

* CELL:

Cells are the basic building blocks of all living things.
The human body is composed of trillions of cells.
Cells are structural, functional and biological units
of all living beings.

* CELL THEORY

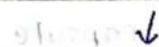
Cell theory was proposed by botanist Matthias Schleiden
and zoologist Theodor Schwann in 1839.

* There are 3 postulates that describe cell theory :-

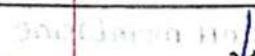
- i) All living things are made up of cell.
- ii) Cell is the structural and functional unit of life.
- iii) New cells from pre-existing cells.

* Hierarchy:

Cell Organelles



How cell → β cells



tissue → Endocrine tissue

↓ Organ → Organ → Organism



System



Pancreas

Human

↓

Digestive

System

→ Primitive → Prokaryotic cells
cells

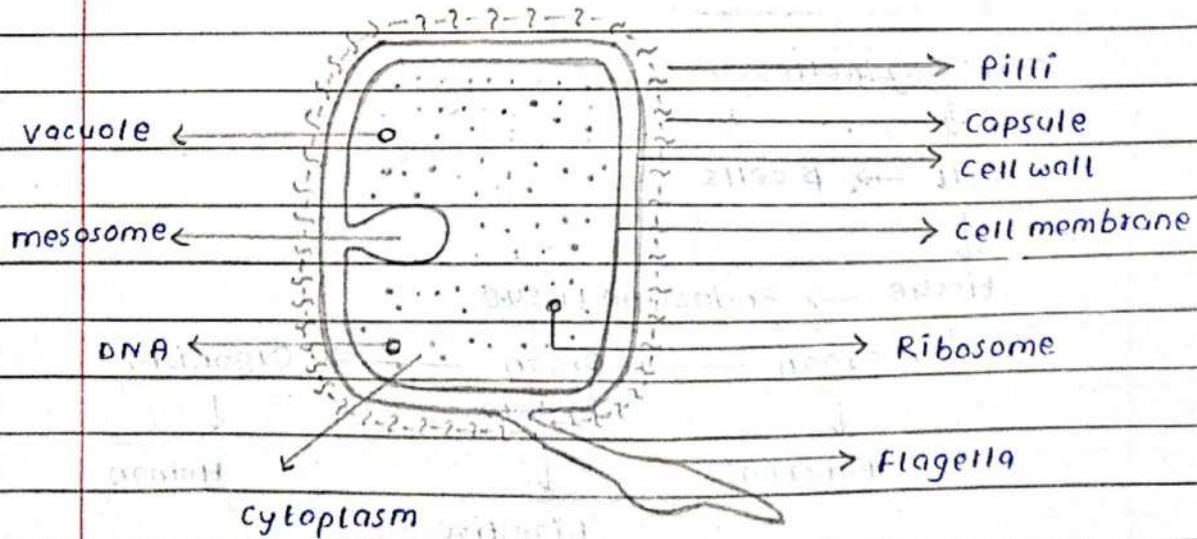
cells

→ Advance → Eukaryotic cells
cells

DNA → RNA → Proteins

* Prokaryotic cells :-
It is a primitive type of a cell that is characterized by the absence of a nucleus. Prokaryotes are exclusively unicellular.

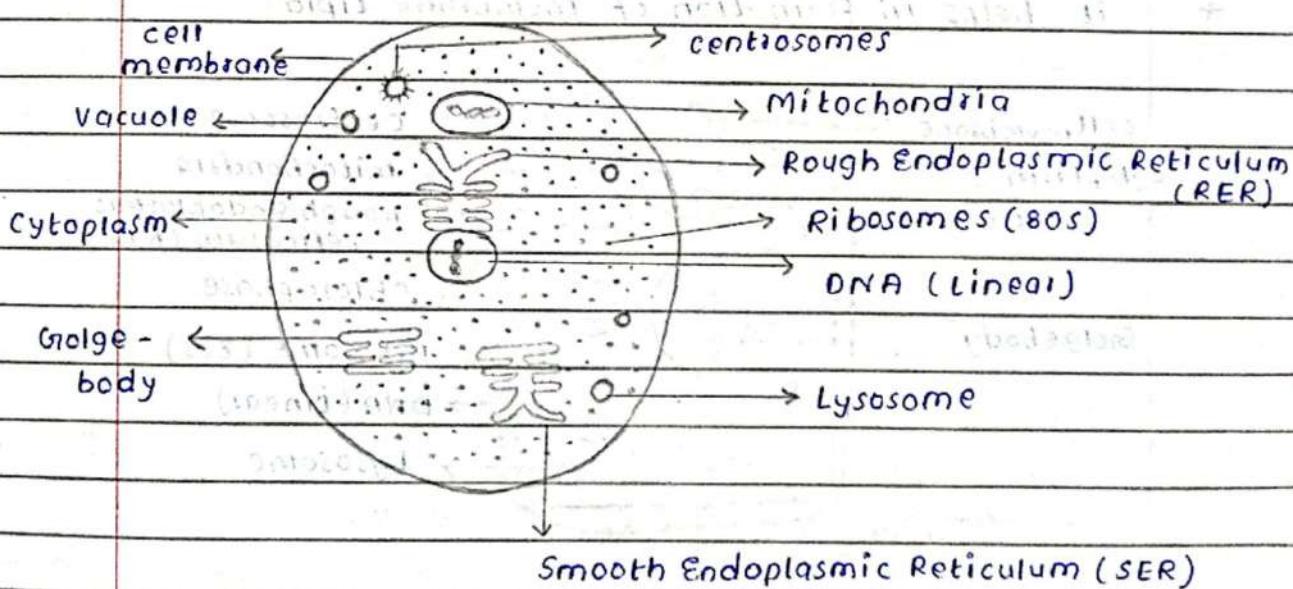
* Eukaryotic cells :-
Eukaryotic cells are cells that possess a true nucleus along with membrane-bound organelles. Eukaryotes can either be unicellular or multicellular.



Bacterial cell

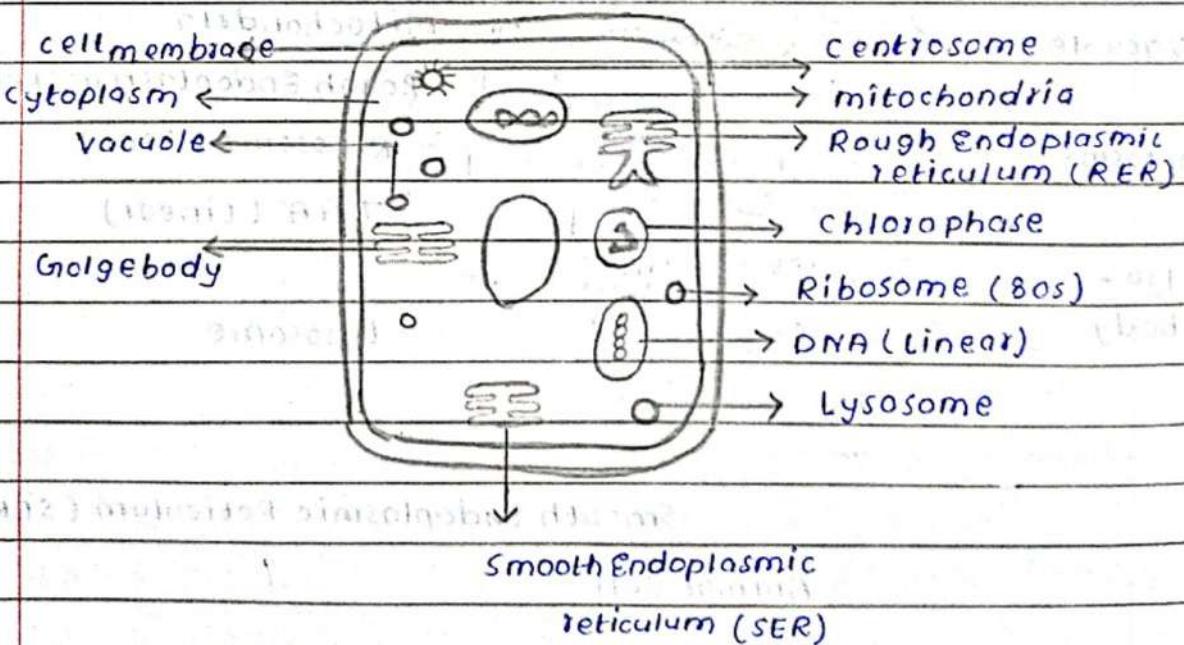
Prokaryotic cell

- i) Pili — For attachment & conjugation — reproduction
- ii) Capsule — slimy layer for protection
- iii) Cell wall — hard & rigid — shape to cell (freely permeable)
- iv) Cell membrane — elastic semi-permeable allowing some substances to come in & go out.
- v) Ribosomes — protein synthesis
- vi) Flagella — movement of cell.
- vii) Cytoplasm — jelly like substance (transportation in material)
- viii) DNA — carry genetic information
- ix) Mesosome — extension or folding of cell membrane where DNA replication occurs.
- x) Vacuole — storage of water & food.



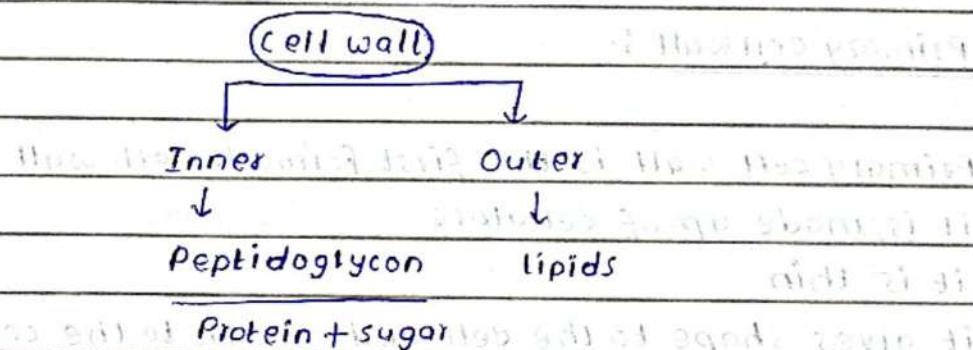
- i) centrosome — Helps in formation of spindle fibres for cell division.
- ii) Mitochondria — powerhouse of cell produces 80s

- iii) Rough Endoplasmic Reticulum (RER) :- It is involved in protein packaging, processing & transportation. When ribosomes are attached to endoplasmic reticulum is called as RER. otherwise it is smooth endoplasmic reticulum (SER)
- iv) Nucleus :- It is the covering of DNA. Nucleus is made up on nuclear membrane.
- v) DNA : is linear & contains genetic information
- vi) Lysosome : are called as suicide bags because they contains lysozymes that kill worn off or old cell organelles.
- vii) Golgi body :- a part of a plant cell -
 - * it helps in transportation of protein.
 - * it helps in formation of membrane lipid.



Prokaryotic cell	Eukaryotic cell
Pro - primitive karyon - nucleus	Ex - True Karyon - nucleus
i) Membrane bound nucleus is absent. In place nucleoid absent.	i) Membrane bound nucleus is present.
ii) Genetic material is not present naked.	ii) Genetic material inside the nucleus.
iii) Extrachromosomal DNA is present c/d plasmid	iii) Extrachromosomal DNA is absent, only genomic DNA is present.
iv) Membrane bound cell organelles is absent.	iv) Membrane bound cell organelles is present.
v) Ribosomes = 70S	v) Ribosomes = 80S
vi) A specialized different- iated form of cell membrane called mesosome is present.	vi) Mesosome is absent.
vii) Nuclear membrane is absent	vii) Nuclear membrane is present.
viii) Eg :- Bacteria, myco plasma, Archaea	viii) Eg :- Plant cell & animal cell

Animal cell	Plant cell
i) cell wall is absent	ii) cell wall is present
ii) chloroplast is absent	iii) chloroplast is present
iii) Centrosomes is present	iii) Centrosomes is absent
iv) Vacuole is ^{absent} present	iv) Vacuole is absent present
v) reserved food is starch	v) reserved food is glycogen



* Prokaryotic cell wall is simple and generally found in bacteria.

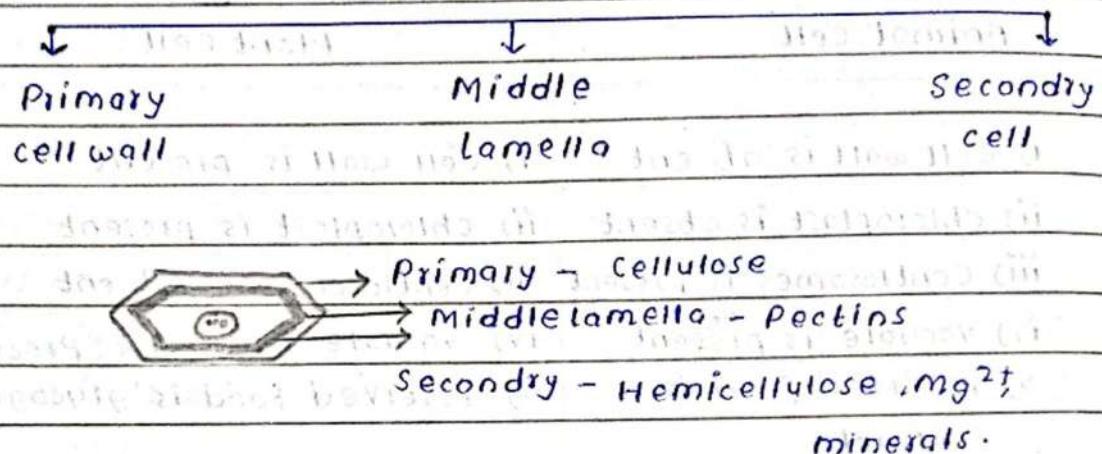
It consists of 2 layer :-

- Inner layer
- Outer layer

* Functions of Prokaryotic cell wall :-

- it provides cell proper shape
- it prevents cell from lysis (burst)

cell walls



i) Primary cell wall :-

- Primary cell wall is the first formed cell wall
- it is made up of cellulose
- it is thin
- it gives shape to the cell and growth to the cell.

ii) Middle lamella :-

- * It is present between primary & secondary cell wall
- * it is formed of pectins

Functions :-

it acts as glue as it attaches with other cells

iii) Secondary cell wall :-

- it is the thickest and innermost layer of cell wall
- it is made up of hemicellulose, Mg^{2+} , minerals

Function :-

it provides rigidity to the cell wall

* Endoplasmic Reticulum :-

- i) ER is a tube like structure that is viscous in nature
- ii) they can be present freely in cytoplasm or attached to nucleus.

Types of Endoplasmic Reticulum :-

- i) Rough Endoplasmic reticulum (RER) :- It is made up of plasma membrane on which ribosomes are attached.

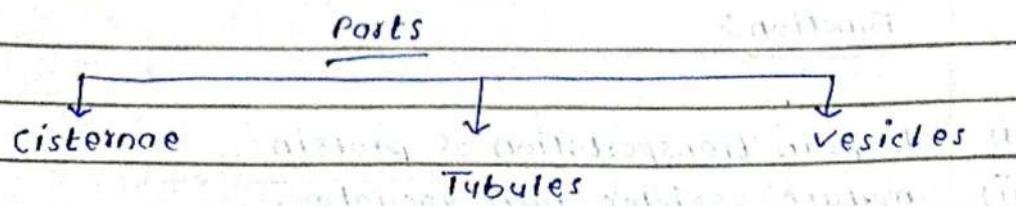
Function :-

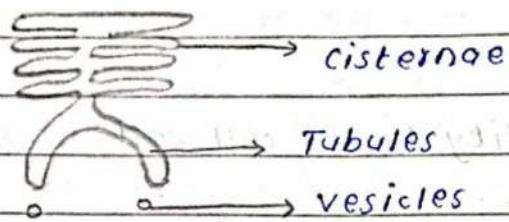
Protein synthesis and transportation

- ii) Smooth Endoplasmic Reticulum (SER) :- It is smooth in nature and is made up of plasma membrane

function :-

Protein secretion and transportation





* Cisternae: They are flat sac like structures that are parallel to each other in making up rough or smooth ER.

- i) they are flat disc like structure that are parallel and interconnected.
- ii) they can be branched & they can be unbranched.

Function:

Synthesis and processing of bodies protein

* Tubules:

they are branched cisternae that help in protein transportation

* Vesicles:

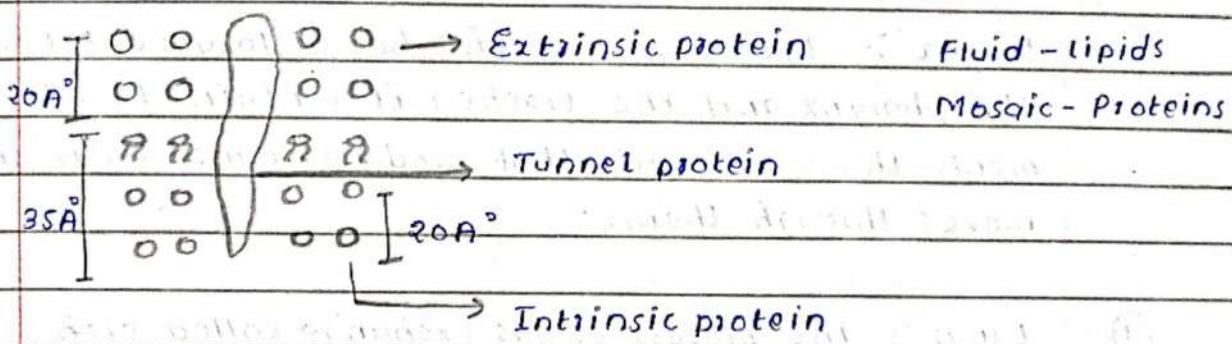
- i) they are oval in shape that get separated from tubules
- ii) they lie freely inside the plasma membrane

Function:

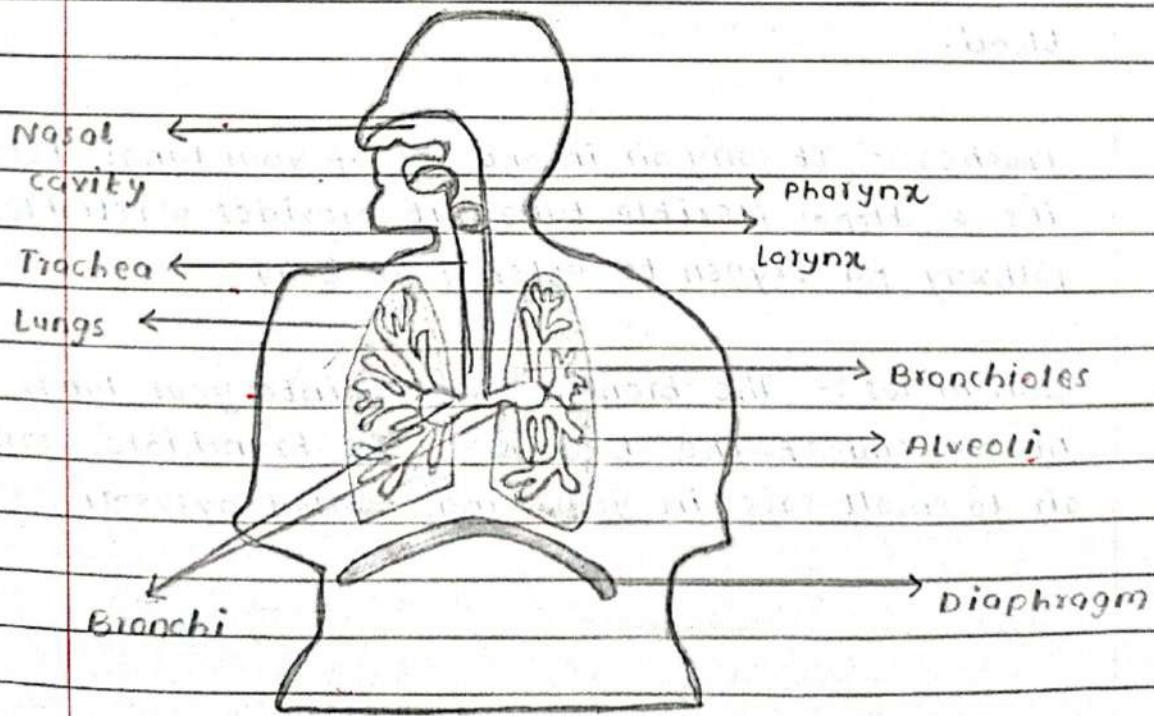
- i) helps in transportation of protein
- ii) mature vesicles turn vacuoles.

Tunnel proteins :-

Tunnel proteins are the proteins that pass through the two lipid layers in cell membrane. They act as tunnel for passing of water molecules.



Fluid Mosaic Model



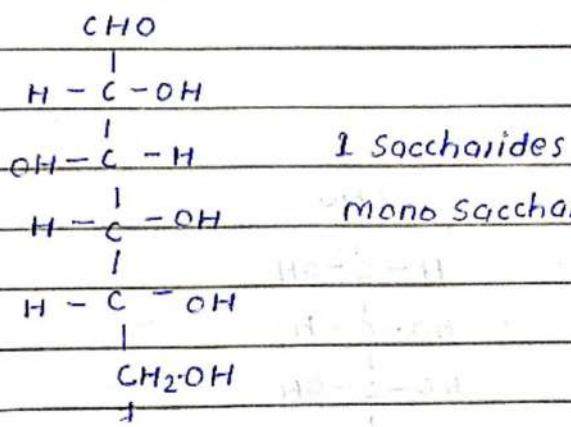
- ① Nasal cavity :- Air passing over the mucous membrane of the nasal cavity is moistened, warmed and filtered.
- ② Pharynx :- The pharynx or throat is located where passages from the nose and mouth come together.
- ③ Larynx :- The larynx or voice box is located between the pharynx and the trachea it contains two ligaments the vocal cords that produce sound when air moves through them.
- ④ Lungs :- The process of gas exchange called exhalation (or breathing). In respiration, oxygen from incoming air enters the blood, and carbon dioxide, a waste gas from the metabolism, leaves the blood.
- ⑤ Trachea :- It carry air in and out of your lungs. Because it's a stiff, flexible tube, it provides a reliable pathway for oxygen to enter your body.
- ⑥ Bronchioles :- The bronchi carry air into your lungs. At the end of the bronchi, the bronchioles carry air to small sacs in your lungs called alveoli.

* Biomolecules *

carbohydrates - Polyhydroxy aldehydes / Ketons



Saccharides - sugar Unit

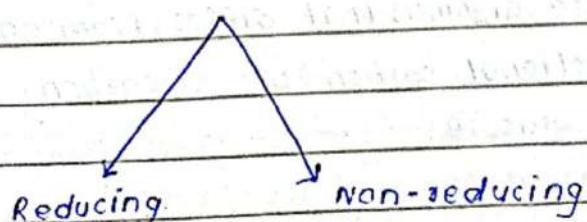


* classification on the basis of sugar Unit :-

- mono - 1 unit or single unit. Eg :- Dextrose & Galactose
- Di - 2 sugar unit Eg :- Lactose, Sucrose
- Oligo - 3 to 10 sugar unit Eg :- raffinose
- Poly - more than 10 sugar unit Eg :- cellulose, starch

$$\text{lactose} = \text{glucose} + \text{galactose}$$

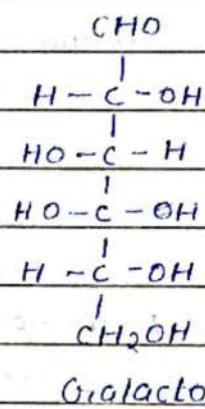
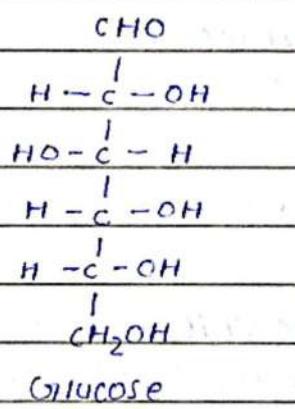
* classification on the basis of functional group :-



i) Reducing sugars are those sugars that contain free aldehydic or ketonic group.
Eg :- Glucose, dextrose.

ii) Non-Reducing sugars are those sugar that do not have free aldehydic or ketonic group.
Eg :- Lactose, cellulose, starch.

* Epimers :-



Epimers are those enantiomers that differ from each other at one carbon atom & that should not be function carbon or C₁ carbon.

Eg :- Glucose and galactose

* Anomers :-

These are those anomers that differ from each other and at functional carbon or C₁ carbon.

Eg :- α - D - glucose

β - D - glucose

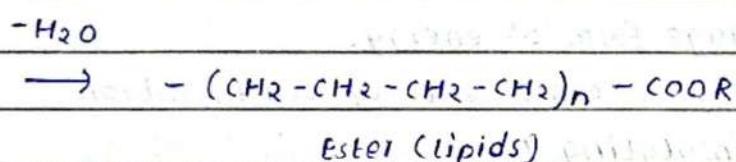
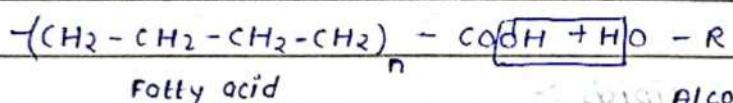
Properties :- enantiomers, chiral carbon

Function of carbohydrate:-

- i) They are instant source of energy
 - ii) They act as signal molecules
 - iii) Cellulose makes cell wall
 - iv) They are present in cell membrane

* Lipids *

Lipids are esters of fatty acid. They are insoluble in water but they dissolve in organic solvent.



* Classification of lipids on the basis of composition :-

- i) Simple
 - ii) Complex
 - iii) Derived

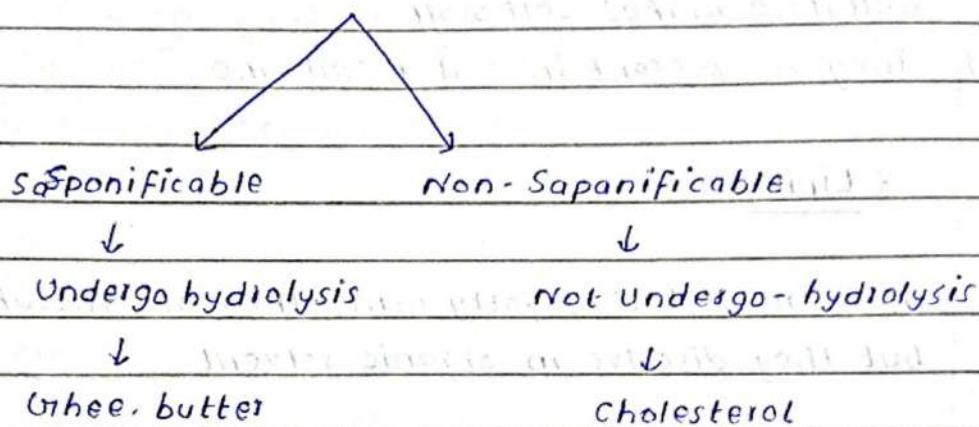
* . Simple :- They are esters of fatty acids .

Eg:- Ghee, Butter

* Complex :- They are simple lipids + different molecules
Eg :- Phospholipids, glycolipids

- * Derived → They are the by products of lipids
Eg:- cholesterol, steroids

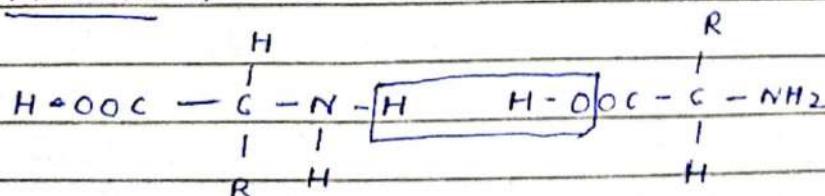
- * Classification of lipids on the basis of hydrolysis



- * Functions of lipids :-

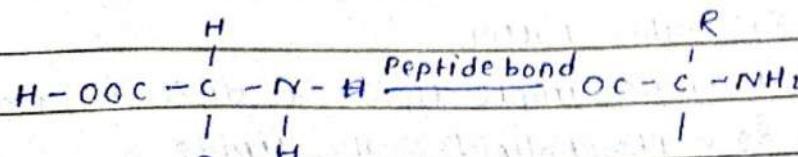
- i) they are storage form of energy.
- ii) they are the major components of cell membrane
- iii) they act as insulating layer
- iv) Some lipids are hormones

* Proteins *



A₁

A₂



A₁

A₂

These are the polymers of amino acid joined by peptide bond.

* Properties :-

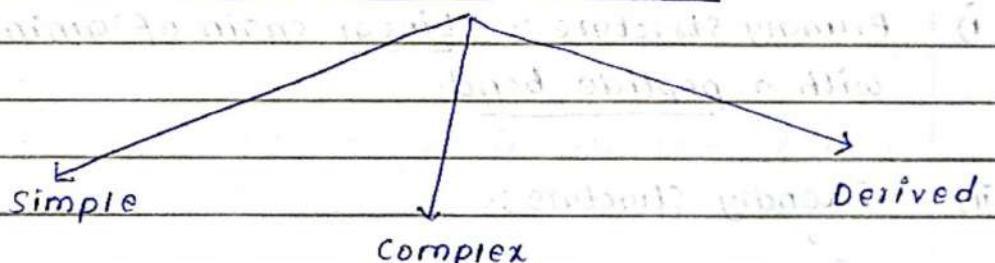
⇒ Proteins are generally contain chiral carbon.

⇒ Proteins have different structure :- Primary, secondary, tertiary, quaternary.

* Denaturation :-

⇒ When the proteins loss their basic structure or folding due to change in temperature, pH or other condition.

* Classification on the basis of composition :-



i) Simple :- They are polymers of amino acid.

Eg:- Keratin, Albumin

ii) Complex :- When there is protein + different molecules

Eg:- Glycoprotein, Lipoprotein

iii)

Derived :- They are by products of proteins.

Eg:- Peptides

Structure

Fibrous

long linear chains

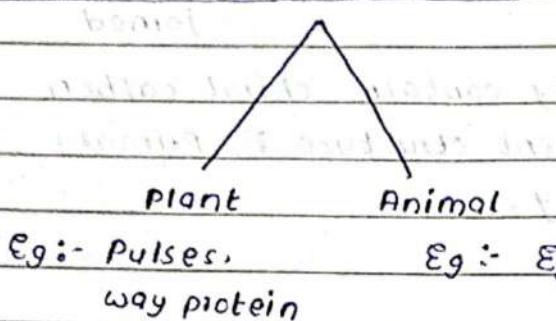
Eg:- keratin (Hair)

Globular

spherical

Albumin (Egg)

* On the basis of source of protein



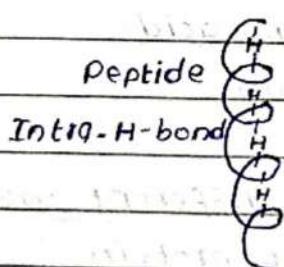
* Structural configuration of proteins :-

i) Primary structure :- Linear chain of amino acid joined with a peptide bond.

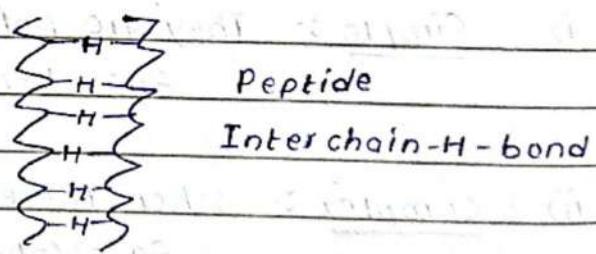
ii) Secondary Structure :-

2°

α Helix



β pleats



Keratin

Fibroin (silk)

When primary structure folds on itself or forms bond with another chain, it is secondary structure.

iii) 3° Tertiary structure :- When secondary structure further folds itself, due to disulphide bond or hydrophobic bond. Eg:- Insulin.

iv) **Quaternary :-** When two secondary structure ($\alpha - \alpha$, $\alpha - \beta$, $\beta - \beta$) they come together, weak forces are formed, this forces are Vander waal forces.
Eg :- chlorophyll, Haemoglobin

* **Function of Protein :-**

i) **Structure :-** They form structure of body.

Eg :- Keratin (Hair), collagen (Muscles)

ii) **Enzymes :-** They are used in metabolism

Eg :- Amylase, Protease

iii) **Hormones :-** They maintain balance in body.

Eg :- Insulin

iv) **Respiratory pigment :-** They are coloured protein

Eg :- Haemoglobin.

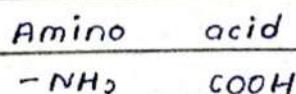
v) **Transport Protein :-** They transport materials from one part of body to another.

Eg :- Haemoglobin

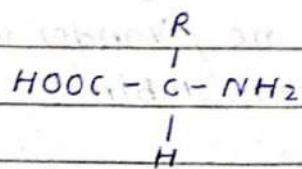
vi) **Storage Protein :-**

vii) **Toxin :-** **Eg :-** Snake Venom

* **Amino Acid :-**



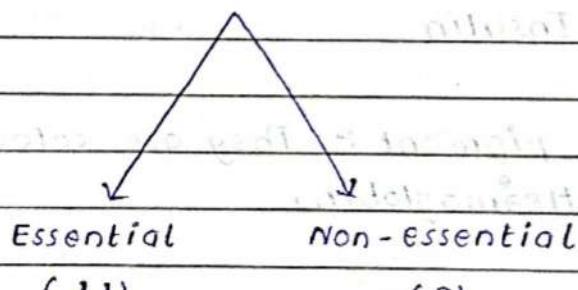
Amino acids are carboxylic acid having amine group



Property :-

- i) chiral carbon
- ii) they are monomers of protein
- iii) peptide bond
- iv) zwitterion
- v) negative and positive charge having same molecule.

* Classification on the basis of essentiality :-



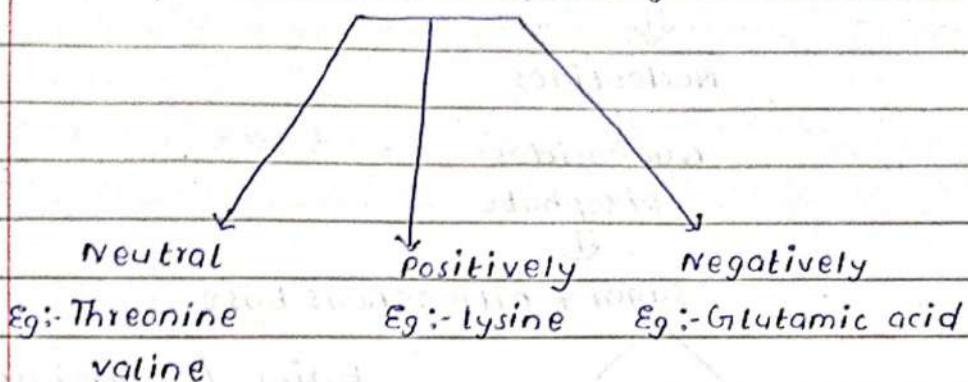
Essential :-

They are not synthesised in body. They are eleven in numbers. Examples - valine, lysine, threonine

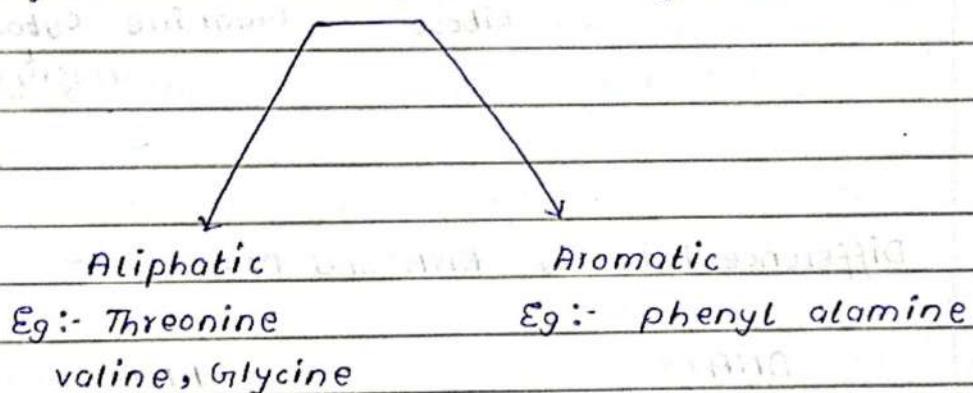
Non-essential :-

They are synthesised in human body. They are nine in numbers. Example → glycine, glutamine.

* Classification on basis of charge :-



* Classification on basis of Aromaticity :-



* Function :-

- i) they are formed proteins.
- ii) their deficiency in body causes diseases.
- iii) they act as fuels in various metabolism.

* Nucleic acids :- (RNA/DNA)

Nucleic acids are polymers of nucleotides.

Nucleic acids



Nucleotides



Nucleosides

phosphate



sugar + nitrogenous base

RNA

↓
Ribose

DNA

↓
Deoxy-
Ribose

Purine / pyrimidin



Adenine Thymine
Guanine Cytosine,
Uracil Cytosine
(C)

* Difference between RNA and DNA :-

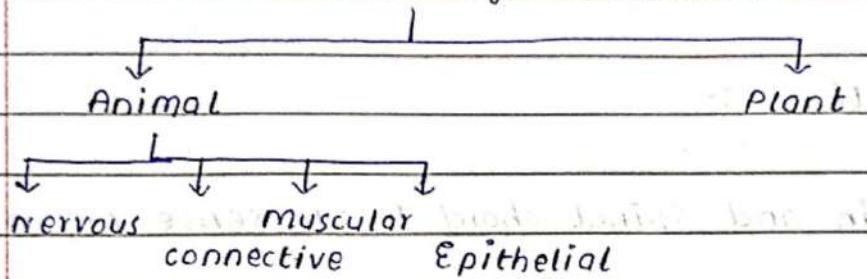
DNA	RNA
i) Double chain	i) Single chain
ii) DNA has Deoxyribonucleic acid	ii) RNA has ribonucleic acid.
iii) Deoxy Ribose	iii) Ribose
iv) DNA is present only in nucleus	iv) RNA is present in both nucleus and cytoplasm
v) DNA is more stable	v) RNA is less stable.

* Tissue *

Date: _____
Page: _____

Tissue is a group of cell with similar function.

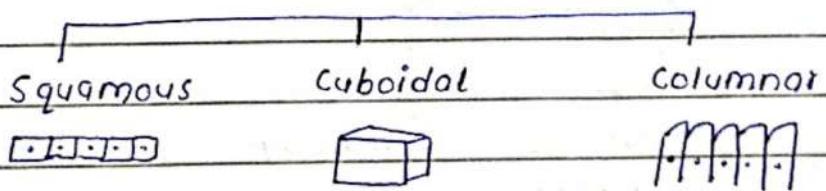
Tissue can be classified into



* Epithelial tissue

They are the outermost layer of body.

Type of cell



Examples :-

Skin , lining of stomach , intestine

Function :-

i) Protection → skin

iii) Absorption , secretion → stomach

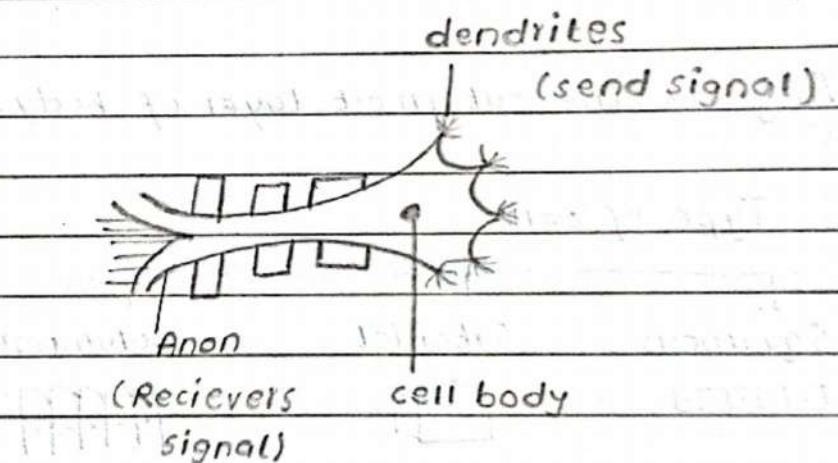
* Connective tissue :-

They are present inside the body and they generally connect or separate a body part.

* Nervous tissue :-

From brain and spinal chord to all sense organs.

Types of cell :- neurons



Example:-

Brain, spinal chord, sense organ

Function :-

- Send and receive signal.

Plant tissue

Meristematic

Permanent

* Meristematic tissue :-

Where it is present - tips of stem & root.

Type of cell - square & cubical



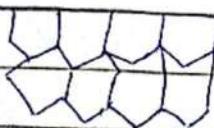
Function - For the growth of plant

* Permanent tissue :-

There are 5 types of permanent tissue :-

- i) Epidermis
- ii) Parenchyma
- iii) Sclerenchyma
- iv) Xylem
- v) Phloem

Where it is present - outermost layer of plant - Epidermis
stem, leave & root.



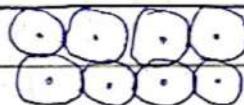
Function - barrier

it acts as a barrier between plant & surroundings

* Parenchyma :-

Where it is present :- it is a basal soft tissue that form majority of stem, roots, fruit and leaves.

Type of cell :- Oval or round

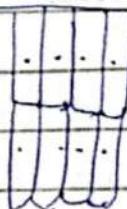


Function :- Storage of nutrients

* Sclerenchyma :-

Where it is present :- it is hard stiff tissue present in branches Bark and seeds.

Type of cell :- Long columnar cells

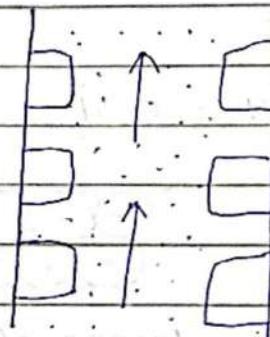


Function :- it gives stiffness and support to the plant.

* Xylem :-

Where it is present :- it is present ⁱⁿ inner to parenchyma
it forms cambium

Type of cell :- they are generally dead cell that regulates
one way flow of water.



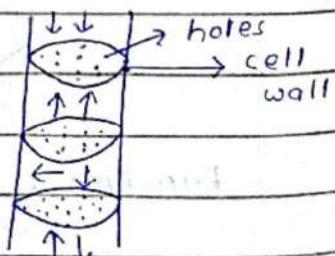
Function :- Transportation of water & minerals

* Phloem :-

Where it is present :- innermost part of the plant

Type of cell :- live multidirectional cell, long columnar cell
that is joined with cells.

Function :- transportation of food &
nutrients.



- * Osmosis Diffusion, Absorption
- * Diffusion - movement of solute molecule from area of higher concentration to lower concentration.
Eg:- mixture of sugar and water.
- * Facilitated Diffusion - when an aid / facility is used to increase diffusion
Eg:- mixing of sugar & water with spoon.
- * Osmosis - movement of solvent molecules from higher concentration to lower concentration through semi-permeable membrane.
Eg:- Raisins in water
- * Absorption - when molecules of solvent enters into solute in bulk.
Eg:- Sponch in water
Raisins in water
- * Adsorption - when absorption takes place at surface.
Eg:- Water molecule adsorbed by roots of plants
- * Osmo-regulation - it is the process in which organism regulates the water and ion balance to maintain osmotic pressure.
- i) Osmo-conformers - try to maintain ionic balance, & osmotic pressure of their body with surroundings
Eg:- jellyfish, starfish

ii) Osmo-Regulators - they do not have any concern with the surrounding they maintain their ionic balance & osmotic pressure of their own.

Eg:- Frog, newt, salamander, lizard

reduces loss of water to environment

loss of water from body - mainly due to evaporation & transpiration process of body. Min. water & max. As evaporation & transpiration process increase

water loss reduction, occurs as follows -
loss of water from body of animal
secretion of urine

loss of water to environment

excrete waste product as excretion nodes - mainly
secretion of urine

loss of water from body of animal

loss of water from body of animal

loss of water from body of animal

animal excretory acts of it - metabolism - excretion
secreted and excreted out substances

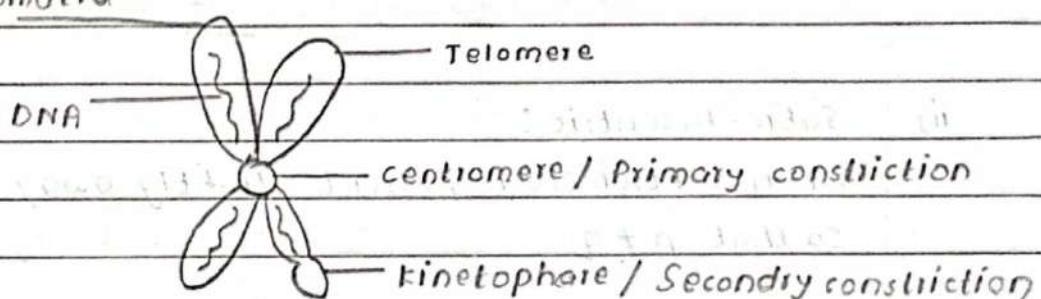
loss of water from body of animal

loss of water from body of animal

- * Chromosome :- are thread like structure which are present in nucleus and are made up of DNA + Histone.

Structure of chromosome :-

Chromatia



Functions :-

- i) chromatia : each chromatia contain one DNA molecule.
- ii) Telomere : DNA replication takes place at telomere .
- iii) Centromere : during cell division spindle fibres are attached to centromere.
- iv) Kinetophore : some proteins needed for cell division are formed at kinetophore.

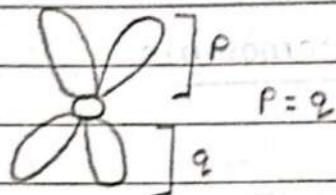
* Types of chromosome :-

On basis of position of centromere:

- i) Metacentric
- ii) Submetacentric
- iii) Acrocentric
- iv) Telacentric

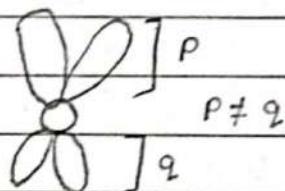
* Metacentric :

When centromere is present exactly in the middle of chromosome so that $p=q$



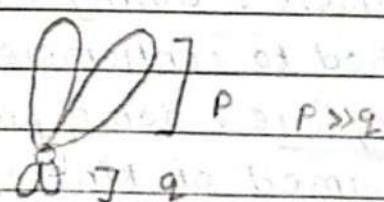
ii) Submetacentric :

When centromere is present slightly away from centre.
so that $p \neq q$



iii) Acrocentric :

When centromere is far away from centre



iv) Telocentric :

When centromere is present at the end of the chromosome.

