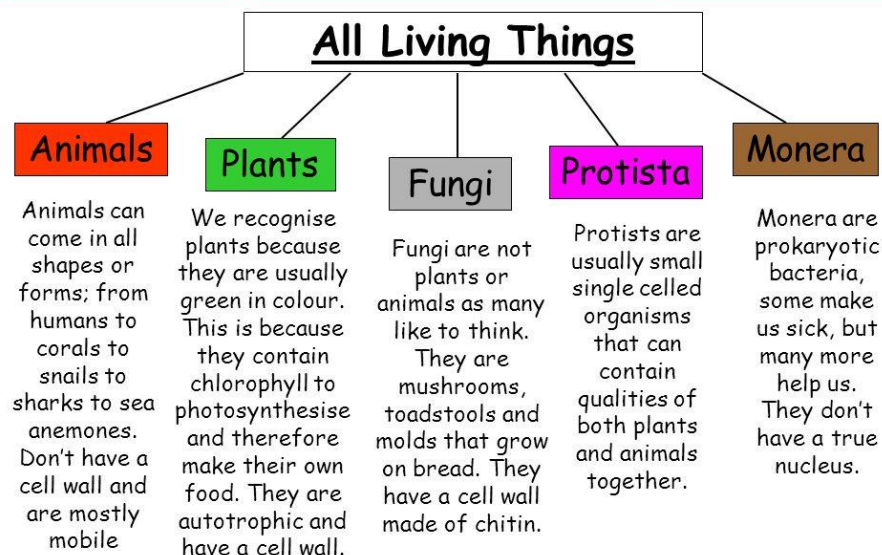


BIOLOGY NOTES BY STUDY FUNDA

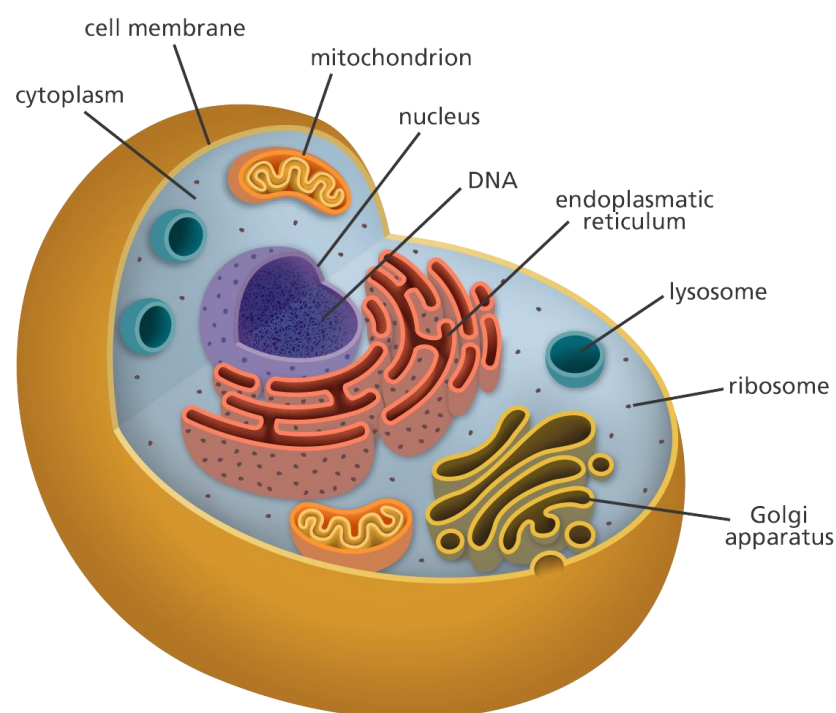
Five Kingdoms Classification :

(1) Plantae (2) Fungi (3) Animalia (4) Protista (5) Monera.

5 Kingdom Classification System

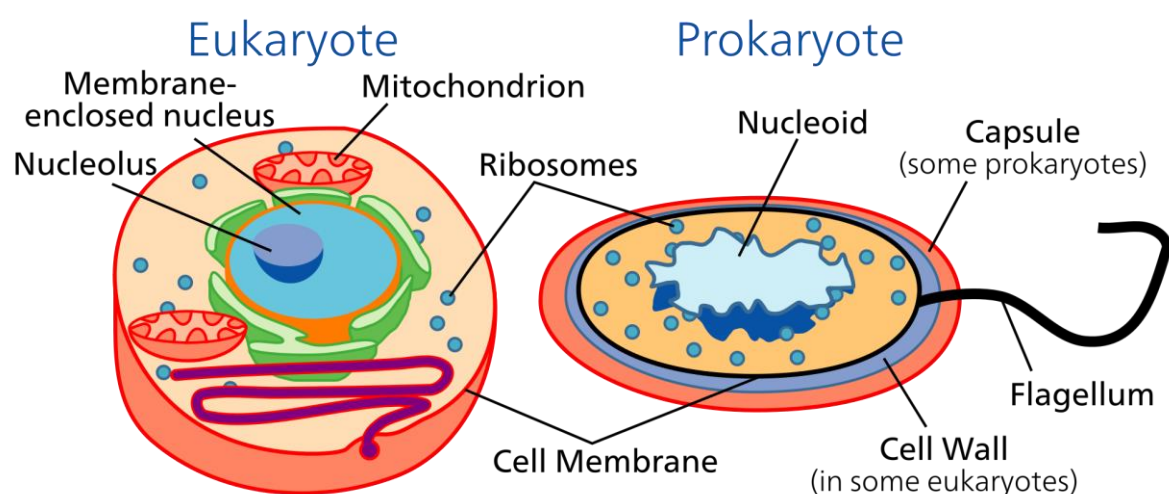


>British Robert Hooke (1665) coined the term Cell, when he saw honey comb like structures in the section of cork.
>A Cell consists of living (Protoplasm) and non- living (Duetoplasm) matter.
>Protoplasm is called physical basis of life. The name protoplasm given by Purkenje.



Cells are of two types

- (1) Prokaryotic (which lacks nucleus and membrane bound organelles).
- (2) Eukaryotic (which have nucleus and membrane bound organelles).



>A cell also contains many membrane bound structures called cell organelles. .
>The most important cell organelle is nucleus which controls all the activities of a cell. **DNA** is mainly found in **nucleus** in small amount. It is also found in mitochondria and chloroplast.
>Protoplasm within the nucleus is called nucleoplasm and outside the nucleus is called cytoplasm.
>**Cell Wall, Plastids and big Vacuole are present in plant cell** but absent in animal cell.

nucleus and membrane bound organelles) and Eukaryotic (which have nucleus and membrane bound organelles).

*Cell Organelle *

>**Endoplasmic Reticulum (E.R.):** Network of tubul like structure attached with nucleus and plasmas membrane. They are of two types:

1. Rough Endoplasmic Reticulum (RER) and
2. Smooth Endoplasmic Reticulum (SER).

>Functions of E.R. :

1. It forms the supporting skeleton frame work for the cell.
2. It provides a pathway for distribution of nuclear material.
3. It provides surface for various enzymatic reactions.

>**Ribosome** : It synthesises protein, and ER "at these protein in various part of the cell. Whereas SER (Smooth Endoplasmic Reticulum) helps in the manufacture of fats.

>**Protein and fat** (lipid) help in building the all membranes. This process is known as membranes biogenesis.

>**Golgi apparatus** : Discovered by Camilo Golgi, it is made up of group of Tubes, Vesicles and Watches

Functions:

1. Its functions include the storage, modifications and packaging of products in vesicles.
2. It is also the organelle that builds Lysosomes (cells digestion machines).

>**Lysosomes (suicidal bag)**. It Is a kind of waste disposal system of the cull having, hydrolytic enzymes. lysosomes also help in carcinogenesis.

>**Mitochondria (power house)** is the respiratory site of cellular respiration which synthesize ATP (Adenosine-Tri-Phosphate) molecules.

>ATP is known as the energy currency of the cell.

>Mitochondria arc strange organelles in the sense that they have their own DNA and ribosomes, therefore mitochondria are able to make their own protein. Its inner membrane has mains folds called Cristae.

>Mitochondria **is absent** in Bacteria and the Red Blood Cells of Mammals.

>Centrioles : Centrioles are concerned with cell division. It initiates cell division.

>Plastids: These are present only in plant cells and of three types :

1. Chloroplast (green plastits)
2. Chromoplast (colour plastids) impart colour to flowers and fruits.
3. Leucoplasts (white or colourless plastids), it stores food in the form of starch, oils and protein are stored.

>Plastids are self replicating, i.e. they have the power to divide, as they contain DNA, RNA and Ribosome.

>Plastids contain the pigment chlorophyll that is known as chloroplast. It is the site of photo synthesis.

>Vacuoles I It is a fluid filled spaces enclosed by membranes called Tonoplast. Its size in animal is small and in plant it is big. Amino acids and sugars are stored in vacuoles.

>Granules : It is not bounded by any membranes. It store fats, proteins and carbohydrates.









>Nucleus :Nucleus was discovered by Robert Brown. It contains nucleoplasm, nucleolus and chromatin material. Nucleus is the controlling centre of cell.

>Chromatin : When the cell is in resting state there is something called chromatin in the nucleus. Chromatin is made up of DNA, RNA and nucleus protein. DNA and RNA are the nucleus acids inside the cell. When the cell is going to divide, the chromatin become very compact. It condenses when the chromatin comes together we can see the chromosomes.

Chromosomes :Chromosomes are thread like structures. found in nucleus and made up of DNA along with histone protein. Bead like structures found on Chromosomes are called as Genes.

Organelles and Their Functions

L1

| | |
|--|--|
|  Nucleus the organelle that contains the cell's DNA and is the control center of the cell |  Chloroplast the organelle that uses the energy of sunlight to make food |
|  Ribosome the organelle in which amino acids are hooked together to make proteins |  Golgi complex the organelle that processes and transports proteins and other materials out of cell |
|  Endoplasmic reticulum the organelle that makes lipids, breaks down drugs and other substances, and packages pro-teins for Golgi complex |  Large central vacuole the organelle that stores water and other materials |
|  Mitochondrion the organelle that breaks down food molecules to |  Lysosome the organelle that digests food particles, wastes, cell |

>Chromosomes are usually found in pairs.

>Human Beings have 46 chromosomes (23 pairs) in which 22 pairs are Autosomes and one pair is Sex Chromosomes.

>Nucleolus : It is a dense spherical granule contained within the **nucieus**.It stores proteins.

Nucleic Acids

.The chromosomes or chromatin material is made up acidic substances called nucleic acids which contains all information about life in the form of codes (genetic codes). These are of Mo types ". DNA & RNA.

.Both DNA & RNA are made up of long chains of units called Nucleotides, each of which contains a Nucleoside (i.e. nitrogenous base + deoxyribose (in DNA) or ribose (in RNA) sugars) and a phosphate (PO4)group. The bonds of nucleic acids are called Phosphodiester bonds.

.DNA (Deoxyribose Nucleic Acid) contains Deoxyribose Sugar and four nitrogenous bases as Adenine (A), Guanine (G). [Both Purines] and Cytosine (C), Thymine (T) [Both Pyrimidines].

.DNA is responsible for carrying our characters from one generation to the other (genetic material).

.RNA (Ribonucleic Acid) helps in decoding the information of DNA for protein synthesis.

.RNA (Single Stranded Structure) also contains four nitrogenous bases Adenine (A), Guanine (G), Cytosine (C) and Uracil (U) along with ribose sugar in the nucleotide.

.RNA found in Nucleus and Cytoplasm both.

IMPORTANT POINTS

.Nerve cells in animals are the longest cells.

.Smallest human cell is red blood cell.

.Largest human cell is female mm.

.The single largest cell in the world is of an ostrich.

.The smallest cells are those of the mycoplasma.

.Every minute about 3 millions cells in our bodydie.

.The Red Blood Cell carries respiratory gases.

.Sieve cells in plants transport nutrients in plants.

IMPORTANT POINTS

.The lysosomal enzymes of the sperm cells digest the limiting membranes of the ovum (egg). Thus the Term is able to enter the ovum.

.During the transformation of tadpole into a ma.;

The embryonic tissues like gills and tail are digesiiit. by the lysosome.

.Mitochondria Schloroplast contain DNA, hence capable of replication.

.Matrix is a transparent, homogenous substance. In its active state it remains saturated with water.

>The study of Algae is called **Phycology** and study of Fungi is called **Mycology**.
 .Algae have chlorophyll and its body is like thallus
 But mostly Fungi are parasitic.
 .Chlorella is known as space algae because an astronaut can get protein, food, water and oxygen by sowing the Chlorella in tank of aircraft.
 .Nostoc, Anabaena are used as manure.
 .Tincher iodine is prepared from Laminar,fucus,Echlonia etc.

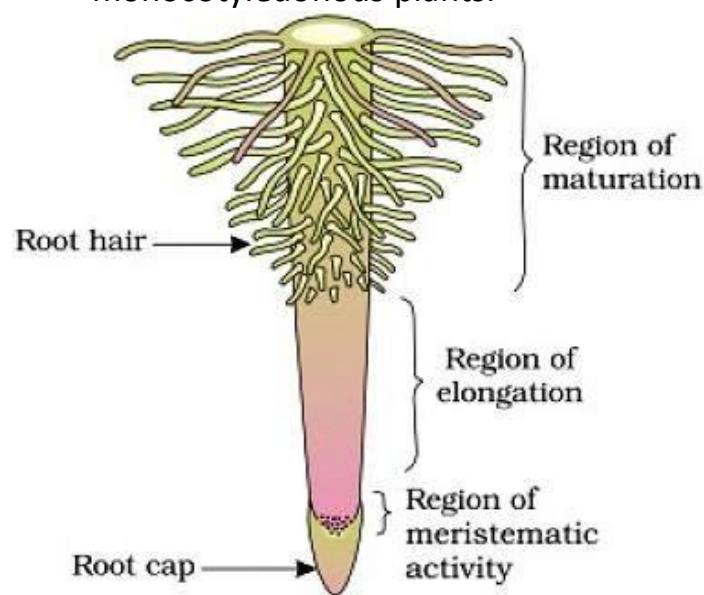
. Cell wall of Fungi is made up of Chitin.
 . **Main Fungal Disease** : White Rust of Crucifer, Loose Smut of Wheat, Rust of Wheat, Early Blight of Potato, Red Rot of Sugarcane, Tikka disease of groundnut, Wart disease of potato, Brown Leaf Spot of Rice, Late Blight of Potato etc.
 .Rhizopus is a fungi commonly known as 'bread mould'.

PARTS OF FLOWERING PLANT :

>Root develops from radicle and absorbs water and mineral salts from soil to the stem and ultimately to leaves. It also keeps plants static.
 >Root are positively geotrophic and negatively phototrophic.

Types of root system:

- (i) **Tap root system:** The tap root system develops from radicle of the germinating seed. It is also called the normal root system. The tap root system is present in **dicotyledonous plants**.
- (ii) **Adventitious root system:** The root system that develops from any part of the plant body other than the radicle is called the adventitious root system. It is mostly seen in monocotyledonous plants.



>Modifications of Tap roots are :

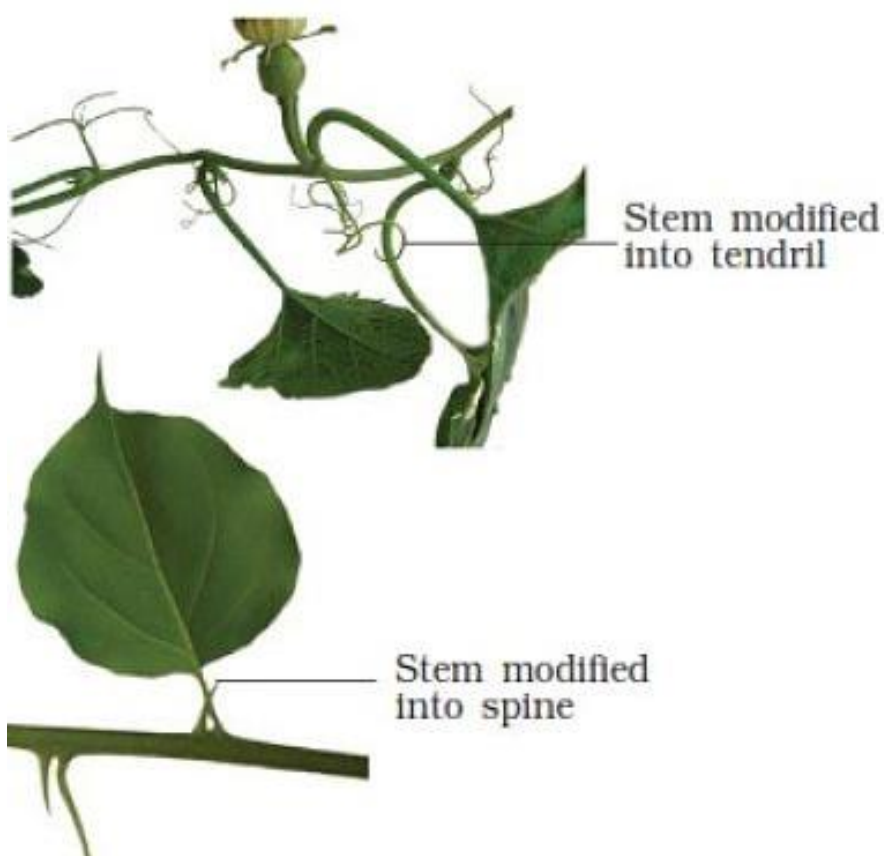
1. Conical (eg. Carrot); 2. Napiform (eg. Turnip, Beet); 3. Fusiform (eg. Radish).
- >Pneumatophores root is found in salt water and for respiratory activities, it undergoes towards negative geotropism eg. Rhizophora.
 >Mycorrhizal roots are mutualistic association of fungus with root tissue.

STEM

Stem is ascending part of plant formed by elongation of plumule and goes towards light (positively phototropic) and opposite to gravity (negatively geotropic).

.Stem modification :

1. Tuber (eg. Potato); 2. Corm (eg. Gladiolus, Saffron); 3. Bulb (eg. Onion, Garlic); 4. Rhizome (Turmeric, Ginger); 5. Stem Tendril (Grape); 6. Stem Thorn (Lemon, roses); 7. Bulbils (eg. Ruscus); 8. Phylloclade (eg. Cactus).



Leaf

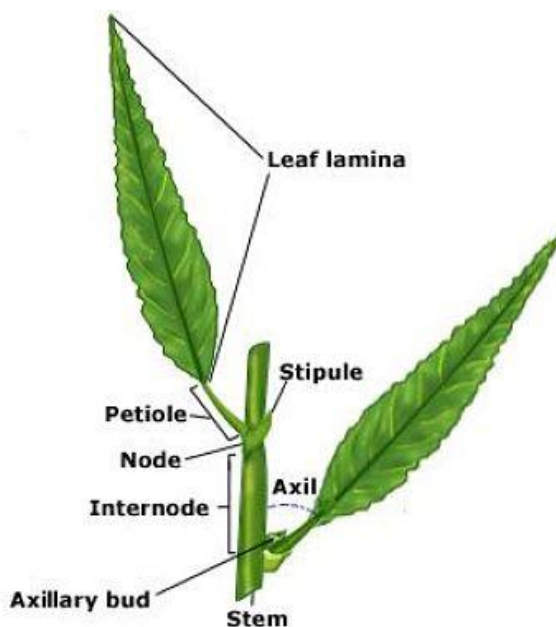
>Leaf is green part of plant having chlorophyll which help in syntheses of food through photosynthesis in presence of sunlight.

>Parts of Leaf :

- (a) Base (Lowermost part of leaf); (b) Petiole (the Stalk of leaf that connects the lamina with stem); (c) Lamina (terminal, flattened, green part of leaf to manufacture food).

>In Cactus (Xerophyte plant) leaf are modified in Spines.

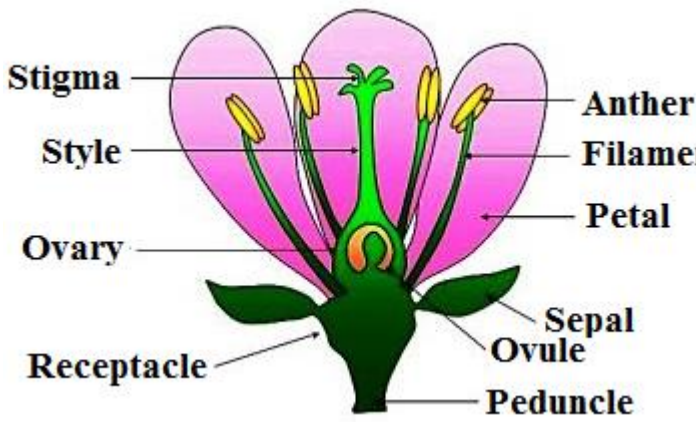
>The arrangement of flowers on a floral axis is called Inflorescence. eg. Capitulum inflorescence (sunflower), Cyathium (Euphorbia), Corymb (Iberis), Hypanthodium (Ficus), Spikelet (Grasses), Spike (Adhatoda).



Flower

>Flower is a modified shoot that consists of accessory whorls (Calyx and Corolla) and essential whorls (Androecium and Gynoecium).

>The plant which bears both male and female flower is called Monoecious while separate plants with one type of flower are called dioecious.



>Androecium is male sex organ. Unit of androecium is stamen. stamen consists of two parts ", a stalk (filament), topped by an anther where pollen grains is produced by meiosis. The filament supports the anther.

>Gynoecium is female sex organ. Unit of gynoeciam is Carpel. There are 3 parts of Carpel : (a) Ovary; (b) Style; (c) Stigma. The Style is long tube that attaches the stigma to the ovary. The sticky tip of pistil (stigma) is the receptor of pollen.

>The ovary is at the end of the style where ovule or egg is waiting to be fertilised.

Pollinalion

>Transfer of pollens from stamens to stigma is called Pollination. it is of two types: (t) Self pollination; (2) Cross-pollination

>Self pollination : Transfer of pollen grain from anther to the stigma of same flower (Autogamy) or different flower of same plant (Geitonogamy).

>Cross pollination : Transfer of pollen from anther of one flower to the stigma of different flower.

>Cross pollination (Xenogamy) takes place with the help of air (anemophily), water (hydrophily), insects (entomophily), birds (ornithophily) or bat (chiropteriophily).

Fertilization

>After pollination, a pollen grain germinates and a pollen tube grows and penetrates the ovule through a tiny pore called a micropyle. After that a male nucleus fuse with egg cell and form a diploid zygote

>The fertilised ovule goes on to form a seed which contains a food store and an embryo that will later grow into a new plant.

>Male gametes are found inside tiny pollen grains on the anthers of flower.

>Female gametes are found inside ovulcs of a flower.

>The ovary develops into a fruit to protect the seed. The fertilised ovule develops into seeds.

Parthertocarpy

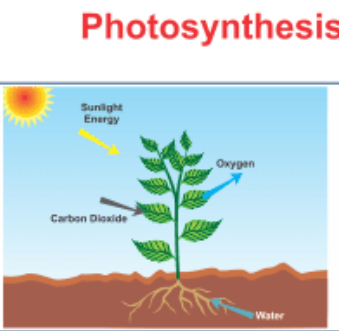
>In some plants fruits are developed from ovary without fertilization. This type of fruit is called parthenocarpy. Normally, these types of fruits are seedless e.g. Banana, Orange, Grapes, Pineapple etc.

Fruit

>Fruit is a ripened ovary of flower . The fruit may be True Fruit (formed from ovary alone) eg. mango, maize, grape etc. or False fruit (developed from other part of flower except ovary) eg. Cashew-nut (from penduncle). Apple, Pear, Cucumber (from Thalamus), Mulberry (fused Perianth) etc. lack fruit and Pineapple are also false fruits as they develop from the entire inflorescence.

Photosynthesis

- The process by which green plants synthesize food(glucose) from carbon dioxide and water in presence of chlorophyll and light energy is called photosynthesis.
 - It is important mechanism of energy input.
 - Provides food and oxygen for plants as well as animals
- carbon dioxide + water + sunlight -----> glucose + oxygen
- $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{sunlight} \longrightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$



Importance of Photosynthesis :

Food for all – source of energy and food for living beings

Oxygen to breathe in – biological process releasing oxygen and supports life on earth

Plants(autotrophs) – food producers

Animals (heterotrophs) – depend directly or indirectly on plants

Photoautotrophs – plants make their food by photosynthesis

Chemoautotroph – production of food using energy from chemical reaction

Raw Materials :

Carbon dioxide – acts as source of carbon and oxygen in the formation of glucose molecules

Water – source of hydrogen in the formation of glucose molecule

Sunlight – energy source to conduct photosynthesis

Process of Photosynthesis



Light Reaction or Hill Reaction : Discovered by Hill. Takes place in the presence of light in thylakoids

Steps in Light Reaction

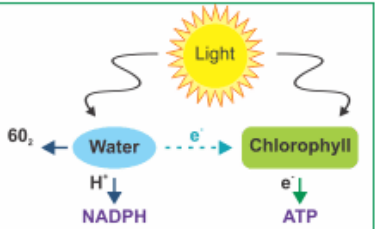
- ❖ **Absorption of Light Energy by Chlorophyll** : Chlorophyll on exposure to light gets activated by absorbing photons
- ❖ **Photolysis of Water** : Absorbed energy is used in splitting of water into hydrogen and oxygen, releasing electrons



- ❖ **Reduction of NADP** : Hydrogen ions released (photolysis) taken up by NADP (Nicotinamide adenine dinucleotide phosphate) is reduced to NADPH₂

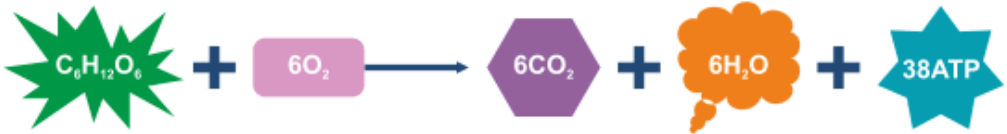


- ❖ **Photophosphorylation** : Formation of ATP (adenosine triphosphate) from ADP(adenosine diphosphate) and inorganic phosphate in the presence of sunlight.



Respiration in Plants

Respiration – the process of biochemical decomposition of organic compounds like simple carbohydrates, glucose, in living cells with the release of energy.



- Energy is released in the form of ATP (Adenosine triphosphate).
- **One mole of glucose** on complete oxidation yields **38 molecules of ATP**.
- It is an high energy molecule which serves as an immediate source of energy.
- It is a form of chemical energy which can be used for all processes in the cell.
- Therefore ATP is called currency of the cell.

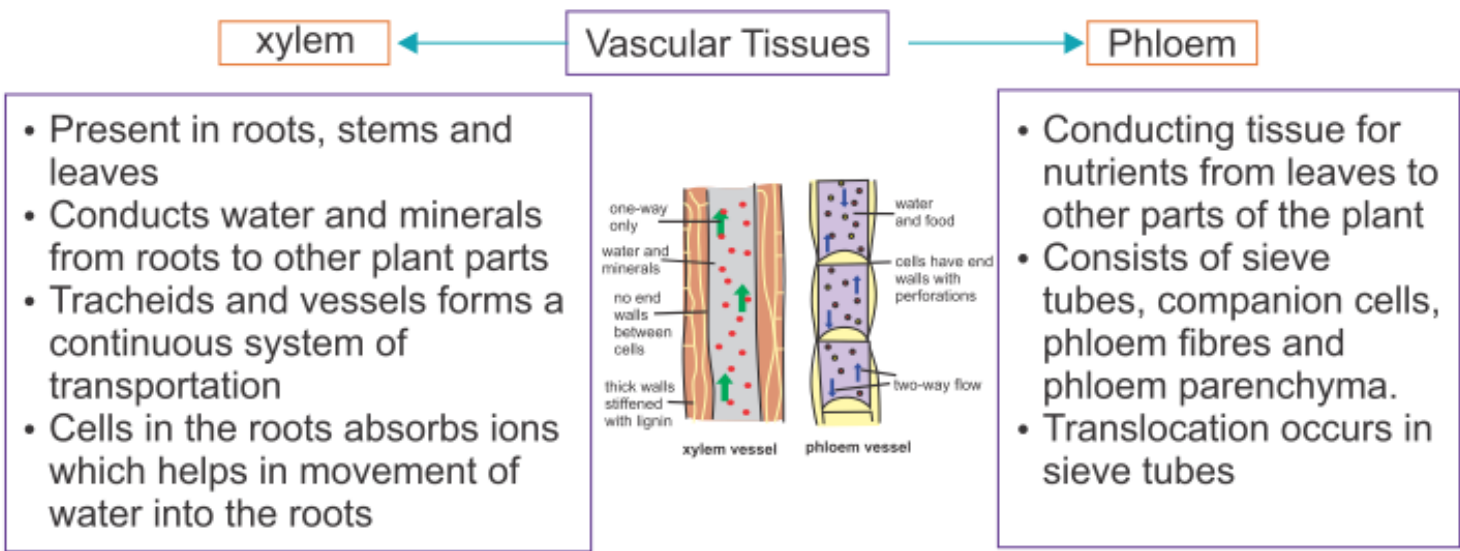
Metabolism is the set of life-sustaining chemical reactions within the cells of living organisms

Two types of metabolic processes take place in living things

Catabolic process – it is a destructive (breaking down) process in which energy is released. e.g. respiration

Anabolic process – it is a constructive (uses energy to construct) process in which energy is used for biosynthetic processes. e.g. photosynthesis

Transportation in plants – performed by two vascular tissues, xylem and phloem



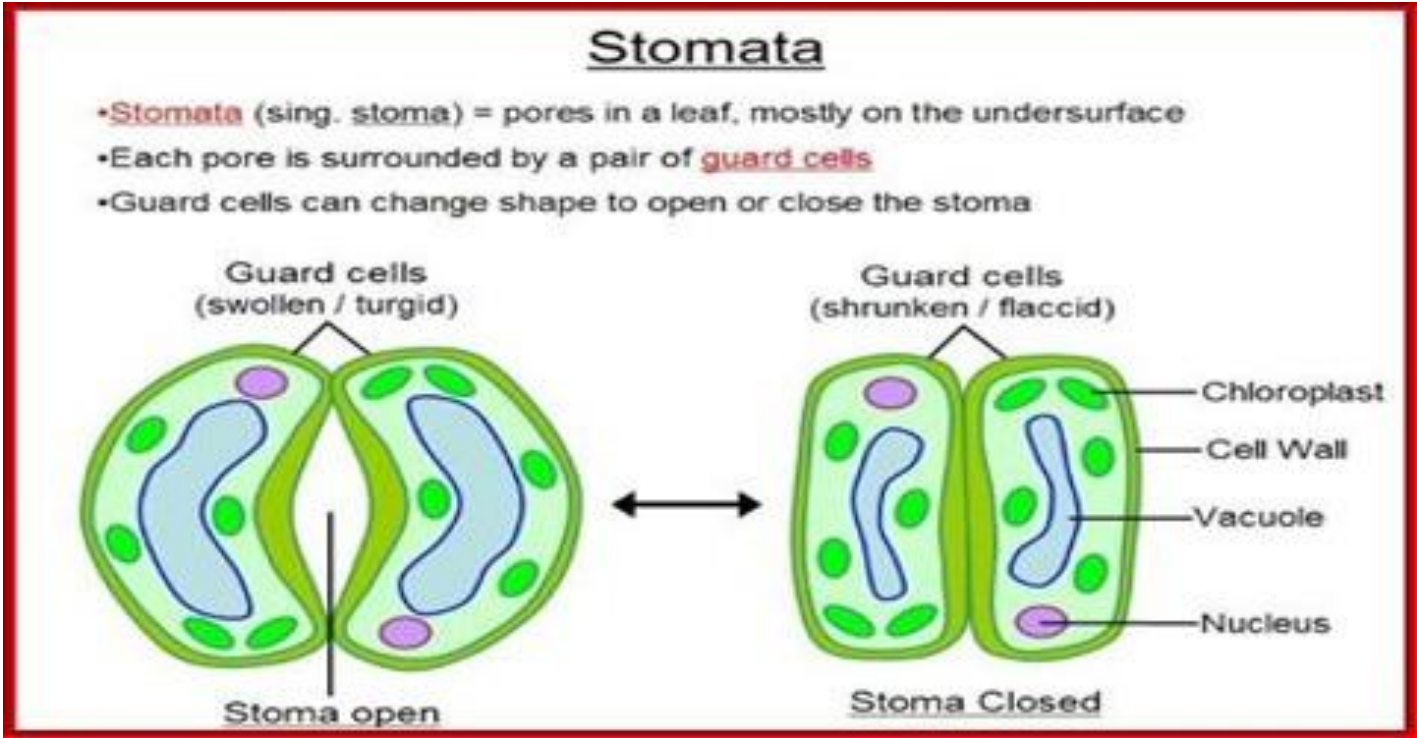
Difference between xylem and phloem

| Xylem | Phloem |
|----------------------------|------------------------------|
| Cells are dead | Cells are alive |
| Carries water and minerals | Carries sugar and aminoacids |
| Upward movement of flow | Flow is in all directions |

>The determination of age of plant is done by counting annual rings of the xylem tissue, This method is called Dendrochronology.

Transpiration

>Transpiration is the evaporation of water from plants through Stomata of leaves. It is measured by **Potometer**. Transpiration rates depends on weather conditions such as temperature, humidity, sunlight, intensity, soil types etc.



>Surrounding each Stomata are two Guard Cells, which regulate the opening and closing of stomata to facilitate gas exchange and control transpiration in plants.

>Guttation is the loss of water in the liquid form from the leaf or stem.

>The Cohesion-Tension theory explains how leaves pull water through the xylem.

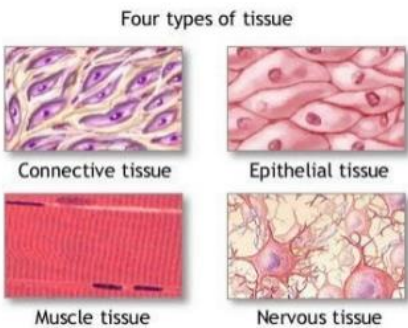
| Plant hormone | Physiological effect |
|---------------|---|
| Auxin | <ul style="list-style-type: none">• Synthesised in the young tip of roots and shoots. It diffuses towards the shady side of plant which stimulates the cells to grow longer, resulting in bending of shoot towards light.• Promotes cell elongation and division• Plays important role in formation of roots and seedless fruits. |
| Gibberellin | <ul style="list-style-type: none">• Help in growth of stem and flower.• Help in germination of seed. |
| Cytokinins | <ul style="list-style-type: none">• Promote cell divison and delay leaf ageing.• Also stimulate leaf expansion. |
| Abscisic Acid | <ul style="list-style-type: none">• Growth inhibitor• Reverses the growth promoting effects of auxins and gibberellins. |
| Ethylene | <ul style="list-style-type: none">• Promotes transverse growth.• Essential for fruit ripening, promotes senescence and abscission of leaves. |

- >The science or branch of Biology deals with animals called Zoology.
- > The primitive atmosphere contained hydrogen, methane, ammonia and water vapour. In it, oxygen and ozone are absent.
- > Homologous organs are similar in basic structure and origin but different function eg. wings of bat, front foot of horse, human's hand and wings of birds are homologous organs, These show Divergent evolution.

TISSUE

Tissues

- A group of similar cells working together form tissues.
- Tissues are more complex than cells.
- Types of tissues are:
 - Epithelial (skin, hair, fingernails)
 - Connective (bone, blood, cartilage)
 - Nerve (brain, spinal cord, nerve)
 - Muscle (limbs, heart, stomach)



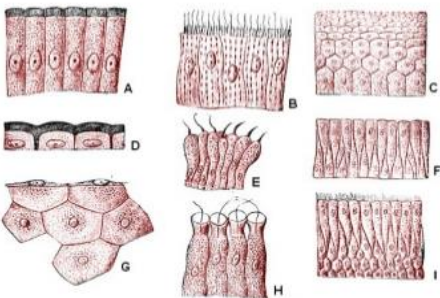
Structure and Function in Epithelial Tissue

- Structure

Cells in epithelial tissue are tightly packed together.

Epithelial tissue covers all body surfaces, lines body cavities and hollow organs.
- Function

Protection, secretion, absorption, excretion, and sensory reception.



Structure and Function in Connective Tissue

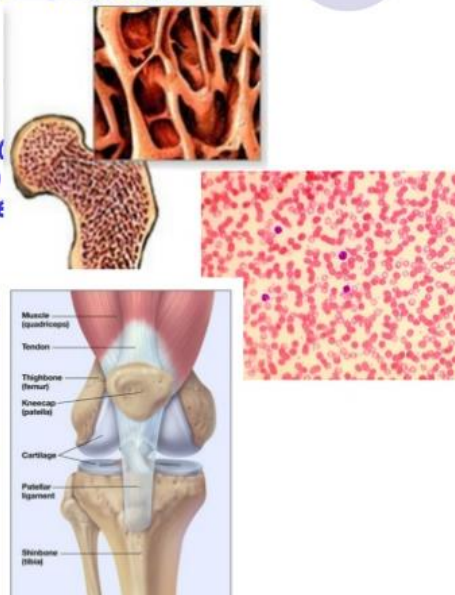
- Structure

Cells in connective tissue can be hard and spongy (bone), small, flexible and rounded (blood), smooth & slippery (cartilage), stringy & elastic (ligaments/tendons).
- Function

Support, cushion and protect organs

Transport substances

Connect 1 tissue to another



Structure and Function in Connective Tissue

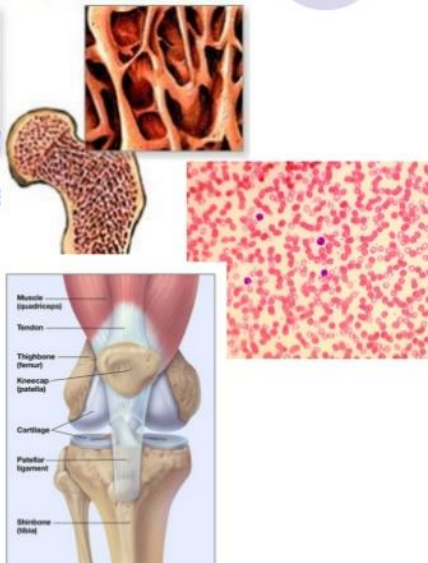
- Structure

Cells in connective tissue can be hard and spongy (bone), small, flexible and rounded (blood), smooth & slippery (cartilage), stringy & elastic (ligaments/tendons).
- Function

Support, cushion and protect organs

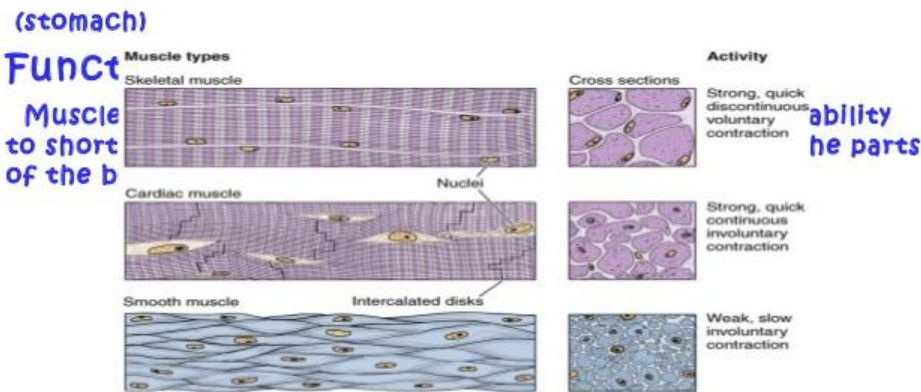
Transport substances

Connect 1 tissue to another



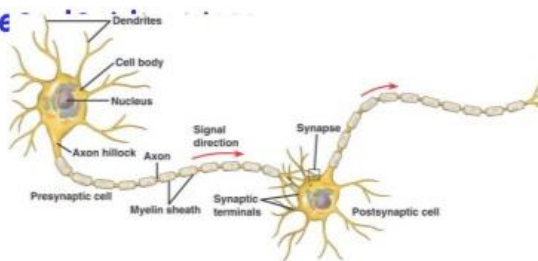
Structure and Function in Muscle Tissue

- Structure:**
- Skeletal muscle fibers are cylindrical and striated – voluntary (arms, legs)
 - Cardiac muscle fibers are branched and striated – involuntary (heart)
 - Smooth muscle fibers are spindle shaped and non-striated – involuntary (stomach)



Structure and Function in Nerve Tissue

- Structure**
- Elongated cells with branches at the ends. Found in brain, spinal cord and nerves.
- Function**
- To deliver a message to the next nerve cell in order to transmit information across the body
- Responsible for coordinating and controlling many body activities
- Messages delivered by electrical impulses



Organs

- Two or more tissues working together form an organ. Organs are more complex than tissues.
- Examples of Organs

- Heart
- Stomach
- Lungs



Important facts regarding animal tissue

- >Muscles contain special protein called contractile or myosin protein.
- >Fat storing adipose tissue is found below the skin and between internal organs.
- >No bones are connected to each other by a tissue called ligament. This tissue is very elastic.
- >The skin, the lining of the mouth, the lining blood vessels, kidney tubules are all made up of epithelial tissue.
- >Voluntary muscles and Cardiac muscles are richly supplied with blood whereas Involuntary muscles are poorly supplied with blood.
- >The Spleen serves as a reservoir for blood, and filters or purifies the blood and lymph fluid that flows through it
- >Antibodies: Antibodies are a type of protein molecule known as immunoglobulins.

Blood

- >Blood is slightly alkaline in nature (pH = 7.4).
- >Its volume in adult is 5 litre.
- >Blood is a Connective tissue and composed of blood corpuscles, plasma (60%) and platelets,
- >Most of the cells are faint yellow and without a nucleus.
- > A dense accumulation of these cells is responsible for the red colour of the blood.
- >These cells are called 'Erythrocytes' or Red Blood Cells.
- >There are also another two types of cells- the 'Leucocytes' or White Blood Cells and 'Thrombocytes' or Platelets.

What makes up our blood?

- **RED BLOOD CELLS** (Erythrocytes) – The most abundant cells in our blood; they are produced in the bone marrow and contain a protein called hemoglobin that carries oxygen to our cells.
- **WHITE BLOOD CELLS** (Leukocytes) – They are part of the immune system and destroy infectious agents called pathogens.
- **PLASMA** – This is the yellowish liquid portion of blood that contains electrolytes, nutrients and vitamins, hormones, clotting factors, and proteins such as antibodies to fight infection.
- **PLATELETS** (Thrombocytes) – The clotting factors that are carried in the plasma; they clot together in a process called coagulation to seal a wound and prevent a loss of blood.

Plasma

- >It is fluid which contains 90 percent water. The chief salt dissolved in plasma is sodium chloride and constitute about 60% volume of blood.
- >The salinity of plasma is one-third that of sea water. Fibrinogen is a protein which is essential for cloning of blood and another protein globulins aid in the defence mechanisms of the body is found in plasma.

Red Blood Corpuscles (RBC)

- >Red Blood Corpuscles(RBC) are the most numerous of the blood cells, they neither have a nucleus nor mitochondria. RBC are a reddish coloured containing iron (Fe) pigment haemoglobin which is responsible for red colour.
- > The normal quantity of haemoglobin present in blood is 12-15 g in every 100ml of blood. A decrease in this quantity is called Anaemia',
- >The average life span of a red blood cell is about four months (120 days). They are produced in the hollow of the bones (bone marrow). Its destruction takes place in Liver and Spleen. Therefore Liver is called Grave of RBC,

White Blood Corpuscles (WBC)

- >White Blood Corpuscles (WBC) differ from RBC in three aspects - first, they have nuclei, secondly, they do not contain haemoglobin, and are therefore nearly colourless. White cells engulf disease causing bacteria. This process is called 'Phagocytosis'.
- >Platelets (thrombocytes) are non-nucleated and formed in bone marrow, it helps in blood clotting. In dengue fever, number of platelets reduced.
- >Rh factor discovered by Landsteiner and Wiener in Rhesus monkey which is responsible for Erythroblastosis foetalis disease.
- >Important component of blood clotting are fibrinogen (protein), prothrombin, thromboplastin, calcium ions and vitamin K.

Blood Group

- >A, B,AB and O are the four blood groups :
- >Blood Group '**O**' **has no antigen** but has both Anti-A and Anti-B antibodies. He can give blood to Group O,A, B and AB and can receive blood only from group O. **Therefore”Group O” it is called Universal Donor.**
- >Blood Group 'A' has A-Antigen and Anti-B antibodies. He can give blood to Group A and AB and can receive blood from Group O & A.
- >Blood Group 'B' has B-Antigen and Anti-A antibodies. He can give blood to Group B and AB and can receive blood from Group O & B.
- >Blood group 'AB' has A & B Antigen but has no Antibodies. He can give blood to Group AB and can receive blood from Group O, A, B, & AB. Therefore **Group AB is Universal Receptor.**
- >Blood Group was discovered by Landsteiner. For this, he got nobel prize in 1930.

The Circulatory System

>Human Heart : The human heart is an thick, muscular organ that pumps blood throughout the body via the Double Circulatory System, supplying oxygen and nutrients to the tissues and removing carbon dioxide and other wastes.

>The human heart has four Chambers (Double circuit).

>The Chambers which receive the blood from body tissues are called Auricles and the Chambers of heart which pump blood to body tissues are called Ventricles.

>The Right Atrium and Right ventricle together make up the "Right heart," the left atrium and left Ventricle make up the "Left heart."

>A wall of muscle called the Septum "seperates the two sides of the heart.

>Valves prevent backflow, keeping the blood in one direction through the heart.

>Tricuspid Valve found between Right A and Right Ventricle while Bicuspid Valve between Lelt Auricle and Left Ventricle.

>A double-walled sac called the Pericardium the heart, which serves to protect the heart and anchor it inside the chest between the outer layer the parietal pericardium, and the inner layer, ii' serous pericardium, runs pericardial fluid, which lubricates the heart during contractions and movements of the lungs and diaphragm.

>The heart's outer wall consists of three layer:

- . The outermost wall layer, or Pericardium,
- . The middle layer, or Myocardiunt. Contains the muscle that contracts,
- . The inner layer, or Endocardiurn, is the lining that contacts the blood.

The heart circulates blood through two pathways :

1. The Pulmonary Circuit
2. The Systemic Circuit

>In the Pulmonary Circuit, deoxygenated blood leaves the right ventricle of the heart via the Pulmonary Artery and travels to the lungs, then returns as oxygenated blood to the left atrium of the heart via the Pulmonary Vein.

>In the Systemic Circuit, oxygenated blood leaves the body via the left ventricle to the aorta, and from there enters the arteries and capillaries where it supplies the body's tissues with oxygen. Deoxygenated blood returns via Veins to the vena cava, re-entering the heart's right atrium.

>The cardiovascular system circulates blood from the heart to the lungs and around the body via blood vessels.

>**Blockage of any artery can cause a heart attack**, or damage to the muscle of the heart, A heart attack is distinct from cardiac arrest, which is a sudden loss of heart function that usually occurs as a result of electrical disturbances of the heart rhythm,

>The heart contains electrical "pacemaker" cells, which cause it to contract — producing a heartbeat.

>The Aorta is the main artery leaving the heart.

>Human heart is mygenic Le. contraction is initiated by a pulse produced by Sino Atrial Node (SA Node) located in right atrium. First heart sound is Lub and second heart sound is dub. **SA Node is natural pacemaker.**

>Contraction of heart is called systole (120 mm Hg) while relaxation is called Dinslole (80 mm Hg).

>Blood Pressure of a normal person (120/80 mm Hg) is measured by **Sphygmomanometer.**

>The normal rate of heart beat is 72/minute. Thyroxine and Arenaline hormones independently controls the heart beat.

>Mammals have Double Circulatory System Le, blood have to cross two times from heart before circulating throughout the body.

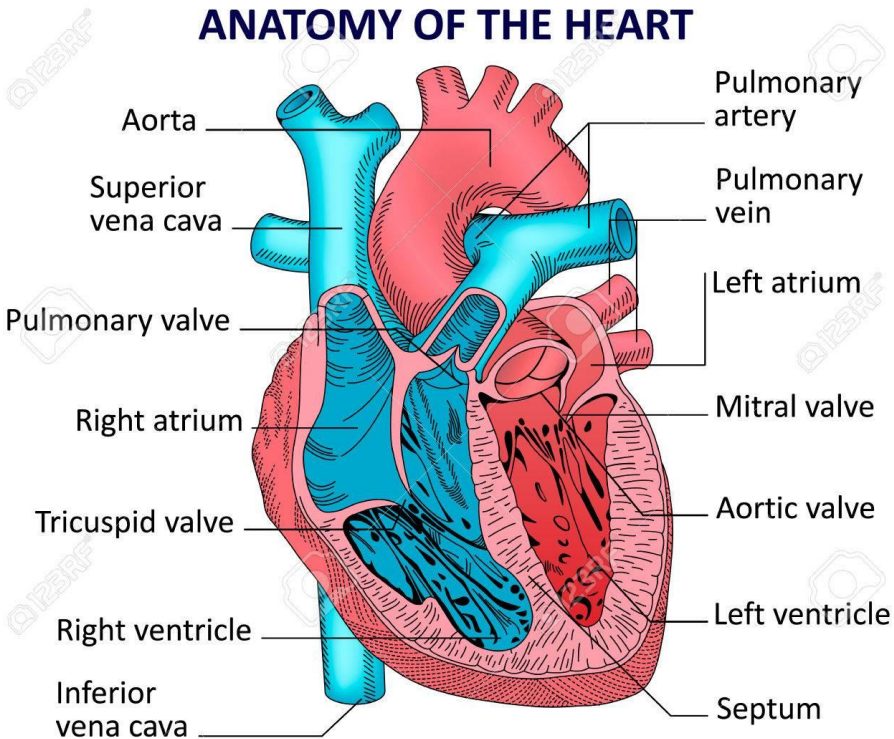
Blood Vessels

Blood vessels are of three types :

>Arteries carry the blood away from the heart to various body part. Usually these carry oxygenated blood in them, except the Pulmonary Artery which carries deoxygenated blood to the lungs.

>Veins carry the blood from various body parts to the heart. Usually these carry deoxygenated blood in them except the Pulmonary Vein which carries oxygenated (pare) blood to the heart.

>Capillaries are thinnest blood vessels which connect arteries to the veins. These help in the exchange of materials like the nutrients, gases, waste products etc. between blood and cells.



Lymph

>Lymph is yellow fluid flows only in one direction from tissue towards heart.

>Lymphocytes present in lymph helps to prevent the body from diseases by killing harmful bacteria. It helps in healing the wounds.

>**The Pulmonary Artery carries deoxygenated blood to the lungs.**

>The Veins have valves that prevent backflow of blood.

Skeleton

>The human skeleton is made up of 206 bones. At birth, new born has more than 300 bones.

>The human skeleton performs six major functions Support, movement, protection, production of blood cells, storage of minerals and endocrine regulation.

>The main bones of the human skeleton:

- . The Skull : Cranium, Mandible and Maxilla
- . Shoulder girdle: clavicle and Supula
- . Arm : Humerus. Radius and Ulna
- . Hand : Carpals, Metacarpals and Phalanges
- . Chest :Sternum and Ribs
- . Spine : Cervical area (top 7 vertebrae), Thoracic (next 12), Lumbar (bottom 5 vertebrae), Sacrum (5 iissed bones) and Coccyx (the tiny bit at the bottom of the spine).
- . Pelvic girdle : Ilium, Pubis and Ischium
- . Leg : Femur, Tibia and Fibula
- . Ankle : Talus and Calcaneus
- . Foot : Tarsals, Metatarsal: and Phalanges.

BONES

- >Bones are formed by the ossification of Cartilage. Calcium is needed for strong bone growth.
- >A Joint is the point where two or more bones meet, There are three main types of joints; Fibrous (immoveable); Cartilaginous (partially moveable) and the Synovial (freely moveable) joint.
- >Tendon joins the muscles and bones.
- >Ligament; joins bone to bone. Ligaments are made up of yellow fibres.
- >The skeletal system in adult body is made up of 206 bones.

Structure of bones

- >The skeleton makes up about 30-40% of an adult's body mass.
- >The skeleton’s mass is made up of non-living bone matrix and many tiny bone Cells.
- >Roughly half of the bone matrix's mass is water, while the other half is collagen protein and solid crystals of calcium carbonate and calcium phosphate.
- >Living bone cells are found on the edges of bones and in small cavities inside of the bone matrix
- >The bone cell allow bones to: (1) grow and develop; (2) Be repaired following an injury or daily wear; (3) Be broken down to release their stored minerals.
- >Long bones ' eg. Femur, Tibia, Fibula, Metatarsals and Phalanges.
- >Short bones : eg. Carpal bones of wrist and Tarsal bones of foot.
- >Flat bones : eg. Frontal, Parietal and Occipital bones of the Cranium.
- >Irregular bones: eg. Vertebrae, Sacrum and Coccyx of the spine as well as the sphenoid, ethmoid and zygomatic bones of the skull.
- Sesamoid bones : eg. Patella and Pisiform bone of carpals.
- >Red Bone Marrow produces red and white blood cells in a process known as hematopoiesis.
- >Red bone marrow is found in the hollow space inside of bones known " the medullary cavity. The amount of red bone marrow drops off at the end of puberty, replaced by yellow bone marrow is used to store energy in the form lipids.
- >Bone cells also release Osteocalcin, a hormone that helps regulate blood sugar and fat deposition.

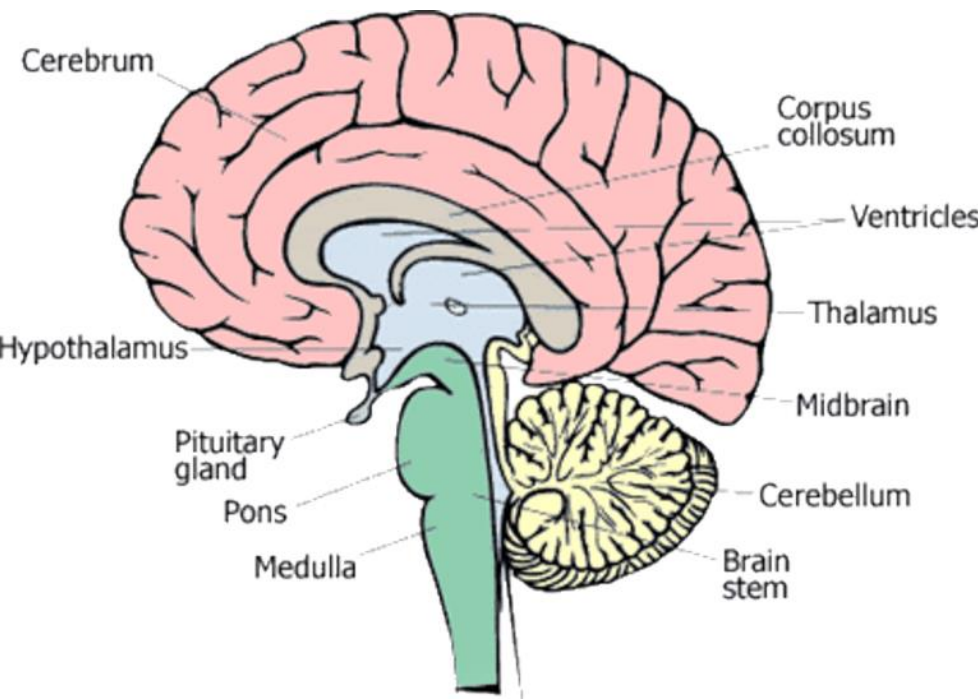
Nervous System

- >The nervous sytem is a complex network of nerves and cells that carry messages to and from the brain and spinal cord to various parts of the body.
- >The nervous system has two parts, called the Central Nervous System (CNS) and Peripheral Nervous System due to their location in the body.
- >The Central Nervous System is made up of the brain and spinal cord which is safely contained within the skull and vertebral column of the spine and the Peripheral Nervous System is composed of Somatic and Autonomic Nervous System.

STUDY
FUNDA

Brain

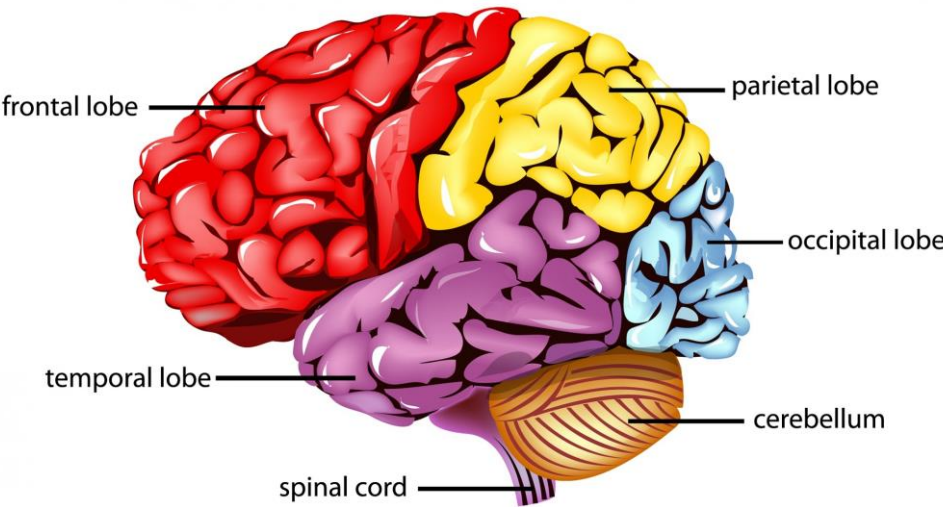
- >The Brain lies within the Skull and is shaped like a mushroom. Brain is covered by membrane called Meninges. It is situated in a tiny box called Cranium.
- >The brain consists of four principal parts : (1)Brain Stem; (2) Cerebrum; (3) Cerebellum; (4) Diencephalon.



- >The brain weights approx, 1.3 to 1.4 kg (3 pounds). It has nerve cells called neurons and supporting cells called the glia (Neuroglia).
- >The 100 billion neurons of the brain form the main control center of the body.
- >The Brain Stem is also known as the Medulla Oblongata. It is located between the pons and the spinal cord and is vital for life as it breathing, heart rate and blood pressure.
- >The Cerebrum forms the bulk of the brain and is supported on the brain stem. >The Cerebrum is divided into two hemispheres. Both hemisphere are connected by a thick band of nerve Fibres called the Corpus Callosum. Each hemisphere controls the activities of the side of the body opposite that hemisphere.

The Hemisphere are further divided into four lobes :
(I) Frontal lobe; (2) Temporal lobe; (3) Parietal lobe (4) Occipital lobe.

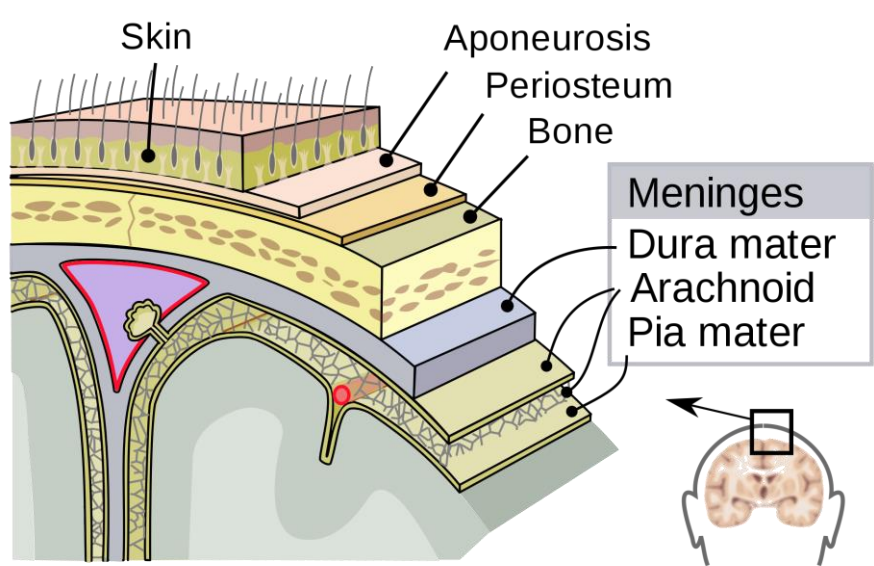
Parts of the Human Brain



- >Wisdom, memory, thought, voluntary movement, language, reasoning and perception are the major functions of the Cerebral Cortex,
- >The Cerebellum is located behind and below the Cerebrum.
- >The major functions of the Cerebellum are maintainence of movement, balance and posture.
- >The Diencephalon is also known as the fore brain stem. It includes the Thalamus and Hypothalamus.
- >The Thalamus is where sensory and other impulses go and coalesce. Thalamus works by integrating sensory information and motor information.
- >The Hypothalamus is pea sized organ part of the Diencephalon. It regulates the body temperatures (thermostat), emotions and hunger, thirst and controls the circadian rhythms.

Meningas

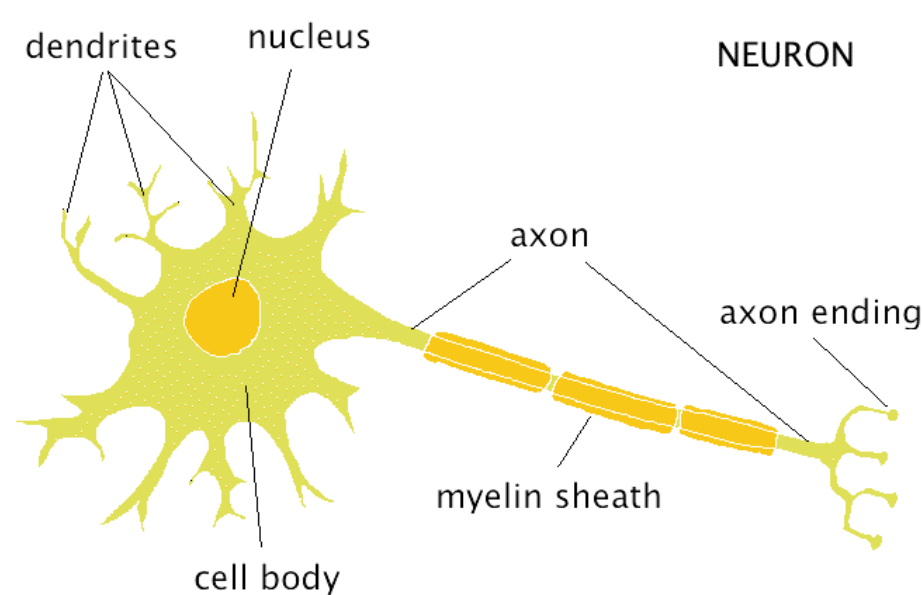
- . The meninges are three layers or membranes that cover the Brain and the Spinal Cord.
- . The outermost layer is the **Duramater**. The middle layer is the **Arachnoid** and the innermost layer is the **Piamater**.



- o The **meninges offer protection to the brain** and the spinal cord by acting as a barrier against bacteria and other microorganisms.
- . Nerves that exist from the Cranium are called Cranial nerves (12 pairs). While those existing from the Spinal Cord tire called Spinal nerves (31 pairs).
 - . Cranial nerves go from brain to eyes, mouth, ears and other parts of head.
 - . Central nerves are in brain and spinal cord.
 - . Peripheral nerves go from Spinal Cord to arms, hands, legs and feet.
 - . Autonomic nerves go from Spinal Cord to lungs, hearts, stomach, intestines bladder and sex organs.

Neurons

- . The neuron is the basic unit in the nervous system.
- .It is a specialized conductor cell that receives and transmits electrochemical nerve impulses. There are many billions of nerve cells (also called neuron) in the nervous system The brain alone has 100 billions neurons in it.
- .A typical Neuron has a cell body and long arms that conduct impulses from one body parts to another body parts.
- .There are three different parts of the Neuron ',
(a) Cell body; (b) Dendrites; (c) Axon



- .The Cell body is with a nucleus or control center and mitochondria.
- .The Cell body has several highly branched, thick shorter extensions that appear like cables and are called Dendrites. The exception is a sensory neuron that has a single, long dendrite instead of many dendrites.
- The dendrite's function is to carry a nerve impulse from other neurons into the cell body.
- .Axon is a long, thin process that carries impulses away from the cell body to another neuron or tissue.

Drugs that act on Nervous System

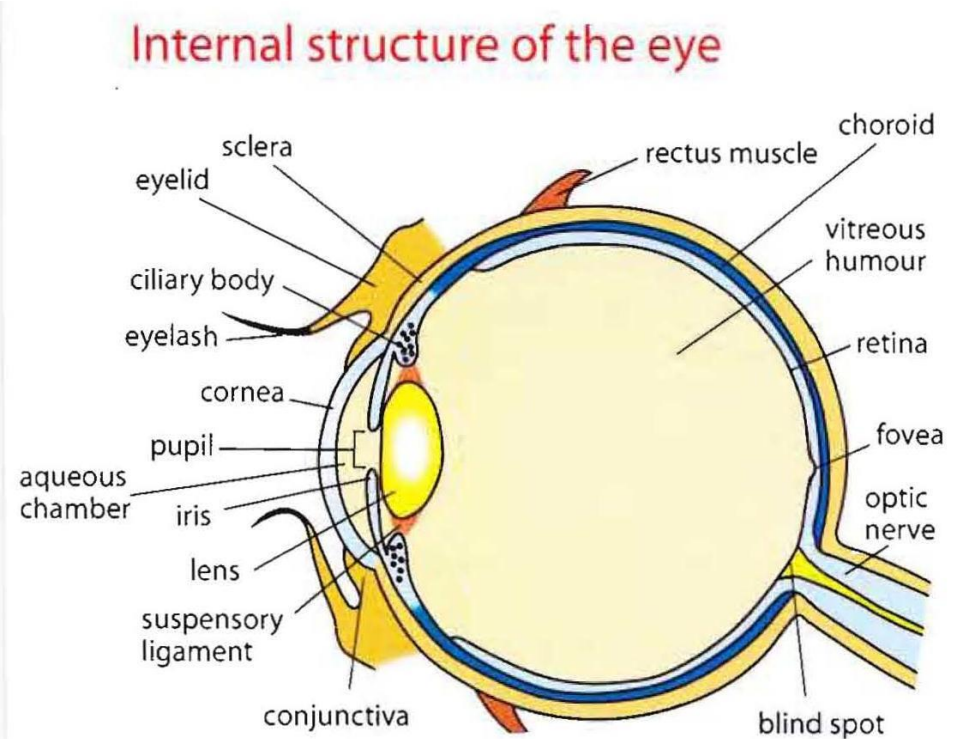
- >**Caffeine** inhibits the release at neurotransmitters by blocking the action of adenosine.
- >**Nicotine** in Tobacco enhances the Acetylcholine and act as **stimulant**.
- >Thorazine drugs affect cognitive or thinking processes.
- >Amphetamines are similar to noradrenaline and stimulate the release at nor-adrenaline and dopamine in brain.
- >**Cocaine** blocks the uptake of dopamine thus leads to hallucinations.
- >Methamphetamine acts similarly as cocaine.
- >**Marijuana (Cannabis sativa)** acts on neurotransmitter serotonin.
- >Depressent effects are seen with tranquillizers like barbiturates and benzodiazepines. These acts by action of the inhibitory transmitter GABA.

****Diseases of Nervous System** :**

1. Huntington's chorea;
- 2, Dementia;
3. Alzheimer disease (memory loss);
4. Parkinson's disease (involves tremors of the limbs and difficulty in maintaining balance along with muscle, rigidity due to lack of dopamine);
5. Epilepsy;
6. Cerebral palsy;
7. Depression (lack of serotonin/ nor-epinephrine);
8. Schizophrenia;
9. Phobias.

The Human Eye

- >The human eye is an organ which react to light and pressure and differentiate between about 10 million colors.
- .The eye is composed of the anterior segment an posterior segment.
- >The anterior segment is made up ofthe **Cornea, Iris and Lens**.
- >The cornea is transparent and more curved, comprised of the vitreous, retina, choroid and the outer white shell called the **sclera**.
- >The eye is made up of three layers or coats. The outermost layer (fibrous tunic) is composed of the **Cornea** and **Sclera**.



- >The middle layer (vascular tunic or uvea) consists of the **Choroid, Ciliary Body**, Pigmented Epithelium and Iris.
- >The innermost layer is the Retina, which gets its oxygenation from the blood vessels of the choroid and retinal vessels.
- >Sclera is a tough and thick white sheath that protects the inner parts of the eye.
- > **Conjunctiva** is a thin transparent membrane that is spread across the sclera. It keeps the eyes moist and clear by secreting small amount of mucus and tears.

>Cornea is the transparent layer of skin that is spread over the pupil and the iris. The function of the Cornea is to refract the light that enters the eyes.

>Iris is coloured, pigmented part of the eye. It controls the amount of light that enters the eye by changing the size of the pupil.

>Pupil is small opening located at the middle of the Iris. It allows light to come in.

>Lens : Transparent structure inside the eye that focuses light rays onto the retina.

>Retina is light sensitive tissue that lines the back of the eye. it contains millions of photo receptors (Rods and Cones) that detect dim and colored lights and convert light rays into electrical impulses that are transmitted to the brain via Optic Nerve. The image formed on the retina is real and inverted.

>**Rods are highly sensitive to dim light, Eg. Owl's eyes contains rod only, Cones are sensitive to bright light Eg, Hens eyes contains cones only.**

| | Function | Distribution | Comments |
|-------|---|--|--|
| Rods | Sensitive to low light intensity. Detect shades of grey | Found throught the retina, but none in the centrer of the fovea or in the blind spot | Provide us with night vision, when we can recognise shapes but not colours |
| Cones | Sensitive only to high light intensity. Detect colour (don't operate in poor light) | Concentrated in the fovea | There are three types, sensitive to red, green and blue light |

>Aqueous humour is a watery fluid that is present in the area between the lens and the cornea. It is responsible for the nourishment of both the lens and the cornea.

>Vitreous humour is a transparent semi solid,jelly like substances that fills the interior of the eyes. Its role is to maintain the shape of the eye and refraction of light before it reaches the retina.

>Optic nerve located at the end of the eyes,behind the retina. The Optic nerve is responsible for carrying all the nerve impulses from the photoreceptors to the brain, without which vision would not be Possible.

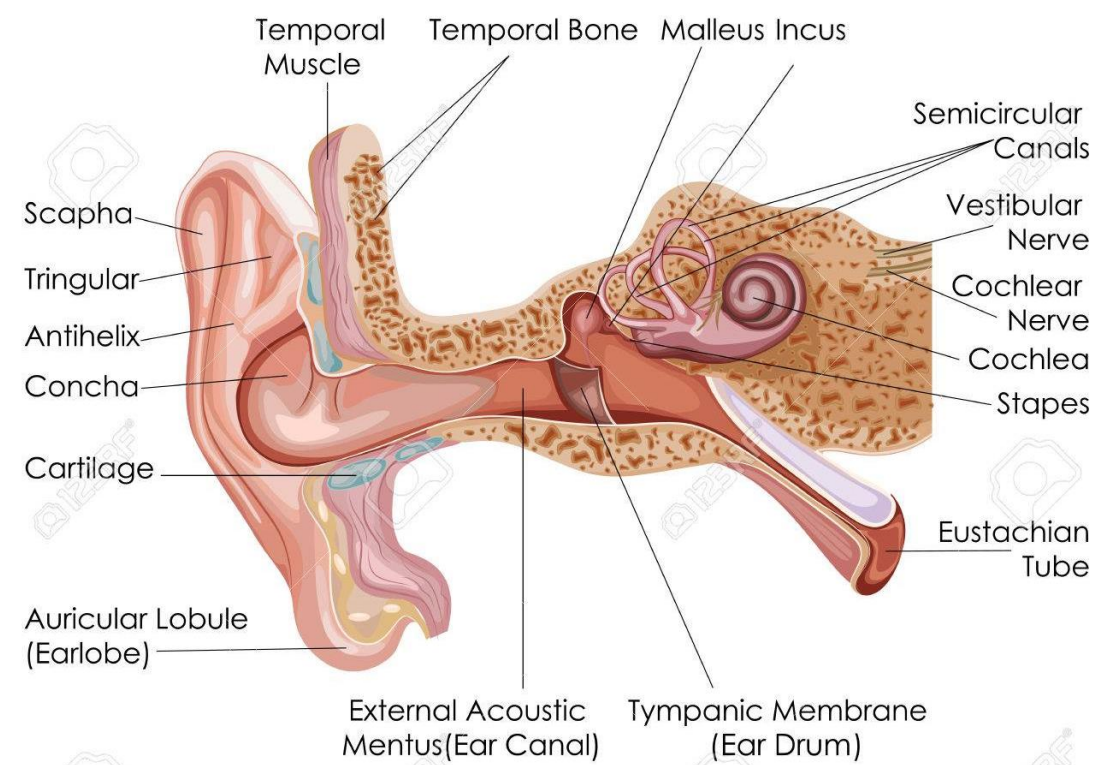
>Macula : Small central area in the retina that contains special light sensitive cells and allow us to see fine details clearly.

The Ear

>Ear are meant for both balancing and hearing Hearing is controlled by auditory area of temporal lobe of cerebral cortex.

>Mammalian ear is made up of three parts i.e. external, middle and inner ear.

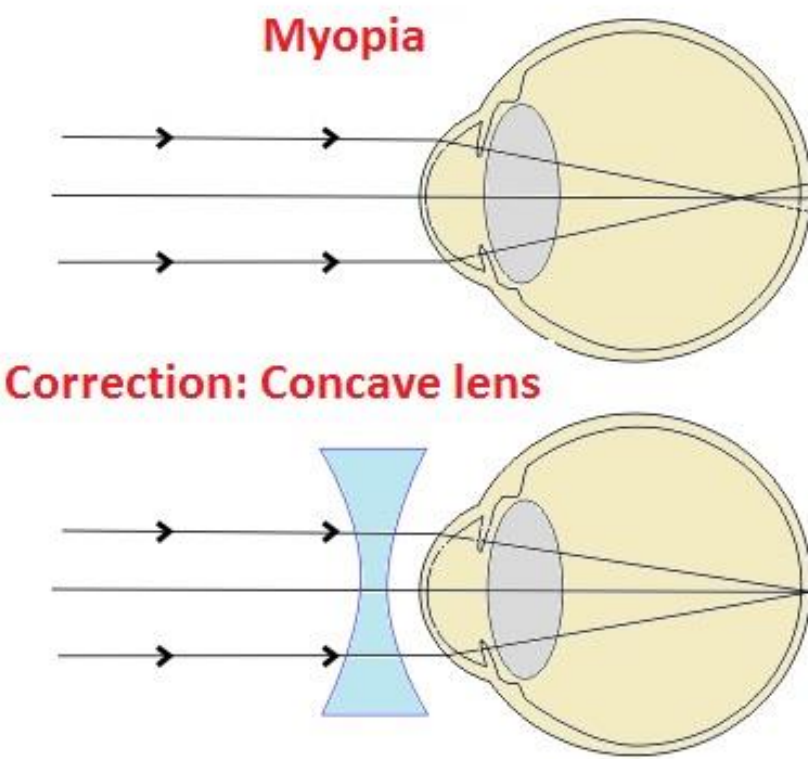
Ear Diagram



Defects of the Eye

>**Myopia (near sightedness)** is a defect of vision in which far objects or distant objects appear blurred but near objects are seen clearly because image is focussed infront of the retina.

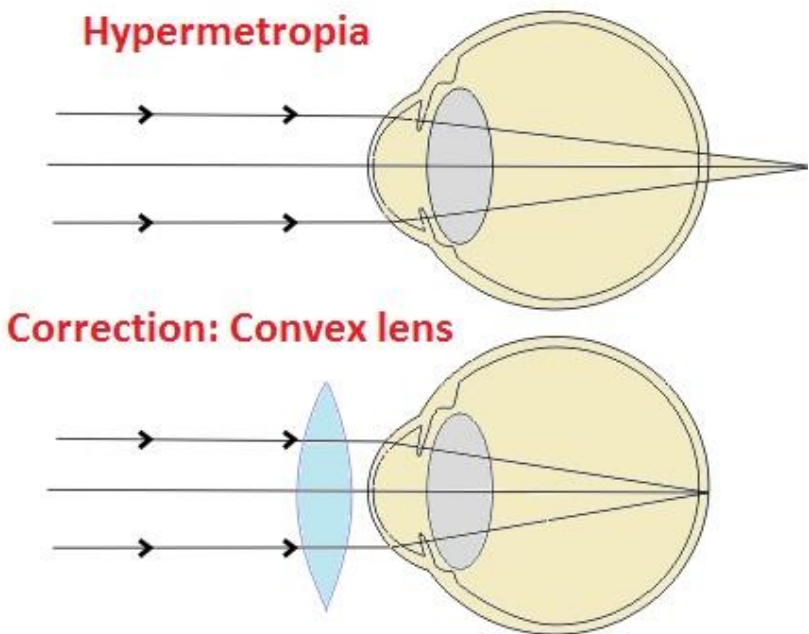
>**Myopia** can be corrected by using **concave lens** that helps to focus the image on the retina.



>Hypertropia (farsightedness) is a defect of vision in which there is difficulty with near vision but far objects can seen clearly because image is focussed behind the retina.

>**Hypertropia** can be corrected by using **Convex lens**

Astigmatism is a defect of vision in which the leil, is warped, causing images not to focus properly on the retina.



>Cylindrical glasses can correct this defect.

Cataracts is clouding of the lens, which prevent a clear, sharp image being produced clouding results in blurred vision.

>Glaucoma is a disease caused by Increased Intraocular Pressure (IOP) usually resulting from a malfunction to the eye's drainage system. [or can cause irreversible damage to the optic nerve and retinal fibres to permanent loss of vision).

>External ear includes a **Pinna or Auricle** (Cartilage covered by skin placed on opposite sides of the head), Auditory canal or ear canal, and Tympanic membrane (ear drum).

>The external ear collects sounds. Sound travels through the Auditory canal, a short tube that ends at the Ear drum.

>Middle ear includes Ear drum, Tympanic cavity and Ear ossicles [3 tiny bones r Malleus (Hammer), Incus (Anvil) and Stapes (Stirrup).

>**Stapes** is the smallest bone in the body,

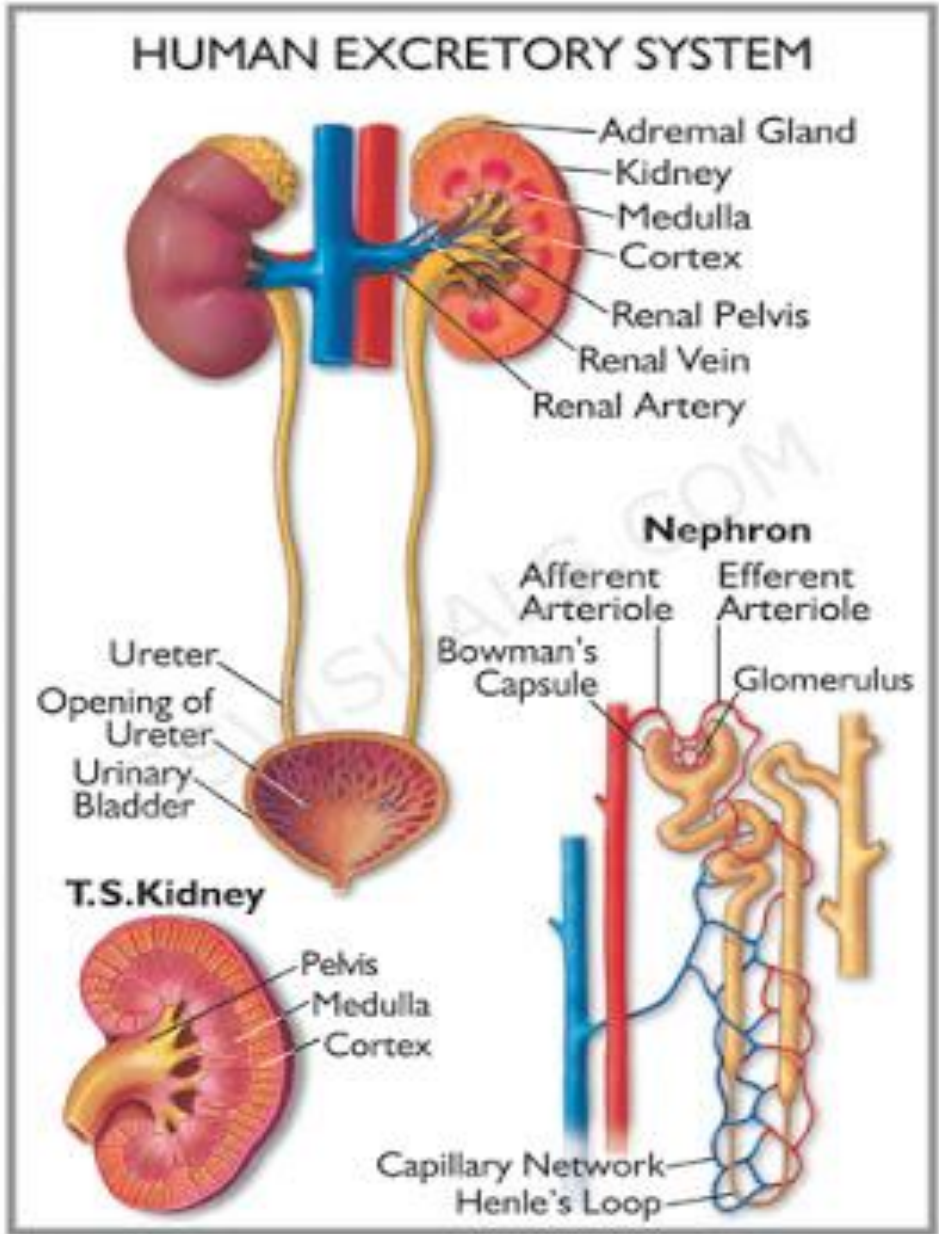
>The Cochlea is filled with fluid and contains the Organ of Corti (a structure that contains thousands of specialised sensory hair cells with projections called cilia). The vibrations transmitted from the middle ear cause tiny waves to form in the inner ear fluid, which make the cilia vibrate. The hair cells then convert these vibrations into nerve impulse or signals which are sent through the Auditory Nerve to the brain where they are interpreted as sound, The round window (fenestra cochlea) is a membrane that connects the cochlea to the middle ear, It helps dampen the vibrations in the cochlea,

The Excretory System

>**Excretion is the removal of harmful waste materials** from the body fluids of organism so as to help maintain internal chemical homeostasis and prevent damage to the body. Therefore excretion means the release of nitrogenous excretory substances like **urea, ammonia, uric acid etc.**

>There are several parts of the body are involved in this process, such as **sweat glands, liver, lungs and the kidney system.**

>Every human has **two** kidney. Each kidney is made up of three sections : the **renal cortex**, the **renal medulla** and the **renal pelvis**.



>The blood arrives at the kidney via the renal artery, which splits into many afferent arterioles.

>**The functional and structural unit of the kidney is the nephron.**

>The nephron produces urine and is the primary unit of homeostasis in the body. It is essentially the long tubule with associated blood vessels.

>The renal pelvis takes urine away from the Kidney via Ureter.

>Both of the Ureters lead the Urine into the body's only Urinary bladder which expands and sends nerve impulses when full. From there, Urine is expelled through the Urethra and out of the body Within the Bowman's Capsule Is a coiled ball of capillaries known " Glomerulus which is made up at two types at arterioles

(a) Afferent arteriole which carries the blood to the glomerulus

(b) Efferent arteriole by which the blood is taken out at the glomerulus.

>The process of filtration of liquid into the cavity of Bowman's Capsule is called Ultrafiltration.

>**Human produce a hormone called Antidiuretic Hormone (ADH)**, also called as Vasopressin, which is secreted by posterior lobe of the Pituitary gland, It regulates the amount of urine by controlling the rate of water absorption in the nephron tubules.

>Low levels of ADH causes a disease called **Diabetes** Insipidus.

Urine

>It is a pale yellow coloured due to presence of Urochrome pigment.

> It has faint aromatic odour due to urinoid.

>Human urine contains about 95% water, 2% salts, 2.6% urea and 0.3% uric acid.

>Haemodialysis is the process of removal of excess urea from the blood of patient using artificial kidney

>Kidney stone is generally calcium oxalate crystals.

>Aquatic animals (like fishes, most invertebrates) generally excrete ammonia.

>Ascaris, earthworm, cartilaginous amphibian and mammals excrete urea.

>Desert animals, insects, reptiles and birds excrete uric acid.

REPRODUC VE SYSTEMS

The Male Reproductive System

>>The major reproductive organs of the male can be grouped into three categories :

- 1: The first category is sperm production and storage. Sperm production takes place in the Testes which are housed in the temperature regulating Scrotum (it provides a temperature about 3°C below normal body temperature), immature sperm then travel to the Epididymis for development and storage (where they gain a tail and motility).
- 2. The second category are ejaculatory fluid producing glands which include the Seminal Vesicles, Prostate Glands and the Vas Deferens.
- 3. The final category are those used for copulation and deposition of the spermatozoa (sperm) within the male, which include the Penis, Urethra, Vas Deferens and Cowper's Gland.

>An Important sexual hormone of male is Androgen and particularly Testosterone.

The Female Reproductive System

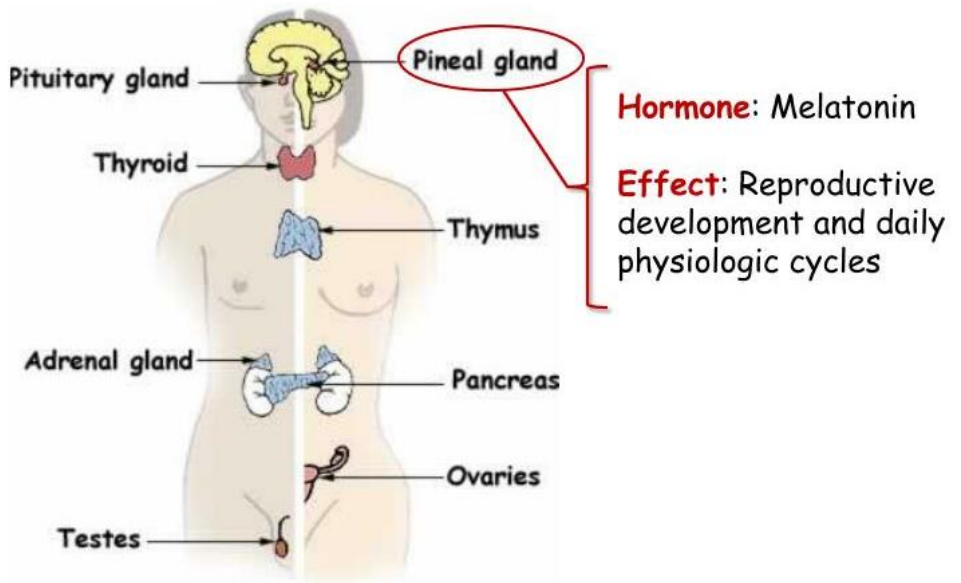
- >The human female reproductive system is a series of organs primarily located inside of the body and around the pelvic region of a female that contribute towards the reproductive process.
- >The human female reproductive system contains three main parts: the Vagina, which leads from the Vulva, the vaginal opening, to the Uterus, the Uterus which holds the developing fetus, and the Ovaries which produce the female's ova.
- >The Vagina meets the outside the vulva, which also includes the labia, clitoris and urethra; during intercourse this area is lubricated by mucus secreted by the Bartholin's glands.
- >The Vagina is attached to the Uterus through **the cervix**, while the Uterus is attached to the Ovaries via the Fallopian Tubes. Each Ovary contains hundreds of egg cell or ova.
- >Approximately **every 28 days, the Pituitary gland** releases a hormone that stimulates some of the ova to develop and grow.
- >One ovum is released and it passes through the Fallopian Tube into the **Uterus**. The lining of the uterus called the Endometrium and unfertilized ova are shed each cycle through the Process menstruation. If the ovum is fertilized by sperm,it attaches to the endometrium and the fetus develops.
- >After the age of 13-14 years, the ovary ovum (egg cell) after every 28 days, This cycle of approximately 28 days is called menstruation cycle.
- >The **fertilization** of egg takes place in the **fallopian Tube** after which the developing embryo becomes attached to the Uterus (implantation).
- >The connection between developing embryo in mother is called Placenta. It supplies different materials like food, hormones, dissolved oxygen to embryo.
- >Birth of child is technically called parturition.

Endocrine System

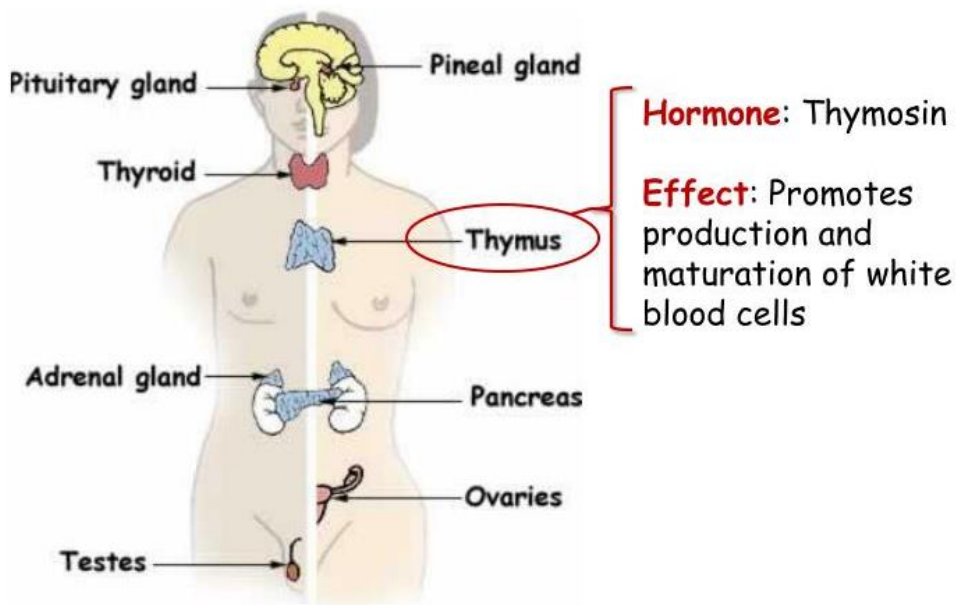
- >The Endocrine System (ductless) is the collection of glands of an organism that secrete hormones directly into the circulatory system to be carried towards distant target organs.
- >Thus hormone is a chemical messenger secreted by endocrine gland directly into the bloodstream where it travels to a target organs, where it exerts a specific effect.
- >The **major endocrine glands** include the **pineal gland, pituitary gland, pancreas, ovaries, testes, thyroid gland, parathyroid gland** and **adrenal glands**.
- >**Endocrine glands are ductless** (secretes its product directly into the bloodstream) in nature while Exocrine glands (such as salivary glands, sweat glands and glands within the gastrointestinal tract) tend to be much less vascular and have ducts or a hollow lumen (secretes its products Into a duct)
- >Endocrine action is slow, prolonged and chemical in nature while nerve action is fast, short lived and electrical in nature.

- >The Hypothalamus and Pituitary gland are neuroendocrine organs. Hypothalamus secretes hormones that controls the secretions of pituitary.
- >**Pituitary gland** is also known as **Master gland**, located at the base of the brain just beneath the hypothalamus.
- > The tiny pituitary is divided into two parts; the Anterior lobe (adenohypophysis) and Posterior lobe (neurohypophysis).

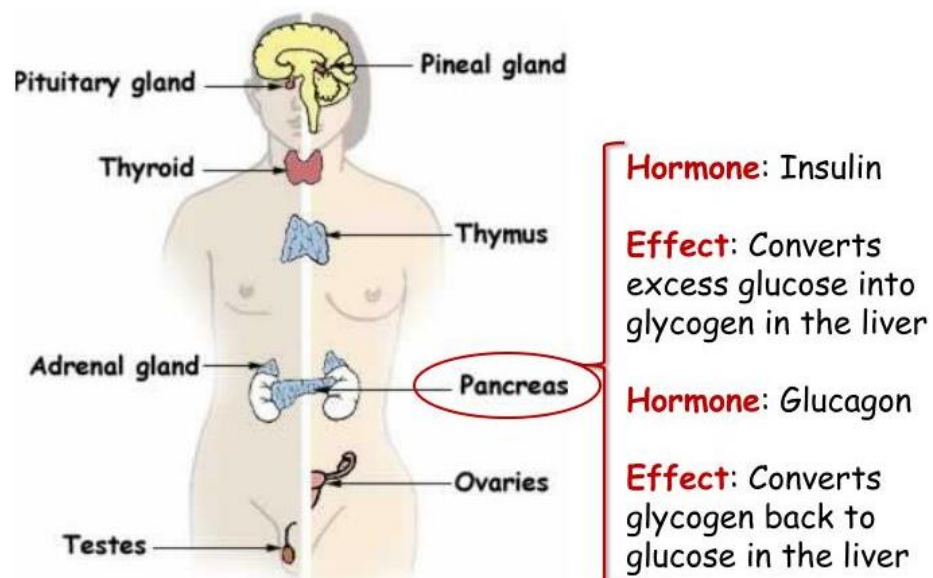
Major Endocrine Glands



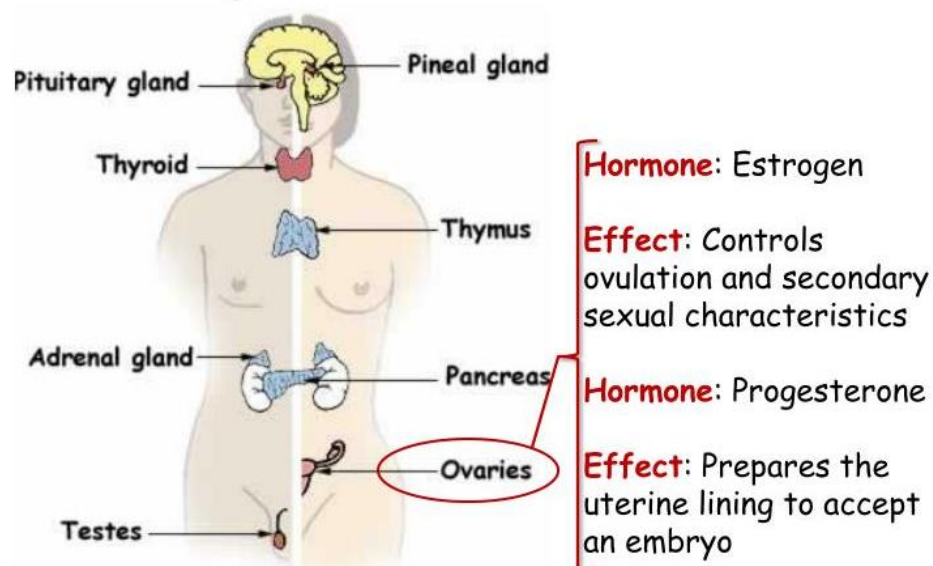
Major Endocrine Glands



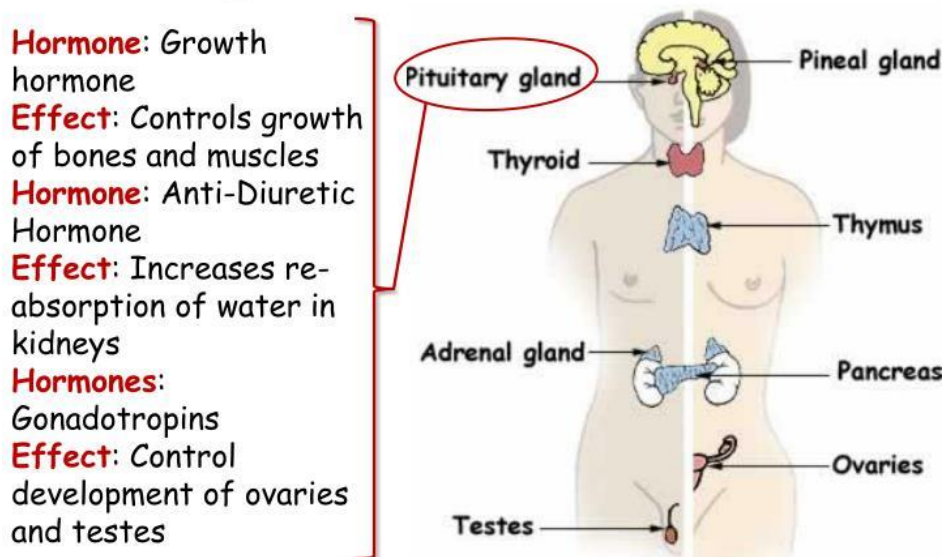
Major Endocrine Glands



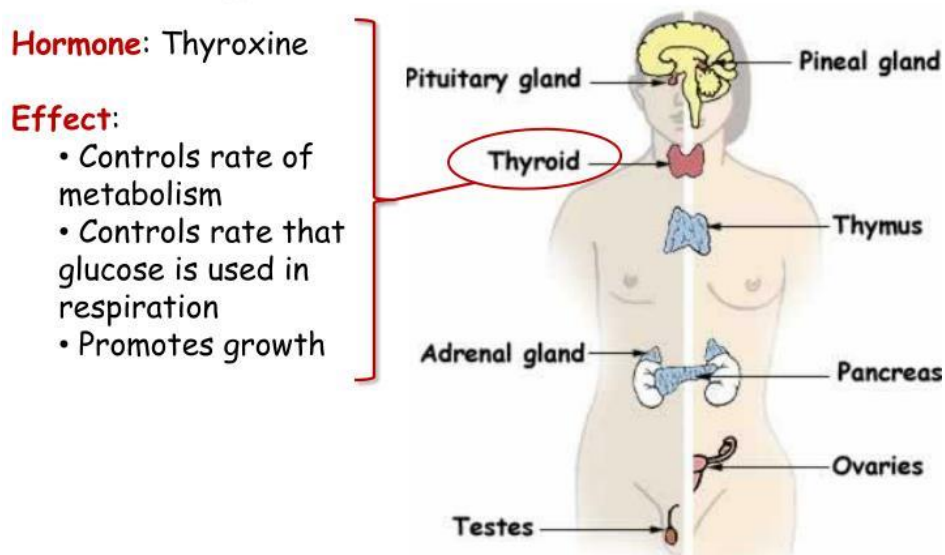
Major Endocrine Glands



Major Endocrine Glands



Major Endocrine Glands

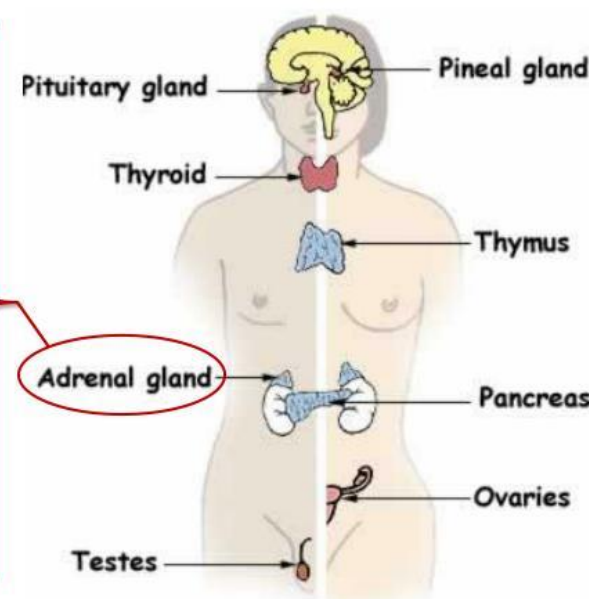


Major Endocrine Glands

Hormone: Adrenaline

Effect:

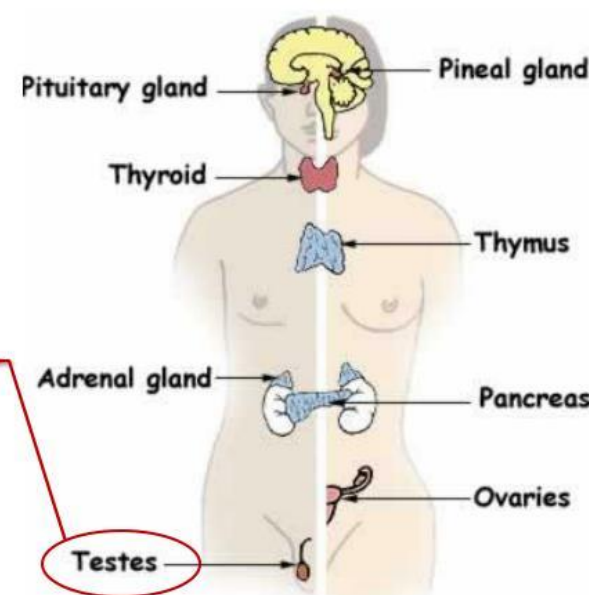
- Prepares the body for emergencies
- Increases heart rate, breathing rate, depth of breathing
- Raises blood glucose level
- Diverts blood from gut to skeletal muscles



Major Endocrine Glands

Hormone: Testosterone

Effect: Controls sperm production and secondary sexual characteristics



>In the **absence of Insulin**, glucose is removed from body and excreted in the kidney, a condition called **Diabetes** mellitus (glucose in urine, heavy urination, excessive thirst). Glucagon stimulates the breakdown of glycogen to glucose in liver.

>A **deficiency of Growth Hormone** (GH) (also known as somatotropin) results in Dwarfism; an oversecretion results in Gigantism and Acromegaly, Gonadotropins hormones, such as Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH) and Melanocyte Stimulating Hormone (MSH) are secreted by anterior lobe of Pituitary Gland.

>FSH stimulates the development of a follicle which contains the egg cell, in males stimulates sperm production, LH (Luteinizing Hormone) in female completes the maturation of follicle and stimulates the formation of Corpus Luteum, which secretes **female hormone (Estrogen)**, and in male, stimulates the production of **male hormones (Testosterone)** in the testes. MSH stimulates production of the pigment melanin.

>**A deficiency of Iodine causes thyroid gland enlargement, a condition called Goitre.**

>An undersecretion of thyroxine during childhood results Cretinism disease (dwarfism with abnormal body proportion and possible mental retardation) and Goitre. In adults, an undersecretion results Myxedema (physical and mental sluggishness) and Plummer's disease.

>**Thyroxine oversecretion results in high metabolic rates, Grave's disease, bulging eyeballs, irritability etc.**

Biomolecules

. Biomnlecules are the substances that are essential for living being to perform the basic function, eg. Carbohydrates, Proteins, Lipids etc.

Carbohydrates

>Ratio of carbon, hydrogen and oxygen ls 1:2:1 In carbohydrates.

>Carbohydrates are derivatives of polyhydroxy alcohols. The end product carbohydrate digestion is glucose (blood sugar). It oxidises In give energy along with Co2 & H2O.

>Monosaccharides cg. **ribose, Glucose, Fructose, Galactose etc**

>D-fructose is the sweetest of all sugars and is found in fruit juice, honey etc.

>Oligosaccharides eg, Maltese, Sucrose, Lactose.

>Polysaccharides cg. Starch, Glycogen, Cellulose, Chitin etc,

>Sources of Carbohydrate '. Wheat, rice, maize,potato.

Protein

- Proteins are large molecules made up of amino acids
- Different combinations of amino acids form different proteins
- Protein is a component of enzymes, hormones, and muscles

>Lack of protein causes Kwashiorkor Marasmus disease.

Fats

. Fat is an ester of glycerol and fatty acid.

. l gram of glucose give 4.2 kilo calories energy while 1 gram fat gives 9.3 kilo calorie energy.

. Coconut oil and Palm oil are examples of saturated oil.

Vitamins

>Vitamin was invented by Sir F.G. Hopkins. The term vitamin was coined by Funk.

>Vitamins are essential nutrients that contribute to a healthy life. Although most people get all the vitamins they need from the foods they eat, millions of people worldwide take supplemental vitamins as part of their health regimen.

They are divided into two groups :

1. Fat soluble vitamin: Vitamin-A, D, E and K.

2. Water soluble vitamin : Vitamin B and C.

>Cobalt (Co) is found in Vitamin B12.

>Synthesis of Vitamin D and K takes place in our body. Vitamin D is synthesised in our skin by ultraviolet rays In sunlight.

>Milk is not considered as complete food due to lack of Vitamin C and Iron.

>Deficiency of calcium and iron is generally found in pregnant women.

>Na+ (Sodium) is important for contraction of muscles and transmission of nerve impulse.

>Calcium (Ca) provides strength to bones and teeth with Vitamin, important role in muscular contraction, help in clotting of blood and blood formation.

>Phosphorus provides strength to bones and teeth.

>Iron is Important for formation of RBC and haemoglobin.

>Iodine is Important for synthesis of thyroxine hormone secreted by Thyroid gland.

| Vitamin Information | | | | | | |
|---------------------|--|-------------------|--|------------|---|---|
| Vitamin | Vitamer Chemical Name | Year of Discovery | Food Source | Solubility | Deficient Disease | Overdose Disease |
| Vitamin A | Retinol, Retinal, and four carotenoids including beta carotene | 1913 | Cod Liver Oil | Fat | Night Blindness, Hyperkeratosis, and Keratomalacia | Hypervitaminosis A |
| Vitamin B1 | Thiamine | 1910 | Rice Bran | Water | Beriberi, Wernicke-Korsakoff syndrome | Drowsiness or muscle relation with large doses |
| Vitamin B2 | Riboflavin | 1920 | Meat, Eggs | Water | Ariboflavinosis | |
| Vitamin B3 | Niacin, Niacinamide | 1936 | Meat, Eggs, Grains | Water | Pellagra | Liver damage (doses >2q/day) |
| Vitamin B5 | Panthotehic Acid | 1931 | Meat, Whole Grains, in many foods | Water | Paresthesia | Diarrhea; possibly nausea and heartburn |
| Vitamin B6 | Pyridoxine, Pyridoxamine, Pyridoxal | 1934 | Meat, Dairy Products | Water | Anemia peripheral neuropathy | Impairment of proprioception, nerve damage (doses > 100 mg/day) |
| Vitamin B7 | Biotin | 1931 | Meat, Dairy Products, Eggs | Water | Dermatitis, enteritis | |
| Vitamin B9 | Folic Acid, Folinic Acid | 1941 | Leafy Green Vegetables | Water | Megaloblast and Deficiency during pregnancy is associated with birth defects, such as neural tube defects | may mask symptoms of vitamin B12 deficiency |
| Vitamin B12 | Cyanocobalamin, Hydroxycobalamin, Methylcobalamin | 1926 | Liver, Eggs, Animal Products | Water | Megaloblastic anemia | Acme-like rash [causality is not conclusively established] |
| Vitamin C | Ascorbic Acid | 1920 | Citrus, Most Fresh Foods | Water | Scurvy | Vitamin C megadosage |
| Vitamin D | Cholecalciferol | 1920 | Cod Liver Oil | Fat | Rickets and Osteomalacia | Hypervitmainosis D |
| Vitamin E | Tocopherols, Tocotrienols | 1922 | Wheat Germ Oil, Unrefined Vegetable Oils | Fat | Deficiency is very rare, mild hemolytic anemia in newborn infants | Increased congestive heart failure seen in one large randomized study |
| Vitamin K | Phylloquinone, Manaquinones | 1931 | Leafy Green Vegetables | Fat | Bleeding Diathesis | Increased coagulation in patients in warfarin |

>Magnesium is important for muscular contraction and nervous system.

>Cobalt is important for synthesis of RBC and Vitamin B12.

Digestive System

>The human digestive system is a coiled, muscular, twisting tube (6-9 metres) that runs from the mouth to the anus, plus the accessory organs (like salivary glands, pancreas, liver and gallbladder).

>The digestive process begins in the mouth. Food is partly broken down by the process of chewing and the chemical action of saliva enzymes Amylase and Lipase producud by the salivary glands. Amylase break down starches into simple sugars of maltose and dextrose and Lipase work on breaking down fats. Saliva has an immunological role in supplying antibodies to the system, such as immunoglobulin A.

>After being chewed and swallowed. the food enters the **Oesophagus**. The Oesophagus is a long tube that runs from the mouth to the stomach, it uses rhythmic. wave like muscle movement (called peristalsis) to force food from the throat (pharynx) into the stomach.

>The Stomach is a large, sac-like organ that mixes the food up with digestive juices including the enzyme Pepsin which targets proteins and Lipase, which works on fats Hydrochloric acid (HCl) secreted from Oxyntic cells or stomach helps to dissolve the stomach contents while killing harmful bacteria.

>Alter being in the stomach. food enters the Duodenum, the first part of the Small Intestine. It then enters the jejunum and then the Ileum (the final part of the Small Intestine). The Duodenum, produces large quantities of mucus to protect the intestinal lining from acid in the chyme and largely Responsible for continuing the process of breaking down food, with the jejunum and ileum being mainly responsible for the absorption of nutrients into the blood stream.

>In the Small Intestine, bile (produced in the liver and stored in the gall bladder), pancreatic enzymes and other digestive enzymes produced by the inner wall of the small intestine help in the breakdown of fluid The Small Intestine is where the major digestion and absorption of nutrients takes place.

>These nutrients are taken into the blood stream via millions of tiny, finger like projections called villi and transported to the liver.

>**Glycerol and fatty acids go into the lymphatic system. Starch and Glycogen are broken down into maltose by small intestine enzymes.**

>Maltose, Sucrose, and Lactose are the main carbohydrates present in the small intestine; they are absorbed by the microvilli.

>Gluten enteropathy is the inability to absorb gluten, a protein found in wheat. Fat digestion is usually completed by the time the food reaches the ileum (lower third) of the small intestine. Bile salts are in turn absorbed in the ileum and are recycled by the liver and gall bladder.

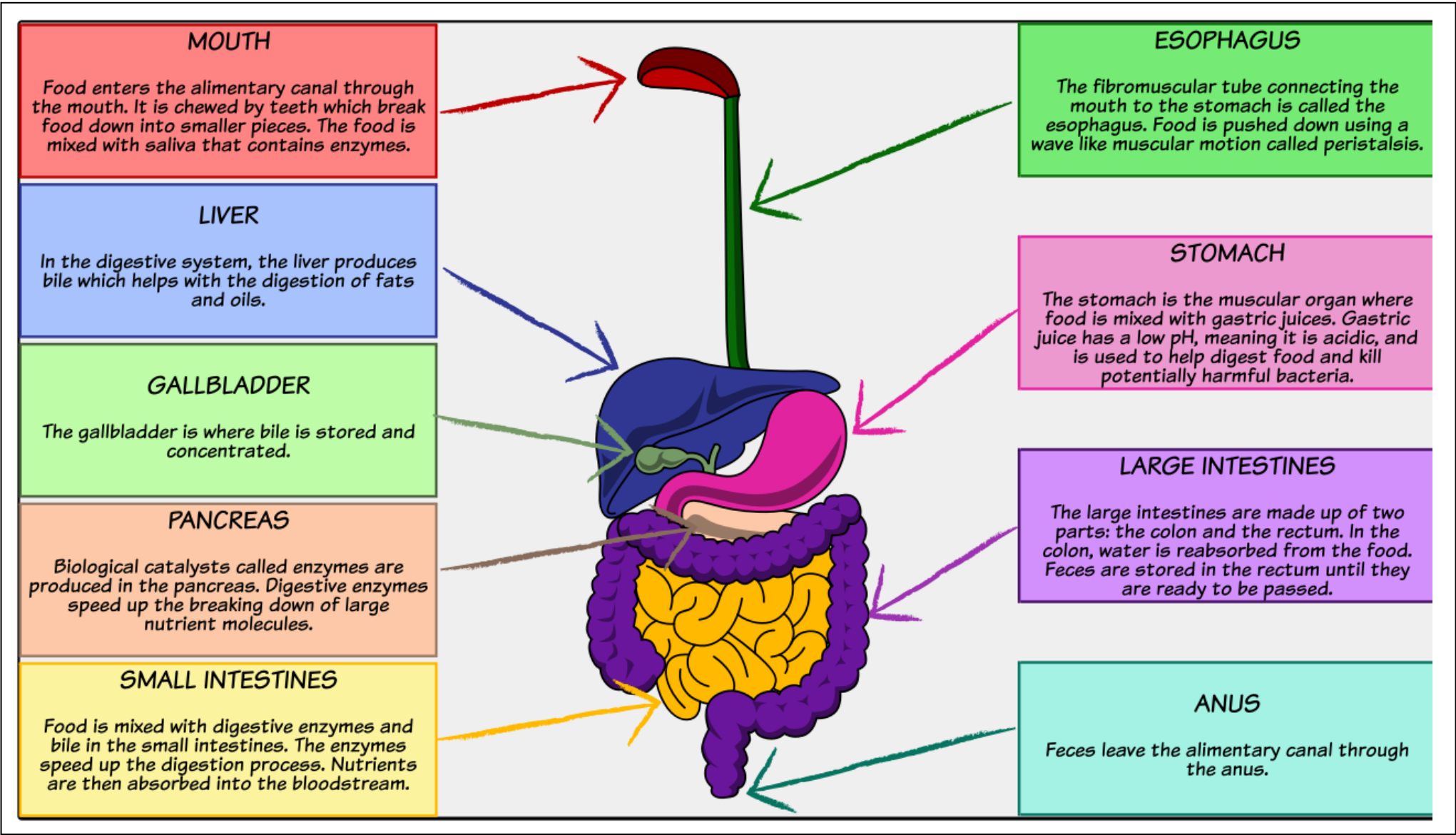
>After passing through small intestine, food passes into the Large Intestine. In the Large Intestine, some water and electrolytes (like Sodium) are removed from food.

>Many microbes (bacteria like Lactobacillus acidophilus, Escherichia coli, Bacteroides Klebsiella) in the Large Intestine help in the digestion process.

>The first part of Large Intestine is called the Cecum (the Appendix is connected to the Cecum). Food then travels upward in the ascending (right) Colon. The food travels across the abdomen in the transverse colon, goes back down the other side (left) of the body in the descending colon and then through the sigmoid colon.

>The Rectum is an 8 inch chamber that connects the Colon to the Anus, solid waste or stool is stored in the Rectum (last part of the large intestine). With the help of Sphincters muscles contract stool is excreted via the anus.

> The Anus is the last part of the digestive tract. It consists of the Pelvic floor muscles and the two Anal sphincters (internal and external) muscles. The anal sphincters muscles provide fine control of stool.



>The six primary processes of the digestive system includes: (1) Ingestion of food; (2) Secretion of fluids and digestive enzymes; (3) Mixing and movement of food and wastes through the body; (4) Digestion of food into smaller pieces; (5) Absorption of nutrients; (6) Excretion of wastes.

>Liver is the largest gland of human body and secretes bile juice, which is stored in Gall Bladder.
>It regulates the storage of glucose as glycogen in blood, destroy dead RBC, regulate body temperature and converts excess of amino acid into ammonia.

>Bile juice is responsible for emulification of fats to ease out attack of lipases (fat digesting enzyme). It makes the medium of food alkaline so that pancreating juice can Worked. It kills harmful bacteria coming with food also.

>In case of obstruction in bile duct by gall stones, jaundice occurs. If bile is absorbed into the blood instead of going out the duodenum and cause yellowing of eyes and skin (bilirubin spread throughout the body).
>Pancreas is the second largest gland of the human body and contains Islets of Langerhans. B-cells of Pancreas secretes insulin and alpha-cell secrete glucagon hormone.
>Pancreas is both an endocrine gland and exocrine gland.

>Pancreas produces and releases digestive enzymes in the pancreating juice that it delivers to the duodenum. Pancreas enzymes which work on Proteins are Trypsinogen and Chymotrypsinogen, smaller amounts of lipase and amylase are also secreted which act on fats and carbohydrates.

>In mouth, salivary Amylase (Ptyalin) acts on starch and converts into maltose.

>Pepsin of stomach digests protein and converts them into peptones.

>Rennin of stomach converts milk (casein) to curd.

>Trypsin of intestine acts upon proteins and breaks them into polypeptides and amino acids.

>Lactose of intestine converts lactose into glucose and galactose.

>Sucrose of intestine converts sucrose into glucose and fructose.

>Intestinal juice is alkaline in nature while pH of saliva, gastric juice and pancreatic juice are 6.8, 2.0 and 7.0.

Tooth

>The part of the tooth that is usually visible over the gums is called the Crown and the part that is attached to the gum is called Root.

>Enamel is the outer calcified tissue layer covering the crown of the tooth. It is one of the hardest substances in the body.

>Dentine is the inner tissue layer that lies beneath the Enamel or Cemetum.

>Humans, like other mammals are diphyodont. Humans have usually 20 primary (deciduous) teeth and 32 permanent teeth.

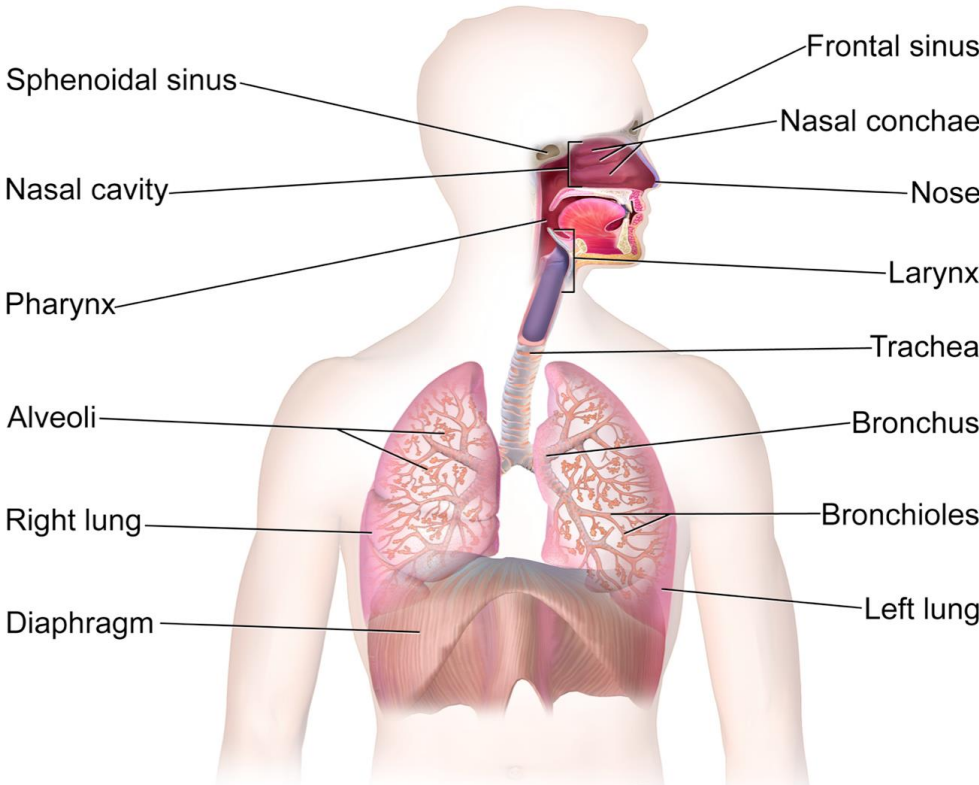
>Humans have four types of teeth: Incisors (for cutting), Canines (for tearing), Premolars (for sewing) and Molars (for chewing and grinding).
>The roots of teeth are embedded in the maxilla (upper jaw) or the mandible (lower jaw) and are covered by gums.

Respiratory System

>The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide.

>As we breathe, oxygen enters the nose or mouth and passes the sinuses, which are hollow spaces in the skull. sinuses, help to regulate the temperature and humidity of the air we breathe.

>Trachea (wind pipe) filters the air that is inhaled. It branches into the Bronchi, which are two tubes that carry air into each lung.



The Respiratory System

>The bronchial tubes are lined with tiny hairs called cilia, Cilia move back and forth, carrying mucus up and out. Mucus, a sticky fluid, collects dust, germs and other matter that had invaded the lungs, We expel mucus when we sneeze, cough or swallow.

>The bronchial tubes lead to the lobes of the lungs, The Right Lung has three lobes; the Left Lung has two lobes.

>Lobes are filled with small, spongy sacs called Alveoli and the exchange of oxygen and carbon dioxide takes place in the Alveoli and is the main function of respiratory system.

>The alveolar walls are extremely thin and composed of a single layer of tissues called epithelial cells and tiny blood vessels called pulmonary capillaries.

>Blood passes through Capillaries. The Pulmonar yArtery carries blood containing carbondioxide to the air sacs, where the gas moves from the blood to the air.

>Oxygenated blood goes to the heart through Pulmonary Vein and the heart pumps it throughout the body.

>When breath taken (inhalation). Diaphragm flattens out and pulls forward making more space for the lungs. During Exhalation, the diaphragm expands and forces air out.

>The contraction and relaxation of diaphragm with the help ofintercoastal muscles.

Classification of Animals

>Unicellular animals are kept in single phylum Protozoa whereas Multicellular animals are divided in 9 Phylums.

>Phylum Protozoa are unicellular or acellular animals, eg. Amoeba, Paramecium, Euglena etc.

>Phylum Porifera have porous body and found in marine water, Their skeleton is made up of calcareous or siliceous spicules. eg. Sycon. Sponge etc,

>Presence of water canal system: Numerous pores (Ostia) found on body wall in Porifers animals.

>Phylum Coelenterate are first proper multicellular animals and their body plan is called blind sac body plan eg. Hydra, jellyfish etc.

>They have specialised Cnidoblast cell to help in catching the food.

>Hydra has a great tendency of regeneration of body organs.

>Phenomenon of polymorphism and metagenesis are associated with Coelenterates. Around the mouth thread like structure called Tentacles are found for holding the food.

>Phylum Platyhelminthes are also called flat worms and exist as parasitic eg. Planaria,Liver fluke, Tapeworm etc.

>Phylum Annelida : Their body is long, thin, soft and metamerically (truely) segmented. eg. Earthworm, Nereis, Leech etc.

> Blood (called haemolymph) is red due to iron rich haemoglobin.

>Phylum Arthropoda is the largest phylum.jointed leg and body is their main feature, eg. Cockroach, Prawn, Crab, Mosquito etc.

>Body fluid (Haemolymph) found in Cockroach.

>Arthropods have hard exoskeleton made up of chitin. Body is divided into Head, Thorax and Abdomen.

>Insects generally have six feets and four wings. Ant is social insect which reflects division of labour.

>The main excretory organ of insects are Malpighian tubules.

Amphibia ; They have mucus glands in the skin and a three chambered hearts. Respiration is through either gills skins or lungs. Eg. Frogs, Toads and Salamanders.

Reptilia : These animals are cold blooded have scales and breathe through lungs. Most of them have a three chamber heart while Crocodile have four heart chambers. Eg, Snakes, Thrtles, Lizards and Crocodiles.

>Cobra is the only snake which makes nests.

>Heloderrna is the only poisonous lizard.

>Sea Snake (Hydrophis Belchm) is world's most poisonous snake.

>Aves: These are warm blooded animals and have a four chambered heart. They lay eggs. They breath, through lungs, All birds fall in this category,

>Flightless birds are Kiwi and Emu.

>Smallest bird is Humming bird.

>Largest alive bird is Ostrich,

>Mammalian: They are warm blooded animals with four chambered hearts. There is no nucleus in RBC of mammals (except in Camel and llama),

>They have mammary glands for the productirm of milk to nourish their young. They produce live young ones,

>However a few of them like Platypus and the Echidna lay eggs.

Micro Organisms

>Micro organisms are classified into four major groups. These groups are bacteria, fungi, algae and proton).

Viruses

>Virus was discovered by Ivanovsky (1892).

>They reproduce only inside the cells of the host organisms which may be bacterium, plants or animal. Virus are connecting link between non- living & living ,

>Mycoplasma : Smallest known prokaryotic cell causing pleuropneumonia, It is also known as PPLO. Bacteriophages are those virus which infect the bacteria, eg. Tobacco Mosaic Virus, T-2 phage. They kill the bacteria. DNA is found in them.

>Bacteria was discovered by Antony Von Leeuwenhoek of Holland. They are unicellular prokaryotic. Their cell wall is made up of peptidoglycans and polysaccharides.

>Dr. Stanley first isolated the virus causing mosaic disease in tobacco in the form of crystal.

Friendly Micro Organisms,

>Making of curd and breed milk is turned into curd by bacteria, The bacterium "lactobacilius" promotes the formation of curd.

>Yeast reproduces rapidly and produces CO, during respiration. Bubbles of the gas fill the dough and increase its volume.

>Yeast is used for commercial production Of alcohol and wine.

>Process of conversion of sugar into alcohol is known as fermentation. Lewis Paster discovered fermentation ,pasteurization of milk and Vaccine of rabies.

****Medical Use of Micro Organisms** :**

>The medicine which kills or stops the growth of diseases causing microorganism is called antibiotics. eg. Streptomycin. Tetracycline and Erythromycin are some of the commonly known antibiotics.

>Alexander Fleming discovered penicillin.

>Antibiotics are not effective against cold and flu as these are caused by virus.

>Harmful Microorganisms: Microbial diseases that can spread from an infected person to a healthy person through air,water,food,or physical contact are called communicable diseases, i.e.- Cholera, Coomon Cold, Chicken POX and TB.

>Another is female anopheles mosquito which carries the prasite (Plasmodium) of Malaria.

>Female Aedes mosquito acts as carrier of Dengue virus.

German scientist Robert Koch discovered the bacteria Of cholera and T.B.

Methods:

>Sodium benzoate and sodium meta-bisulphite are preservatives. These are also used in James and squashes to check their spoilage.

>Sugar reduces the moisture context Which inhibits the growth Of bacteria Which spoil food.

>Use of oil and vinegar prevents spoilage of pickles because bacteria cannot live in such an environment.

>Pasteurized milk : The milk is heated to about 70•C 15 to 30 seconds and then suddenly chilled and stored.

^ TYPES OF DISEASES^

^Diseases caused by Viruses^ :

> Chicken pox - It is caused by Variola virus.

>Small Pox - It is casued by Varicella virus.

> Influenza - It is caused bu Influenza virus.

>AIDS (Acquired Immuno Deficiency Syndrome) - It is caused by Human Immunodeficiency Virus (HIV).

> Measles - It is caused by Rubella virus .

> Polio - It is caused by Polio virus . Polio virus effected nerve and throat backbone .

> Rabies - It is caused by Rabies virus (Rhabdo viridae family). Rabies effected nervous system .

> Meningitis : It is an inflammation of the brain .

^ Diseases caused by Protozoa^ :

> Malaria caused by Plasmodium transmitted (carrier agent) by Female Anophelies mosquito .

> Pyrrohoea caused by Entamoeba gingivalis and effected part is gums.

> Sleeping sickness caused by Trypanosoma and carrier agent is Tse- Tse flies to effected brain.

> Kala ajar caused by Leismai donovani and carrier agent is Sand flies to effected bone marrow.

> Diarrhoea caused by Entamoeba histolytica to effected intestine .

^ Diseases caused by Fungus^ :

> Asthma (Aspergillus fumigatus), Athlete's foot Cracking of feet (Tenia Pedes), Baldness (HAIR FALL), Ringworm (Trycophyton Lerucosum).

> Human Genetic Disorders

> Down's syndrome : Trisomy 21 (extra chromosome number)

> Edwad's syndrome : Trisomy 18 (extra chromosome number)

> Patau's syndrome : Trisomy 13 (extra chromosome number)

>SEX linked disease are Haemophilia, Colour blindness. Colour Blindness lead to failure of distinguished Red and Green colour.

Autosomal linked disease are Phenylketonuria , Sickle - cell anaemia , Cystic fibrosis , Huntington's disease etc.

>Thalassemia are inherited blood disorders characterized by abnormal haemoglobin production.

^ Diseases caused by Bacteria^ :

> Whooping Cough - It is caused by bacterium called Hemophillis pertussis .

> Diphtheria - It is caused by Coryne bacterium diphtheria.

> Cholera - It is caused by Viberio cholerae .

> Leprosy - It is caused by Mycobacterium leprae.

> Pneumonia - It is caused by Diplococcus pneumoniae.

> Tetanus - It is caused by Clostridium tetani.

> Typhoid - It is caused by Salmonella typhi .

> Tuberculosis - It is caused by Mycobacterium tuberculosis .

> Plague - It is caused by Pesteurella pesties.

> Effected organ in Tetanus (nervous system), Cholera (intestine) , Tuberculosis (lungs) , Plague (lungs) , Pneumonia (lungs), Leprosy (nervous system).

Major Field of BIOLOGY

>Anatomy : Structure and organisation of living things.

>Bacteriology : Study of Bacteria.

>Biochemistry : Chemical processes and substances occurring in living things.

>Biophysics : Applies tools and techniques of the physics in the study of living things.

>Botany : Study of plants.

>Cryobiology : Analysis how extermely low temperatures affect living things.

>Cytology : Structure, composition and function of cells.

>Ecology : Relationships between living things and environment.

>Embryology : Formation and development of plants and animals through fertilization until they become independent organisms.

>Entomology : Study of insects.

>Ethology : Animal behaviour under natural conditions.

>Evolutionary biology : Study of evolution of organisms.

>Ichthyology : Ichthyology is study of fish.

>Immunology : Study of body's defence mechanism against diseases and foreign substances.

>Limnology : Bodies of fresh water and the organisms found in them.

>Marine biology : Investigates sea life.

>Medicine : Science and art of healing.

>Microbiology : Study of microscopic organisms.

>Molecular biology : Analysis of molecular process in cells.

>Neurobiology : Study of nervous system of animals.

>Ornithology : Study of birds.

>Palaentology : Study of fossils.

>Pathology : Examines the changes in body leading to the disease or changes caused by the disease.

>Physiology : Function of living things.

>Sociobiology : Focuses on biological basis for social behaviour in human beings and other animals.

>Taxonomy (Systematics) : Scientific classification of plants and animals.

>Virology : Deals with viruses and viral diseases.

>Zoology : Study of animals.