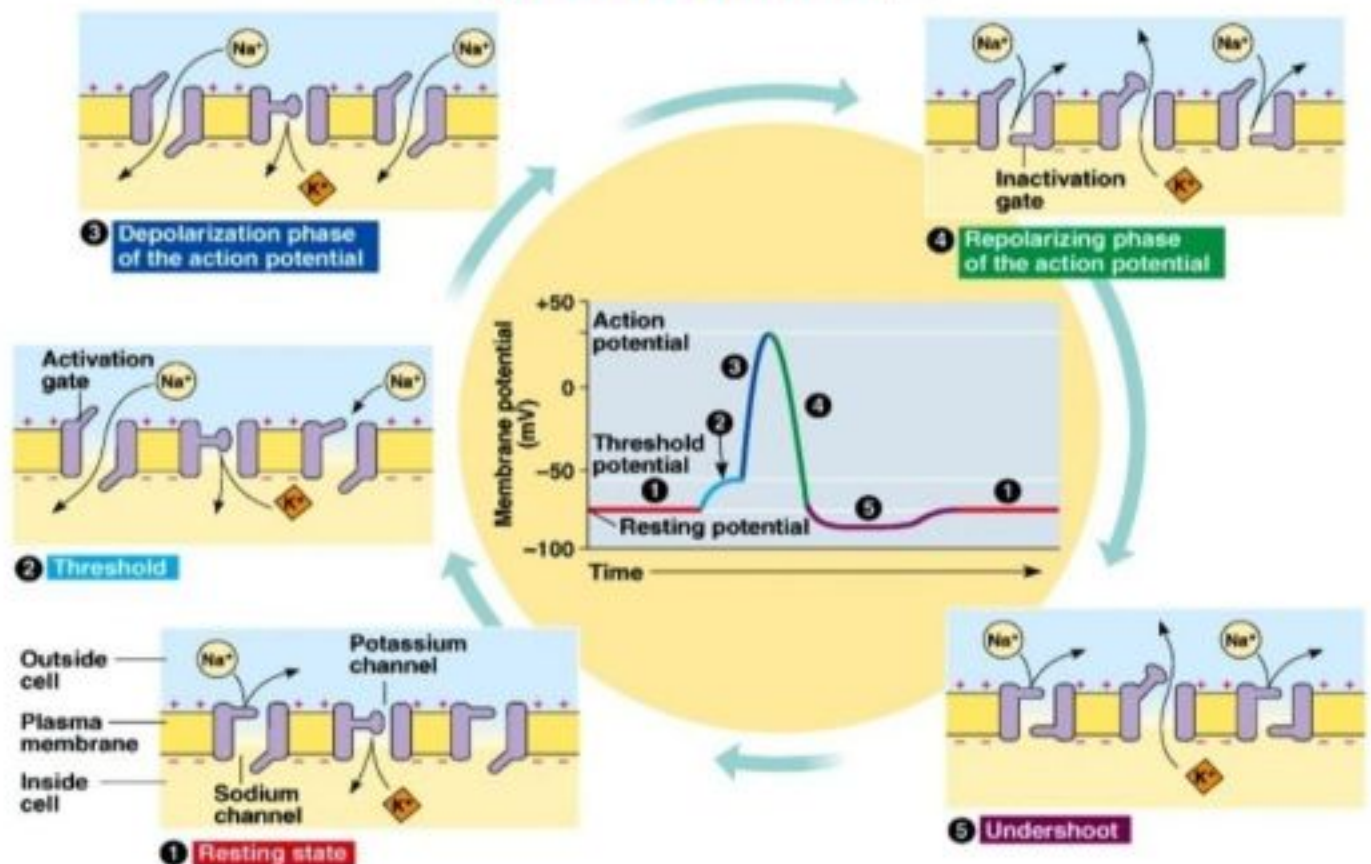
☆ Axon :

- The cell's output structure.
- tubelike structure branches at end that connect to dendrites of other cells.

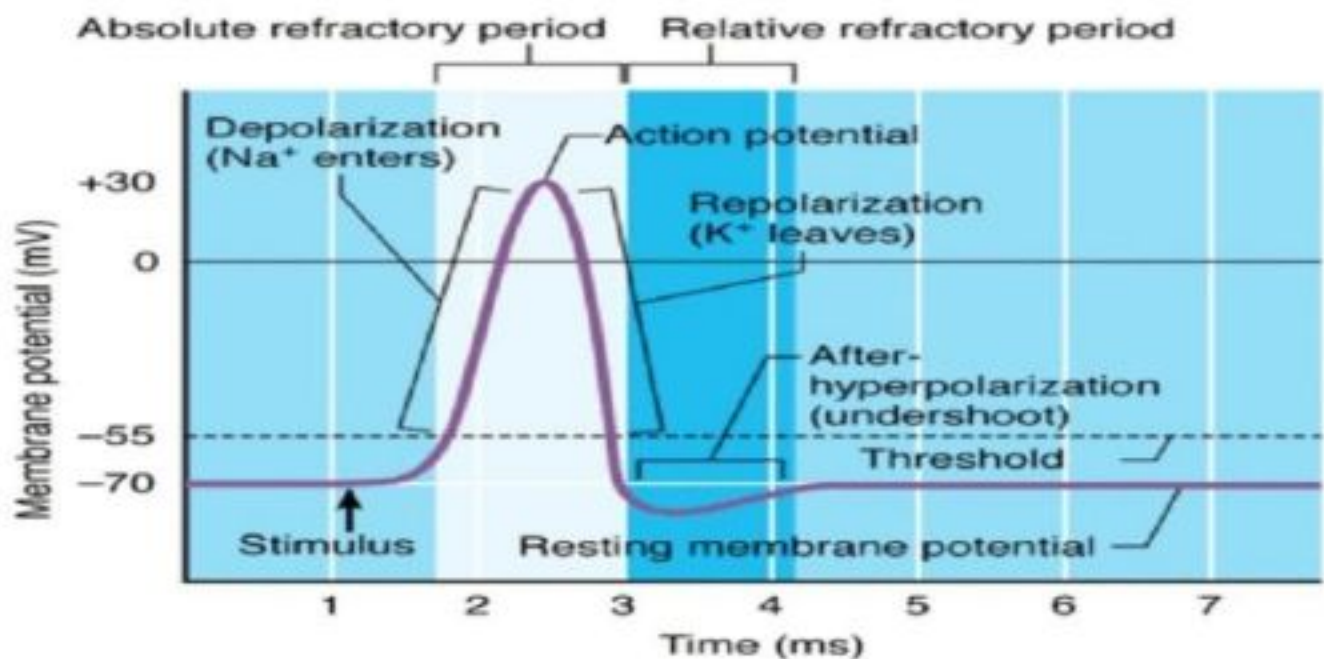
☆ Myelin sheath:

- White fatty casing on Axon.
- Acts as an electrical insulator.
- Not present on all cells .
- When present increases the speed of neural signals down the axon.

☆ Action potential ☆



1. Resting membrane potential .
2. Depolarizing stimulus.
3. Membrane depolarizes to threshold.
4. Rapid Na^+ entry depolarizes cells .
5. Na^+ channels close and slower K^+ channels open.
6. K^+ moves from cell to extracellular fluid.
7. K^+ channels remain open and additional K^+ leaves cell , hyperpolarizing it .
8. Voltage - gated K^+ channels close .
9. Cell returns to resting ion Permeability and resting membrane potential.



☆ خلي بالك يا دكترة:

- ☆ Action potentials are based on movements of ions between the outside and inside of the cell.
- ☆ Nervous communication by means of an electrical signal called **Action potential**.
- ☆ When an **action potential** occurs a molecular message is sent to neighboring neurons.

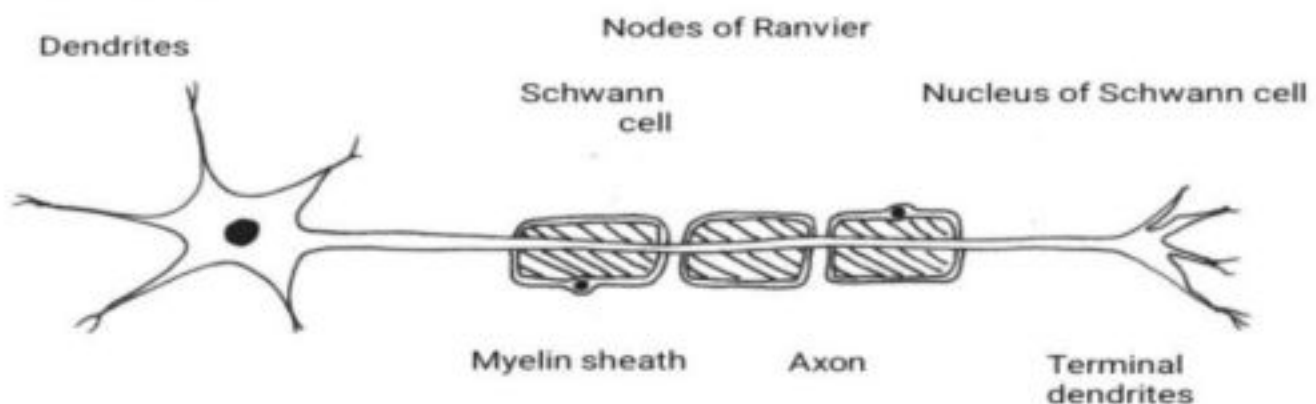
☆ Synapse :

- axon terminals contain small storage sacs called **Synaptic vesicles** .
- vesicles contain **neurotransmitters molecules** .

☆ خلي بالك يا دكترة:

- ☆ Action potential causes **vesicles to open** .
- ☆ **Neurotransmitter** released into Synapse.
- ☆ Locks onto receptor molecules in the **Postsynaptic** membrane.

☆ The Neuron :



☆ Neurones:

- Neurons like other cells are more negatively charged inside than outside.
- This results in a **membrane potential** of about - 70 mv .
- This is called **the resting potential** of the neuron.

☆ Potassium & Sodium ions :

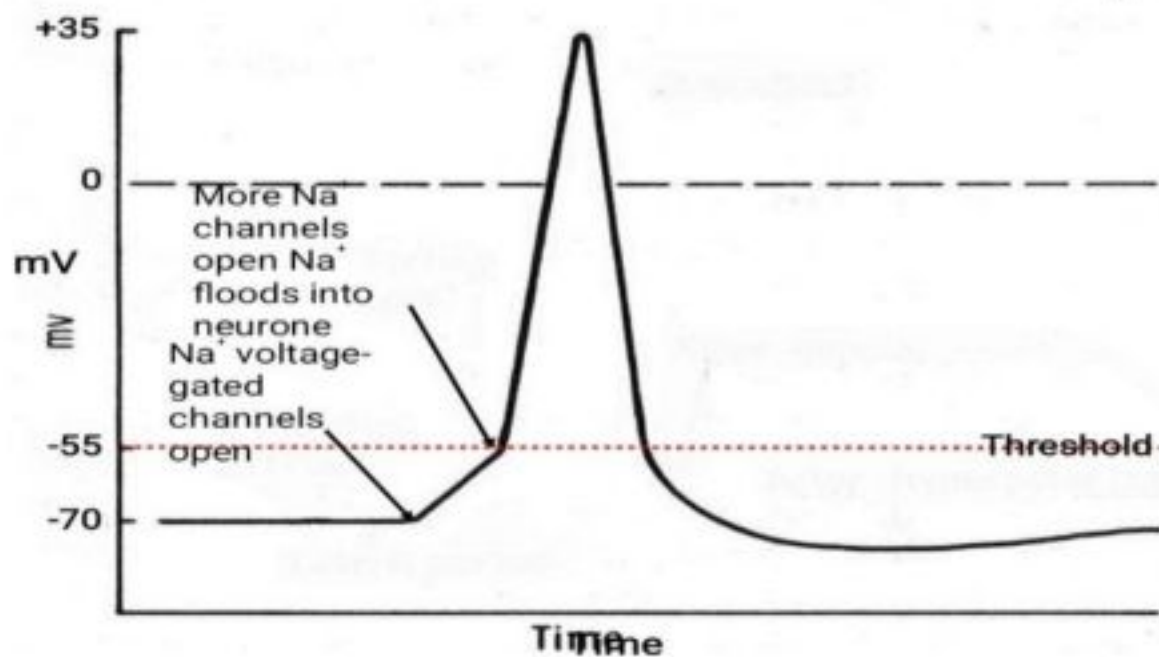
- The two important ions in a **nerve cell** are K^+ and Na^+ .
- Na^+ ions move more slowly across the membrane than K^+ or Cl^- ions .
- This is because although the Na^+ ion is smaller than the K^+ ion Na^+ has a larger coating of water molecules giving it a bigger diameter.

☆ Nerve impulses:

- Localised currents in the ion occur just ahead of the impulse causing localized **depolarization** .
- Nerve impulses are **not** like electrical signals travelling down a wire .

☆ خلي بالك يا باشا :

- These are called **Voltage - gated Na^+** channels.
- As Na^+ moves into the cell more and more Na^+ channels open .

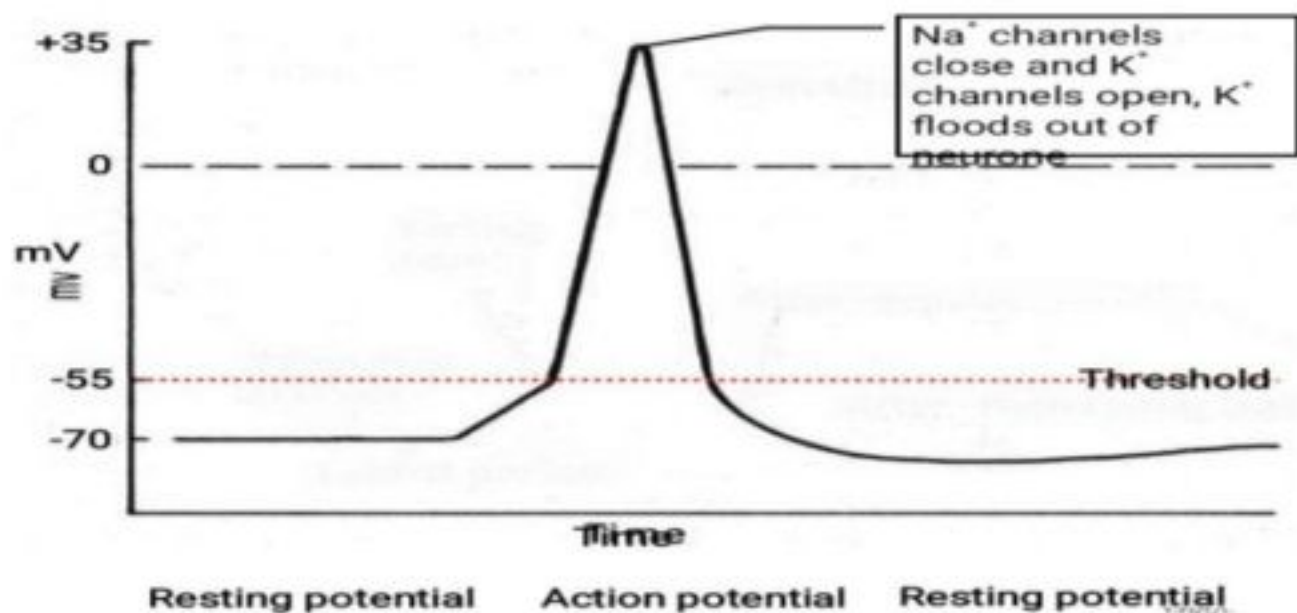


☆ Depolarization:

- a stimulus arriving at a receptor cell
e.g - - - - - > vibration of a hair cell in the ear
- a chemical fitting into a receptor site
e.g - - - - - > a neurotransmitter
- a **nerve impulse** travelling down a neuron .

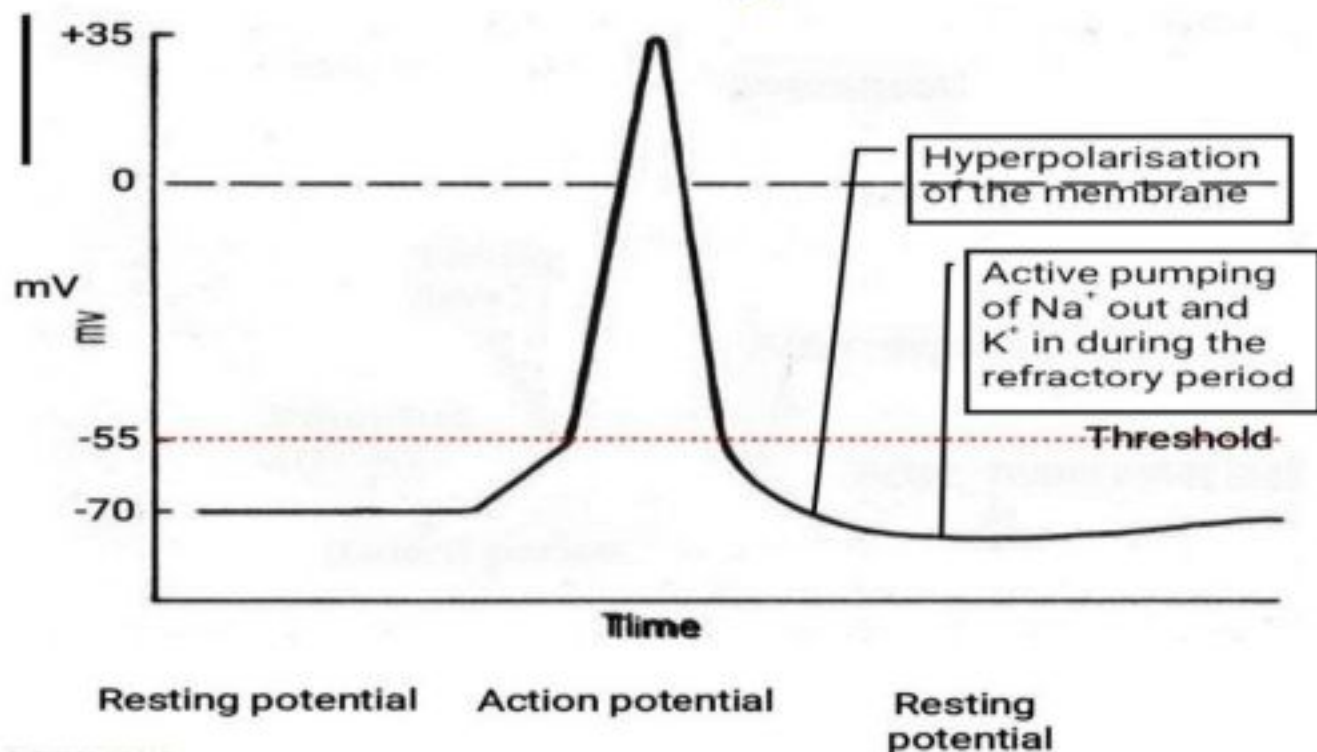
☆ The threshold:

- - 55 mV represents the **threshold potential**
- The membrane potential rises to **+35 mV** this is the peak of the **action potential** .
- The cells are almost at the equilibrium for Na^+ ions .



☆ Hyperpolarisation:

- The membrane potential falls below the resting potential of -70 mV.
- During this period no impulses can pass along that part of the membrane. This is called the refractory period.



سبحان الله ، الحمد لله ، لا اله الا الله ، الله اكبر

☆ The Circulation:

A circulatory system is an **organ system** that moves substances to and from **cells** , it can also help stabilize body temperature and **PH** .

Three types:

No circulatory system	Open circulatory system	Closed circulatory system
Some organisms do not have a circulatory system because they rely on direct diffusion to transport gases, nutrients, and waste . ex : flatworm, platyhelminthes.	An open circulatory system is an arrangement of internal transport present in some invertebrates. ex : mollusks and arthropods.	The main components of the circulatory system are the heart , the blood vessels . ex : earthworms and cephalopods.

☆ Blood vessels:

	Arteries	Veins	Capillaries
Function	Carry oxygenated blood away from the heart to the body	Carry deoxygenated blood back to heart	Facilitate the exchange of nutrients , gases , and waste between blood and tissues
Blood pressure	High	Low	Very Low
Wall Thickness	Thick and elastic to withstand high pressure.	Thinner and less elastic than arteries.	Extremely thin and delicate, consisting of a single layer of cells
Location	Usually deep within the body	Closer to the surface of the skin and sometimes visible.	Found throughout tissue , connecting arteries and veins.

☆ Proteins of blood plasma:

☆ Albumin :

- **Function:**
- Maintains Oncotic pressure.
- helps regulate osmotic pressure .
- Transports various substances.

☆ Immunoglobulins:

- Are classified into five types based on the structure of their heavy chains .

ex : IgG , IgA , IgD ,

- They are essential for immune defense against **Pathogens** .

☆ Fibrinogen:

- is a plasma protein that plays a crucial role in blood clotting produced by the liver.
-

☆ Mammalian Circulation :

- Deoxygenated blood collects in two major veins : the **superior vena cava** and the **inferior vena cava** .
- The superior and inferior vena cava empty into the **right atrium** .
- The blood is then pumped through the tricuspid atrioventricular valve into the **right ventricle** .
- from the right ventricle , blood is pumped through the pulmonary semi - lunar valve into the **pulmonary trunk** .
- The Deoxygenated blood leaves the heart by the pulmonary arteries and travels through the lungs and into the **Pulmonary vein** .
- The **Oxygenated** blood then enters the **Left atrium** .

Blood:

Blood is a unique form of connective tissue composed of forming element (RBCs , WBCs and Platelets) suspended in a liquid plasma .

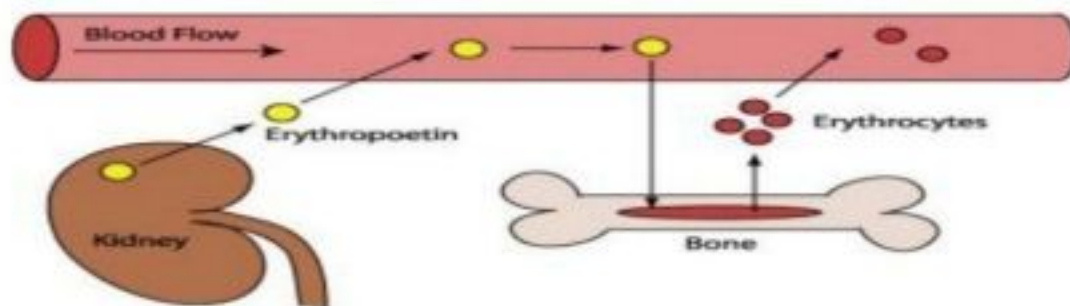
Main differences between RBCs and WBCs

RBCs	WBCs
-Number : 4.5 to 5.5/ m³ blood. - they are of one type. - they are corpuscles =not true cells . - they have no nuclei and no cell	-Number: 5000 to 11000/m³ blood -they are of 5 types. -they are true cells . - They contain nuclei and cell organoid.

organoids - they have no movement. - biconcave corpuscles. - Appear in rouleaux . - diameter : 7.5μ. -easily hemolysed. - contain Hb. - carry O₂ and CO₂ inside the blood vessels. They develop in red bone marrow. -life span: about 4 months.	-they have amoeboid movement -spherical cells -No rouleaux appearance. -diameter : 8-18μ -they resist hemolysis partially. -having no Hb -phagocytic cells but outside the blood vessels. -develop in red bone marrow and in lymphatic tissue -life span: from few days to years
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☆ Red blood cells (Erythrocytes) :

- In all Mammals , Mature erythrocytes are devoid of a nucleus and have the shape of a biconcave lens .
- The lack of nucleus allows more room for Hb and biconcave shape of these cells raises the surface and **cytoplasmic volume ratio** for more efficient the diffusion of O^2 .



☆ Jaundice: it is a yellowish staining of the eyeball and skin due to accumulation of bile pigments

- An increased rate of erythrocyte breakdown.
- Obstruction in the biliary ducts.
- Liver damage as in hepatitis , cirrhosis and liver cancer.

☆ Blood Platelets = Thrombocytes :

Structure: Mass of cytoplasm surrounded by a plasma membrane.

Origin: From large cells , inside bone marrow.

Life span : 10 days .

Function: Prevention of blood loss from damaged blood vessels.

Haemostasis means the stoppage of bleeding.

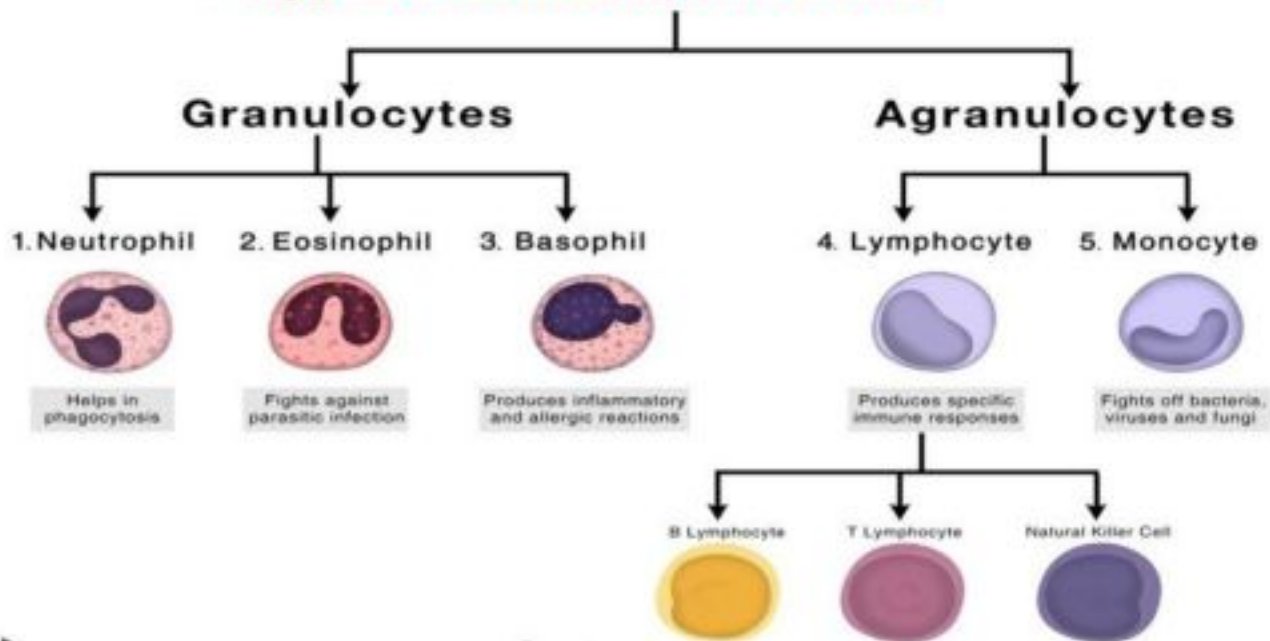
→ **Blood vessel spasm :** when blood vessel is ruptured, platelets release substance.

→ **Platelet vessel formation:** To the damaged blood vessels leading to formation of loose Platelet plug that stop blood loss .

→ **Blood coagulation :** This plug is stabilized by deposition of fibrin threads which convert loose plug to strong blood .

صلي علي النبي

☆ Types of White Blood cells :



☆ Blood Diseases :

- **Anemia:** A decrease in number of **RBCs** or haemoglobin content due to servere blood .
- **Leucopenla:** abnormal decrease in number **WBCs** due to servere viral infection of excess of antibodies.
- **Polycythemia:** abnormal increase in number of **RBCs** in blood circulation due to bone marrow.
- **Leuokemia :** abnormal increase in number of **WBCs** due to bone marrow.

☆ Valves :

- The two semilunar valves are present in the arteries leaving the heart.

☆ Mitral valves :

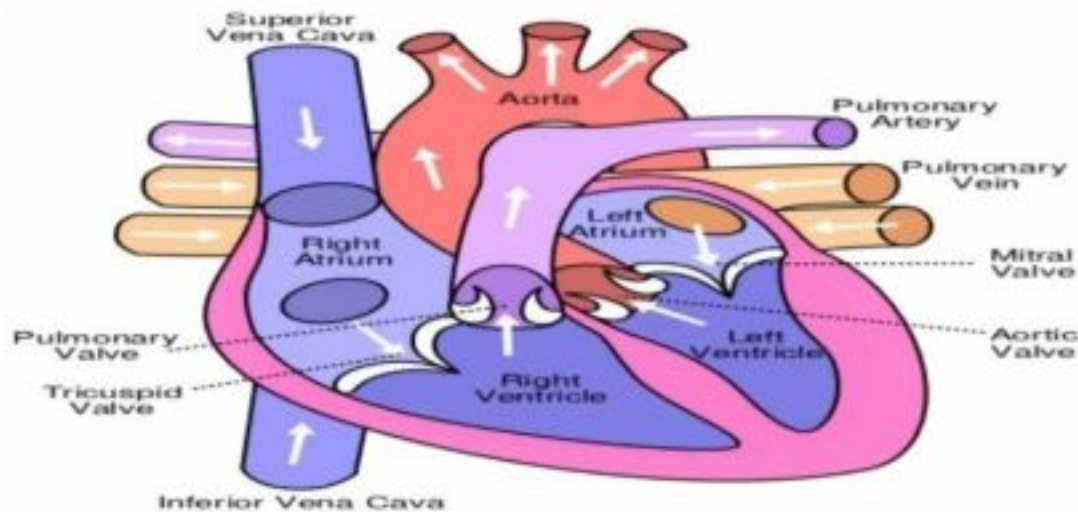
- it present blood flowing form the left ventricle into the left atrium.

☆ Tricuspid valve:

- Vavle allows blood to flow form the right ventricle when the heart is relaxed during diastole.

☆ Pulmonary Valve:

- These are positioned on the pulmonary artery and the aorta.
- When the ventricular pressure drops to below the Pulmonary artery pressure , the Pulmonary valve closes and prevents back - flow of blood into the ventricle.



☆ Digestion :

Is the breakdown of complex food substance into simpler food substances which can be absorbed into the bloodstream for body stream for body use .

☆ Metabolism :

Is a term that is used to describe all chemical reactions involved in maintaining the living state of the cells and the organism.

• خلي بالك:

- **Catabolism:** the breakdown of molecules to obtain energy.
- **Anabolism:** the synthesis of all Compounds needed by the cells .

☆ **Carbohydrates:**

- Are widely distributed both in animal and in plant tissues .
- They provide about 50% of the calories in most diets .

☆ **Physiological important of carbohydrates:**

- They form about 50 - 60% of the human diet .
- Stored in liver & muscles as glycogen .
- May be converted to fats or protein.
- They form a part of the mucous membrane.

☆ **Monosaccharides :** Simple sugars composed of a single sugar unit.

☆ **Disaccharides:** composed sugars formed 2 molecules of Monosaccharides

E.g : maltose , sucrose

☆ **Polysaccharides :** consist of a long chain of Monosaccharides units.

E.g : Starch , cellulose

☆ **Digestion of carbohydrates:**

- In mouth : Salivary amylase starts the digestion of starch.
- In stomach: No digestion , but hydrolysis of carbohydrates by HCl .
- In the small intestine: By Pancreatic & By intestinal juice.

☆ **Absorption of sugars:**

Through blood route to Portal vein by both simple diffusion & active transport.

☆ **Glycogenesis :** Formation of glycogen from glucose in liver & muscle .

☆ **Glycogenolysis:** breakdown of glycogen to glucose in liver & to pyruvic acid in muscles .

☆ Proteins:

● Physiological important of Proteins:

- Formation of supporting structures in the body as bone , cartilage , skin , hairs .
- Enter in the formation of the buffer system of the blood .
- Enter in the formation of antibodies , haemoglobin , enzymes & protein hormones.

☆ Classification of proteins :

Simple Proteins	Compound Proteins
On hydrolysis gives only amino acids E.g : Albumin & globulins	On hydrolysis gives amino acids & non - protein substances. E.g : glycoproteins & phosphoproteins

☆ Digestion of Proteins:

- **In stomach:** Pepsin hydrolyses Proteins into proteoses & peptones.
- **In the small intestine :** By Pancreatic juice & intestinal juice.

☆ **Absorption of proteins :** amino acids are absorbed through the blood route by both simple diffusion & active transport .

☆ Metabolism of Proteins:

- Used to form cells & tissues .
- Form plasma Proteins, enzymes & peptide hormones.
- Undergo dissimilation.

☆ Lipids :

● Physiological important of Lipids:

- Lipids are a source of fat - soluble vitamins , essential fatty acids.
- Lipids in adipose tissue serve as energy stores .
- Lipids have a role in protecting and fixation of internal organs such as kidney.
- Lipids under skin serve as thermal insulators .

☆ Classification of Lipids:

Simple Lipids	Compound Lipids
These are esters of fatty acids with various alcohols. Ex : Neutral fats	These are esters of fatty acids containing groups in addition to an alcohol and a fatty acid . Ex: Phospholipids Glycolipids

- **Derived Lipids:** Substances derived from the above Lipid groups by hydrolysis and still having the same general of Lipids.

☆ Digestion of Lipids:

- **In stomach:** By gastric lipase .
- **In the small intestine :** By Pancreatic juice.

☆ Absorption of Fats :

- Short chain fatty acids (<10C) are absorbed through the blood route .
- Long chain fatty acids (>10C) are absorbed through the Lymph route.

☆ Metabolism of Lipids:

- Storage as neutral fats .
- Building of cell membrane of all tissues & other Lipid decrease compound .

- Oxidation.

● **Minerals:**

A number of minerals must be ingested daily for maintenance of health. **Include:**

Mineral	Function
Sodium	Essential for normal blood pressure.
Potassium	Normal function of nerve & muscle
Calcium	Bone & teeth formation. Muscle contraction & nerve impulse transmission. Blood clotting.
Phosphorous	Bone & teeth formation. Muscle contraction.
Iron	Haemoglobin formation.
Copper	Iron utilization & haemoglobin formation.
Manganese	Various enzyme activity.
Zinc	Insulin activity, sexual function, growth & tissue repair.
Iodine	Formation of thyroid hormones.

☆ **Vitamins:**

- Fat soluble vitamins:

Vitamin	Function	deficiency
Vitamin A	Regeneration of photopigments in retina	Night blindness
Vitamin D ₃ (1,25 (OH) ₂ vit. D ₃ (active form of vitamin D ₃))	Essential for deposition of Ca ²⁺ & phosphorous in bone & teeth.	Rickets in children & osteomalacia in adults (Bones become soft & deformed).
Vitamin E (Tocopherol)	Essential for normal function of reproductive system	Causes sterility.
Vitamin K	Essential for normal blood clotting	Delayed blood clotting time.

- Water soluble vitamins:

Vitamin	Function	deficiency
Vitamin B complex (thiamin, nicotinic acid, biotin, folic acid, riboflavin, ..) & vitamin B ₁₂ .	Act as component of co-enzymes concerned with different metabolic reactions. Production of red blood cells.	Abnormal metabolic reactions. Abnormal production of RBCs.
Vitamin C (ascorbic acid)	Necessary for healthy blood vessels & wound healing.	Haemorrhage into tissues & delayed wound healing.

☆ Water :

- It forms about 60% of the body weight.
 - It forms about 90% of blood plasma.
 - It acts as a thermo - regulator.
 - It is essential for transport of food & gases .
 - All vital processes (digestion , respiration , excretion) occur in water medium .
-

وكده خلصنا يا دكترة جزء Physiology

سبحان الله وبحمده
سبحان الله العظيم

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Histology

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By : Ahmed Salah ✍️

☆ Histology:

☆ Epithelial tissue: النسيج الطلاني

• General character :

- Arise from all primary germ layer .
- Have a **Scanty** matrix.
- Cells rest on **basement membrane** .
- Have **No** blood vessels .
- Have **nerve fiber** .
- Have great ability **to regenerate** .
- Nutrients can pass through **the basement membrane by diffusion**.

☆ Have Three names :

Epithelium	Endothelium	Mesothelium
When covering the outer surface of body .	When it was found in Hollow organ .	When it is found in the internal body cavity.

☆ Simple epithelium tissue:

One layer of flattened cells arranged side by side on the **basement membrane** .

☆ Types of simple epithelium tissue:

☆ Simple squamous:

- Simple one layer of **Flattened** .
- Have **Flattened** nuclei.
- very **thin** .
- **Haven't** a basement membrane.

☆ Found in :

- Lining epithelium of **blood vessels** .
- In Bowman,s of **kidney** .



Simple squamous

L.S



Simple Squamous

V.S

☆ Simple Columnar:

- Pillars shape one layer from all cells .
- Have a **basement membrane** .
- Have a **basal** , **oval** nuclei shape.

☆ Found in :

- Lining **stomach** , have a **Secretary** function.
- In a **small intestine** , it has an **absorption** function.



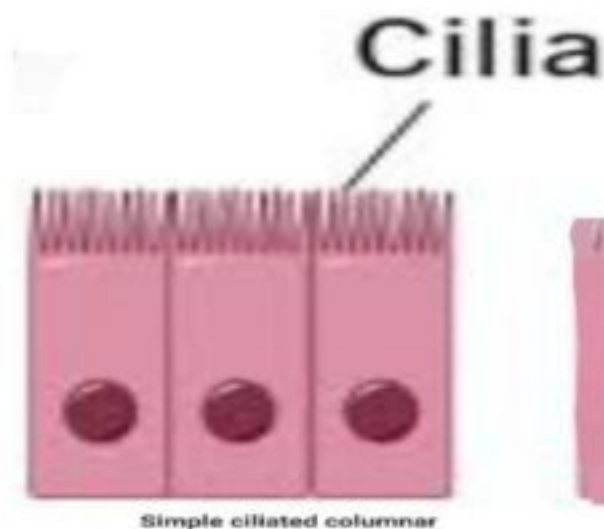
Simple Columnar

☆ Simple ciliated columnar:

- نفس اللي فوق بالظبط يا دكترة لكن عنده أهداب
- Have a cilia.

☆ Found in:

- In Bronchioles of **Lungs** , its function is **gas exchange** .

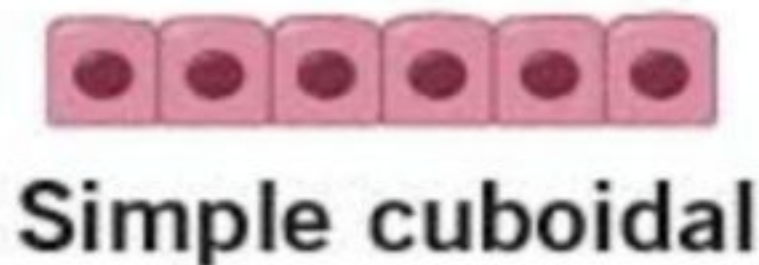


☆ Simple cuboidal:

- One layer of cuboidal cells rest on **the basement membrane** .
- Have a **central round** nuclei shape.

☆ Found in :

- In the tubules of **Kidney** .
- In **Sweat gland** .
- In **Thyroid gland** .



☆ Pseudostratified epithelium:

- One layer of two kind of cells

Tall with narrow end	Small conical
The tall cell towards the surface	The short conical The nuclei towards the basement membrane.

☆ Found in:

- Parotid gland. الغدة النكافية



PSEUDOSTRATIFIED EPITHELIUM

☆ Ciliated pseudostratified epithelium:

☆ نفس اللي فوق بالظبط يا دكترة بس فيها أهداب

- Have Cilia.
- **found in** : Parotid gland.



☆ Stratified epithelial tissue:

- **Stratified squamous epithelium:** it is two type:

Non - keratinized type	Keratinied type
● Cubical cells ● The intermediate layers are of polygonal cells . ● The outermost layer is the squamous layer .	● The intermediate layers are of polygonal cells . ● The outermost layer changes to a non living horns layer .

- **Stratified cuboidal epithelium:**

- The lowermost layer of this type is formed of cubical cells .
- The intermediate layers are of polygonal cells.
- The outermost layer is formed of cubical cells .
- This type is found in the ducts of sweat glands.

- **Stratified columnar epithelium:**

- The intermediate layer are of polygonal cells
- The outermost layer is formed of columnar cells
- It is found Lining the large duct of a livery gland.

- **Ciliated stratified columnar epithelium:**

- its stratified columnar epithelium except the outermost layer Carry cilia.
- It is found in Lining the Larynx .

- **Transitional epithelium:**

- The intermediate layers are of polygonal cells .
- The outermost layer is formed of cubical cells with a broad convex free border.
- The urinary bladder is found.

☆ Connective tissue: النسيج الضام

- **Origin** : from Mesoderm
- Has **no basement membrane**
- The most **abundant** and important in body tissue

☆ Connective tissue fibers:

White collagen fibers	Yellow elastic fibers	Reticular fibers
• Have collagen protein • Affected by boiling • Affected by acids and alkalis • Digested by pepsin and collagenase enzymes.	• Single and thin. • Not affected by boiling or chemicals. • Not affected by acids or alkalis. • contain elastic protein	• They are reticular as the small units called Anastomes • Not affected by boiling or chemicals • Not affected by acids or alkalines • formed from Reticular protein • Give Black color with silver strain

☆ Macrophages:

- **shape** : Oval , rounded or branched.
- **function**: Phagocytosis of foreign bodies.

☆ Mast cells :

- found along **blood vessels** .
- **Shape**: Oval or rounded
- **function** : contain :
Heparin - - - - > when clotting factor

Serotonin - - - - > Narrowing blood vessels

Histamine - - - - > Widening blood vessels.

☆ **Pigment cells :**
“ Chromatophores “

- **found:** in iris of eye or Dermis of skin
- **shape:** Branching with cytoplasm and melanin

☆ **Eosinophil :** consists of two types:

Acidophil	Neutrophil
Increases in number in allergic conditions	Migrates to the site of infection doing phagocytosis.

☆ **Fat cells :**

- **found** in adipose connective tissue.
- **shape:** signet ring shape
- **function:** Storage of Fats

☆ **Plasma cell :**

- **shape :** Oval or rounded
- Eccentric nucleus.

Mesenchymal cell	Fibrocyte cell
Shape : small and branching with Oval and large nucleus Function: They can divide and give other types of connective tissue cells	Shape: Branching cell with Oval open face nucleus Function: Formation of fibers & bundles. • Formation of microfibrils & Matrix

لا حول ولا قوة الا بالله

☆ **Nervous tissue:**

● **Characteristic:**

- Ectodermal in origin.
- Their mature cells do **not** divide again .
- Distributed throughout the body as an integrated and communicated network.

☆ **Neurons** : The functional and specialized cells of the nervous system.

- A neuron **structure** is formed of: cell body and processes.
- The **cell body** comprises a nucleus and cytoplasm.

☆ **Glial cells :**

Support and protect neurons and participate in neural nutrition , neural activity.

☆ **Types of neurons :** According to the **number of cells** .

Pseudo - Unipolar	Bipolar	Multipolar
Having one process as in spinal and cranial ganglia .	Having two processes one is dendrite and the other is axon .	With several dendrites and one axon .

☆ **Synapse:**

Axodendritic Synapse	Axosomatic Synapse	Axoaxonic Synapse	Dendrodendritic Synapse
site of contact between an axon and a dendrite	site of contact between an axon and a nerve cell	site of contact between axons .	site of contact between dendrites.

☆ **Nerves:**

These are bundles of nerve fibers and connective tissue.

☆ **Nerve structure:**

Epineurium	Perineurium	Endoneurium
The outer layer of dense connective tissue surrounding bundles of nerve fibers.	The connective tissue individual nerve fascicles Function as a barrier to most macromolecules.	A thin layer of connective tissue investing individual nerve fibers.

🌟 و كده يا دكاترة خلصنا الحيوان كله

By : Ahmed Salah ✨