oocyte + Sperm cell = formation

Date
Page
Student's

→ Definition & scope of Anatomy & Physiology

i) Human body = Highly compliated and sophisticated machine.

ii) Anatomy = (Aakar); Study of str. of body and org- - anjr of body parts = Brain, liver, lungs kidney, stomach etc.

iii) Physiology = study of the functin of body str. and the way they work independently to maintain the life / health

iv) Subdisciplines of Anatomy:

1) Embryology; study of origin and development of individual life from fertilizn of an oocyte to the 8 week of development.

2) Developmental Anatomy; study of the changes of cell tissue, organ, body as a whole undergo from the fertilizn of secondary oocyte to the resulting offspring.

3) Histology; Tissue + study

Rays Graph-data (fracture matery)

4) Radiographic Anatomy; Study of anatomy of tissue with the help of imaging technique like X-rays = Diagnosis of particular tissue anatomy

* an damage area = Light (white mein), normal = dark sopt, the light pass

5) Pathological Anatomy; Pathogen = MO = Disease, anatomy of diseased tissue

→ Subdiciplines of Physiology include

1) Endocrinology = Endo (inside) + Crine (secrete) + logy
Branch of the physiology and medicine
include study of — endocrine glands and their hormone

2) Cardiovascular physiology : Cardio + Vascular + Physiology
The study of circulatory System
heart, and blood vessels.

Heart → blood → B.V → cells.

3) Immunology = Immune System + logy, study of
body's immune System and MOA of body
protection from Antigen.

4) Respiratory Physiology : Respire = O_2 → in, CO_2 → out

Blood $\xrightarrow{O_2}$ coming inside ↓ ↑ CO_2 get out by cell

Blood to cell → cell have O_2 then cell to blood ↓ To libarate CO_2

5) Renal Pathophysiology : Renal = kidney = blood purification
via urine formation

Toxic → blood → kidney → Nephron → Urine

6) Pathophysiology : Study about disordered physiological
prolus associated with disease of
injury or organ

CT - Loose Con·tis, Adipose tis, Cartilage tis, Ligament
Elastin fibres, Collagen, Common bone-to-bone

ET - outer layer skin, inter. lining & surf. lin. abd. gland.

Date
Page
Staller

→ Levels of Structural organizn

* Level = stage or position, organizn = Groups of Unit

* Levels of organizn = 06 = ① chemical ② Cellular ③ Tissue level ④ Organ level ⑤ System ⑥ organism

1) Chemical level; Include smallest unit of matter = Atom (smallest part) Atoms combine to make molecule

ex: — Carbon - C, H, O ≥ (they represent Atom) (molecule)

∴ Atom + Atom = molecule = glucose = $C_6H_{12}O_6$ (3-diff. adds up to form)

2) Cellular level: Molecules combine to form = cell = Structural and functional unit of life = performs vital activities of life

ex:- metabolism, digestion, reproducn, Excretn

3) Tissue level: Tissue, 4 ÷ types — ① Epithelial (body covering)
② connective (via blood for nutrients) ③ Muscular (movement)
④ Nervous tissue - brain, spinal cord nerves.
(cardiac, smooth, skeletal)

Different

4) Organ level - Tissue type 01 + type 02/03 ×
* Different tissue types or more than one type of tissue combine to form organ, which perform specific designated funcn
ex:- Stomach = Digestion of food

5) System level; No. of organ with a common funcn are grouped into a system.

The system works interdependently to perform a pe
functn. Ex:- Digestive system, Urinary system, Skeletal system

6) Organism level = All parts - functn together to m
organism.

→ Summary of Various Systems in human body

① Integumentary System: It is a system which p
us from extern
internal harmful stimulus / or gone protein
such as = skin, hairs, nails, cebaceous glands
sweat glands.

* function: ① Protect body ② Regulate body temp. &
water content.
③ Detect sensation like warmth, cold & touch.

② Skeletal System: components = bone cartilage, Jo

* funcn: ① Support and protect body ② help in movem
③ manufacture blood in red bone marrow

③ Muscular System; muscle = Skeletal / smooth, car

* funcn: ① Allow locomot. ② Push food through
GI-tract ③ Push blood through B.V
of heart.

Integument : A tough outer protective layer, that of

Spleen - store & filter blood & make WBC

Date | Page

4) Nervous System : Components = brain, Spinal cord nerves

(Digestive, muscle contra homeostasis)

* func^n : ① Control and regulate other system
② Detect changes in internal & Ext. environ.
(vomitting, pain, enemy)
③ Give appropriate response (detect → Stimuli → response) defence

5) Endocrine System :- Component = Endocrine glands
(growth by growth hor. reproduc by reprod. horm)

* func^n : Produce hormone and regulate body func^n

6) Cardiovascular System : = Components = heart, B.V

* func^n = ① Heart pumps blood through B.V
② Blood carry O_2 and nutrient to cell
③ Take CO_2 and waste away from body.

7) Lymphatic System - Components = lymph, lymph vessels, lymph node, spleen, from thymus
(filter subst. that travel through lymph fluid) → contain WBCs → fight infec^n

* func^n : ① Prevent body from infec^n
② Absorb fat from intestine & carries it to blood.

8) Respiratory System : Component = lung, Pharynx larynx, trachea, bronchi

* func^n ; ① Transport O_2 from inhaled air to blood
② Transport CO_2 from blood to exhaled air

Oxygen → blood; CO_2 in blood → Exhaled
come from lungs; already

when inside ↓ → cell
O_2 CO_2
due to ↑ partial

9) Digestive system : Stomach, intestine (small and
ous, Glands (diff.) = salivary gland, liver, pan

* Func^n : ① Physical and chemical breakdown of
and produce nutrient that can be use
our body ② Eliminate waste.

10) Urinary System : Component = kidney, ureter,
bladder, urethra

Func^n : ① Produce, Store, eliminate, urine
② Regulate acid base balance

11) Reproductive System : Components = Ⓐ male = Te
vas deferens, seminal vesicl
prostate gland, penis

Ⓑ female : Ovaries, Uter
Uterus, Vagino

* Func^n ① Maintain sexual characteristics
② Continuation of species

⇒ Basic life process = Process of human body
&

* Life process = Power to live the life in a balanced
way

① metabolism : Set of the chemical rxn that takes p
in the living organism to maintain life

② catabolism : Cat = t = cut = breaking complex
↓
simple

*11 Systemes works in the body to function.

Date
Page
Staller

Ex:- Protein → (break) Amino acid (simple molecule)

(B) Anabolism: = Ana = Aana = coming close

Simplex molecule → complex molecule
Simplex →

Ex: Amino Acid + Amino acid → (combine) Proteins (complex

2) Movement: Includes = motion of either whole body, organ or single cell.

Ex: Injury = movement of WBC from blood vessel to site of injury

3) Responsiveness: Ability of body to detect and respon to any internal & external changes

Ex: Endocrine cells in the pancreas (β-cell) = detect ↑ sugar → = ↑ insulin level

4) Growth: ↑ in body size via hypertrophy = ↑ cell size 0 = 0 or/and
• Hyperplasia = ↑ in no. of cell 0 = 0000

5) Differentiation: Cell develops from unspecialized state to specialized state with different forms and funcn from its unspecialized ancestor cell

Ex: Red bone marrow contain unspecialized cell that differentiate to form — RBC & diff types of WBC

6) Reproduction: Cell division & formation of new cell for either growth/repair / replacement

⇒ Homeostasis

* Homeostatic = Homeo + static = maintaining homo environment

* Definition. Condition of equilibrium that is maintain by keeping body's internal environment within narrow limit.

* Homeostasis word was coined by — American physiolo Walter B Cannon. Significance were discovered by — frenc Scientist = Claude Bernard.

Cells in the body are surrounded by — interstitial flu (fluid b/w cells) which is referred as — body's internal env. It provide glucose, oxygen, Ions needed by the cell, also remove cellular waste.

The composition of interstitial fluid undergo changes there is continual exchange of substance b/w the inter - stitial fluid and plasma present in the blood capillar

Regul'n of interstitial fluid composition is essential to maintain the proper functioning of the body's cell

* many factors in internal env. must be maintain in narrow limit, like - blood sugar level O_2/CO_2 level B.P, H_2O, electrolyte and body temp. etc.

⇒ Controls of Homeostasis

* Homeostasis in human body is continually being disturb due to changes in (A) External Env. = intense heat, ↓

Date
Page
Staller

* Body regulate thru changes through different Components

1) Detector or Sensor: Detect the changes in body's internal env. that act as a stimulus, send input as a nerve signal or chemical signal to control Centre

2) Control Center; It set the limit within which various factor must be maintain, It evaluate the input coming from detector and after certain adjustment it generate the output in the form of nerve impulse or hormone and send it to Effector

3) Effector; It is a body str. that receive output from control center and produce a response or an effect that brings the condition back to its normal state.

* Heat → Detector → control Center → Effector = Sweating

ex: ↓ body temp → temp sensitive nerve ending detect it → and input to control Center
= hypothalamus in brain → send signal to skeletal muscle → cause body shivering that result in = ↑ body temp.

⇒ Homeostasis = Feedback mechanism / system

* Feedback; Response or action taken, ↑ = information, ↓ = information

* Type; ① -ve feed back ② +ve feed back

① **-ve feedback** : i) Response generated by effector, opp the stimulus and brings the condition back to its normal condn.

ex: ↑ in BP (stimulus) → detected by Baroreceptor → ... the nerve impulse (input) to the brain (control centre)

Pressure (SI unit) Barometer

surface & inside cell. molecule found

→ Analyse signal → generate output → send signal to heart (effector) → ↓ the heart rate. = cause ch... to ↓ BP = restore homeostasis. (120/80 m...

② **+ve feed back** : i) Response generated by effector enhance the stimulus

ex:- Uterine contracn during normal child birth.

= Initial contracn of labour (stimulus) push the body's head into the cervix of uterus → stretch the cervi...

→ streaching is then detected by stretch receptor (detector) → send input to control center (br...

↓

Release the oxytoun hormone (output) into blood

* oxytocin further ↑ contracn → push baby further down to the uterus → stretch the cervix even more.

Cervix ↓ narrow passage at the opening of the place where a baby grows inside a woman's body (uterus)

Garbhashya greeva

* Sometimer called the neck of the uterus, Cervix paly imp. role in allowing fluids to pass b/w uterus and vagina. It enable baby to leave uterus so that it contra... through...

Date
Page
Staller

(1)

→ Homeostasis = Flow chart representation

Detector (Peripheral temp. Sensitive nerve ending)

↓

Control center (Grp. of cells in hypothalamus of brain)

↓

Effector (Skeletal muscle - shivering, blood vessel in skin - narrow, warm blood keep in body core, behavioural change - putting on more cloth)

↓

↑ Body temp.

↓

Loss of body heat

↓

↓ Body temp. — Stimulation

Inhibition

(2)

→ When B.P ↑

↓

Baroreceptor detect ↑ in B.P and send nerve impulse

↓

Input send

↓

Control center evaluate the input and generate output

↓

output

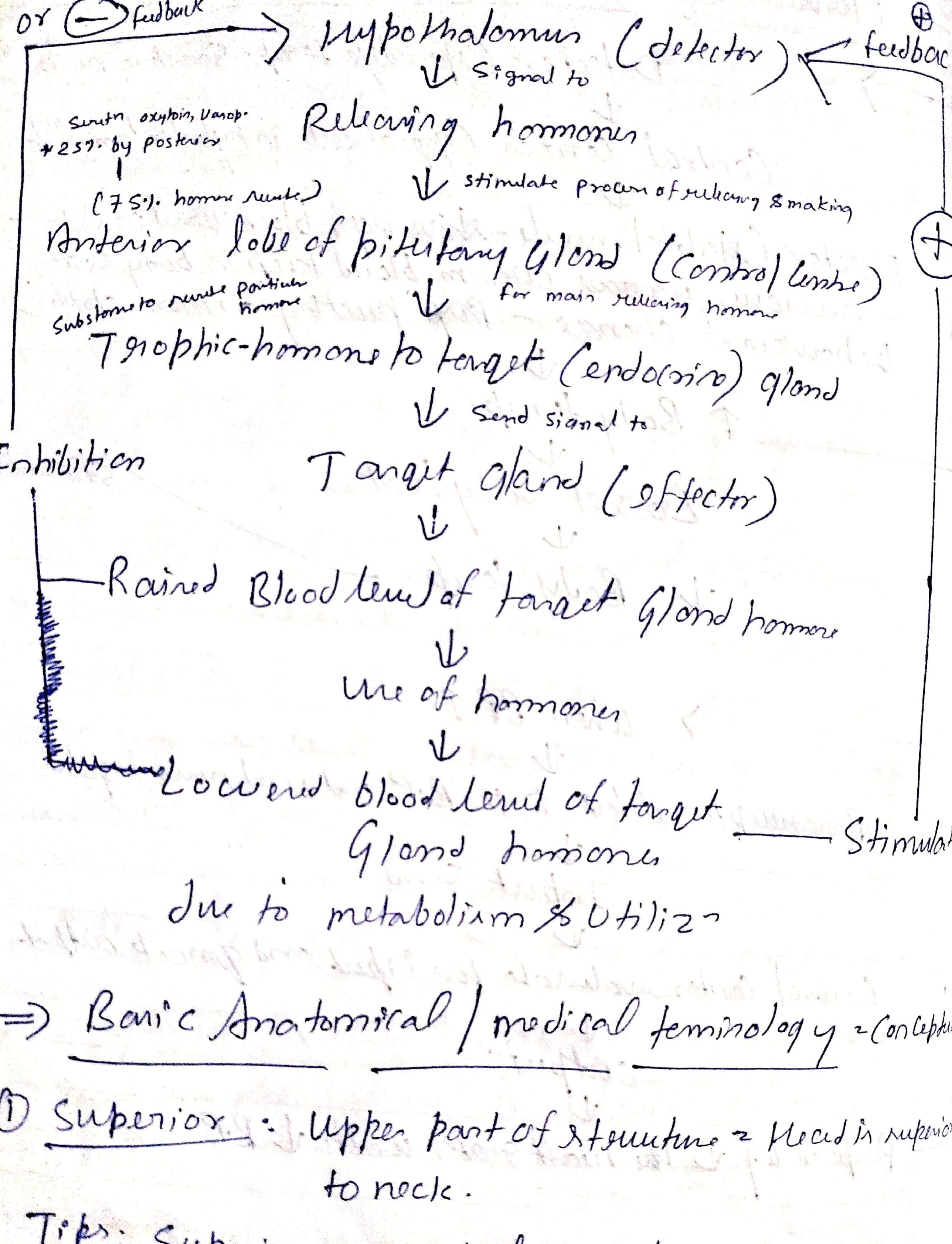
↓

Respond by ↓ the heart rate, which ↓ B.P

⊖ ve feedback

Return to its original state

③ The feedback regulation of secretion of hormones by anterior lobe of pituitary gland :

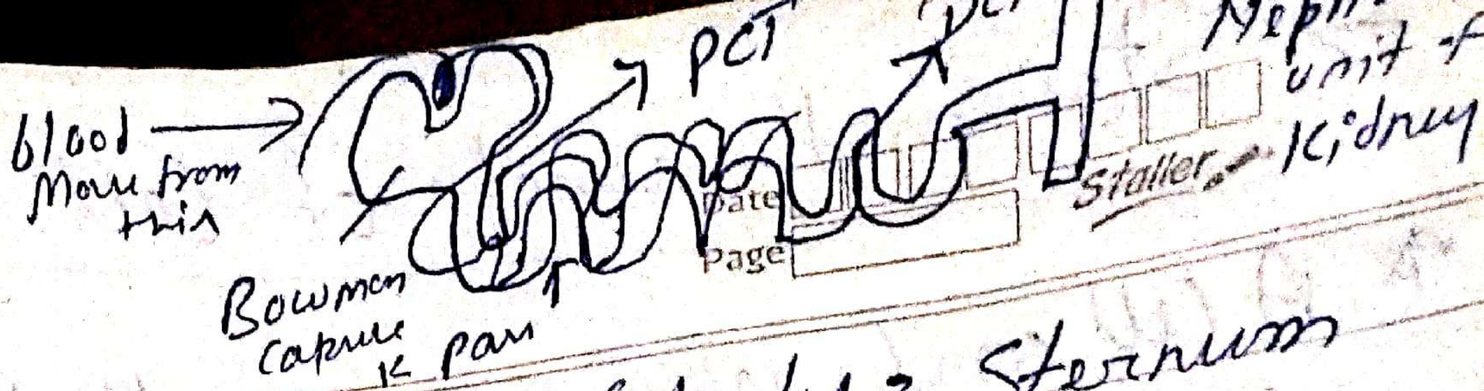


⇒ Basic Anatomical / medical terminology = Concepts

① Superior : Upper part of structure = Head is superior to neck.

Tips: Superior = Sounds like = Upar

② Inferior : Lower part of a str. = mouth is lower to nose



3) Anterior : Towards the front of body = Sternum (chest bone) is anterior to heart

Trick: Anterior = A = Aage = front

4) Posterior ; Towards the back of body = Oesophagus is posterior to trachea

Trick; Posterior = Peeche.

5) Medial = Near the midline of the body = chest is medial to arms

Trick = Medial = middle

ex:- Arms are lateral to che

6) Lateral = Away from the midline = lung are lateral to heart / Means to the side of or away from the middle of the body ex: Ears are late to nose.

7) Proximal : Near to the origin or attachment = Wri is proximal to hand. to the body

Trick; Proximal = P = Pass = near.

8) Distal : Away from the origin or the attachmen = wrist is distal to elbow. (Kohni) made u 3- bon Radius, Ul humo

Trick; Distal = D = Door = Away cartilage - cushion for slidi joi

9) Superficial ; Toward the surface of the body = Rib are superficial to legs. (opp. to dee

Trick = Superficial = surface = Satah. ① Skin i to muscl ② Cornea in su surface of e

10) Deep ; Away from the surface of body = Bones are deeper to skin

Trick; Deep. = Gahra. deeper inside

⇒ Str. and funct" of Cell

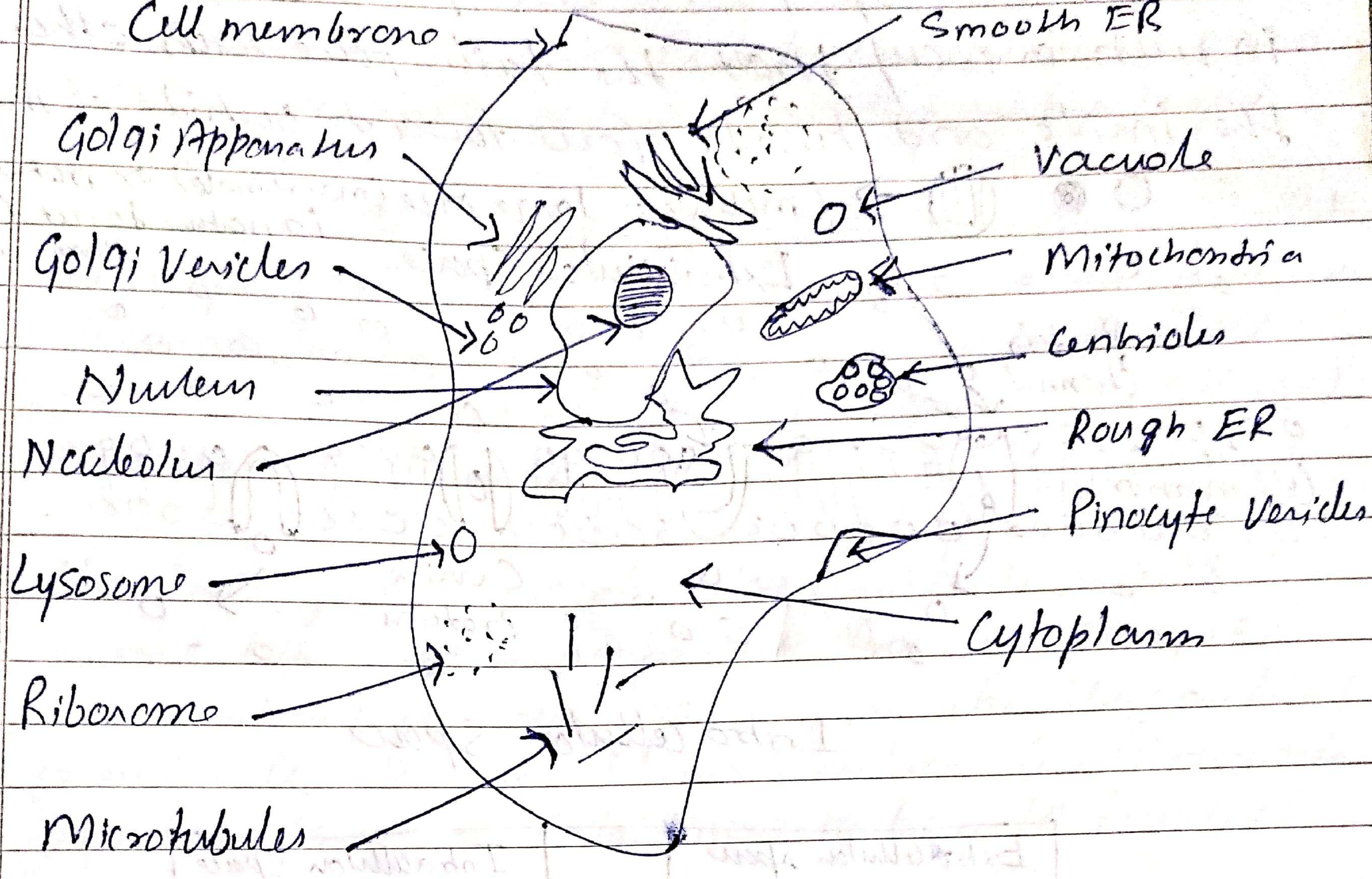
* A cell can be define as the smallest unit of life. It is str. functional and biological unit of all living beings.
* A cell can replicate itself independently and are known as - gerd as building blocks of life. Each cell contain cytop which is enclosed by a membrane and contains several biom - lecules like protein, nucleic acids etc.
* Cells are similar to small factories with diff. labourers and depts. that work all the time to make life possib Various kinds of cells perform diff. funcⁿ like protein synth and energy produ
* There are two major kinds of living org. based on the Cellular str. ① Prokaryotes ② Eukaryotes.

Prokaryotes are made up of cells with nonuleus. The all are single celled m/o including archice, ~~bac~~ Archa bacteria, and photosynthetic blue-green Algae which are I/a Cyanobacteria.

Eukaryotes consist of cells with a nucleus. This broad category invalue all plants, fungi (molds, yeast. and mushrooms), protozoa (P. falciparum and parasite that Cause malaria) and animals.

* Plasma membrane is responsible for monitoring transp of nutrients and electrolytes in and out of the cell also supp

for all to cell communicn.



→ Cell membrane : Also called plasma membrane physically separates the intracellular space (inside the cell) from extracellular env. (outside the cell). All plant & animal cell have cell membrane. The cell memb. surround and protect the cytoplasm. Cytoplasm is part of protoplasm & is living component of the cell.

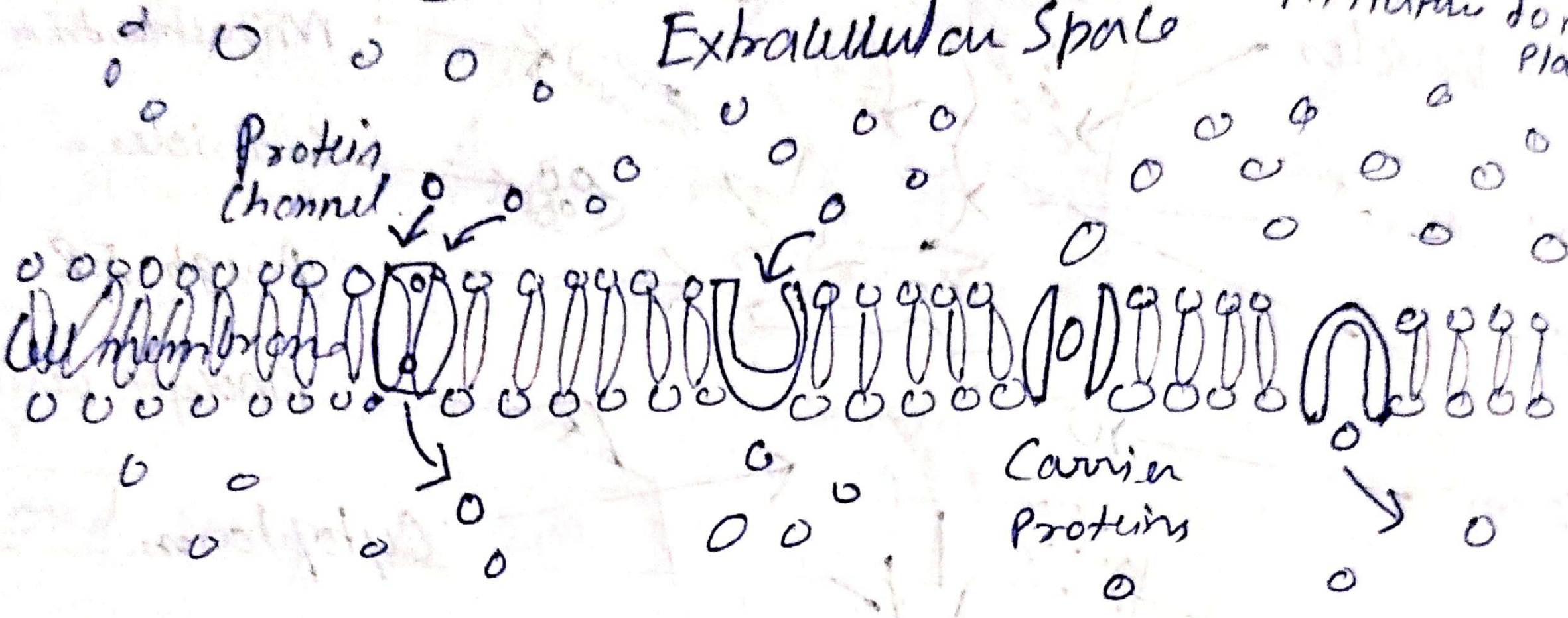
* The memb. enclosing a cell is made upof two lipid layer called a bilipid membrane. The lipid that are present in the plasma membrane are called phospholipids. The lipid layers are made up of no. of fatty acid building blocks.

The fatty acid that makes up this memb. ha

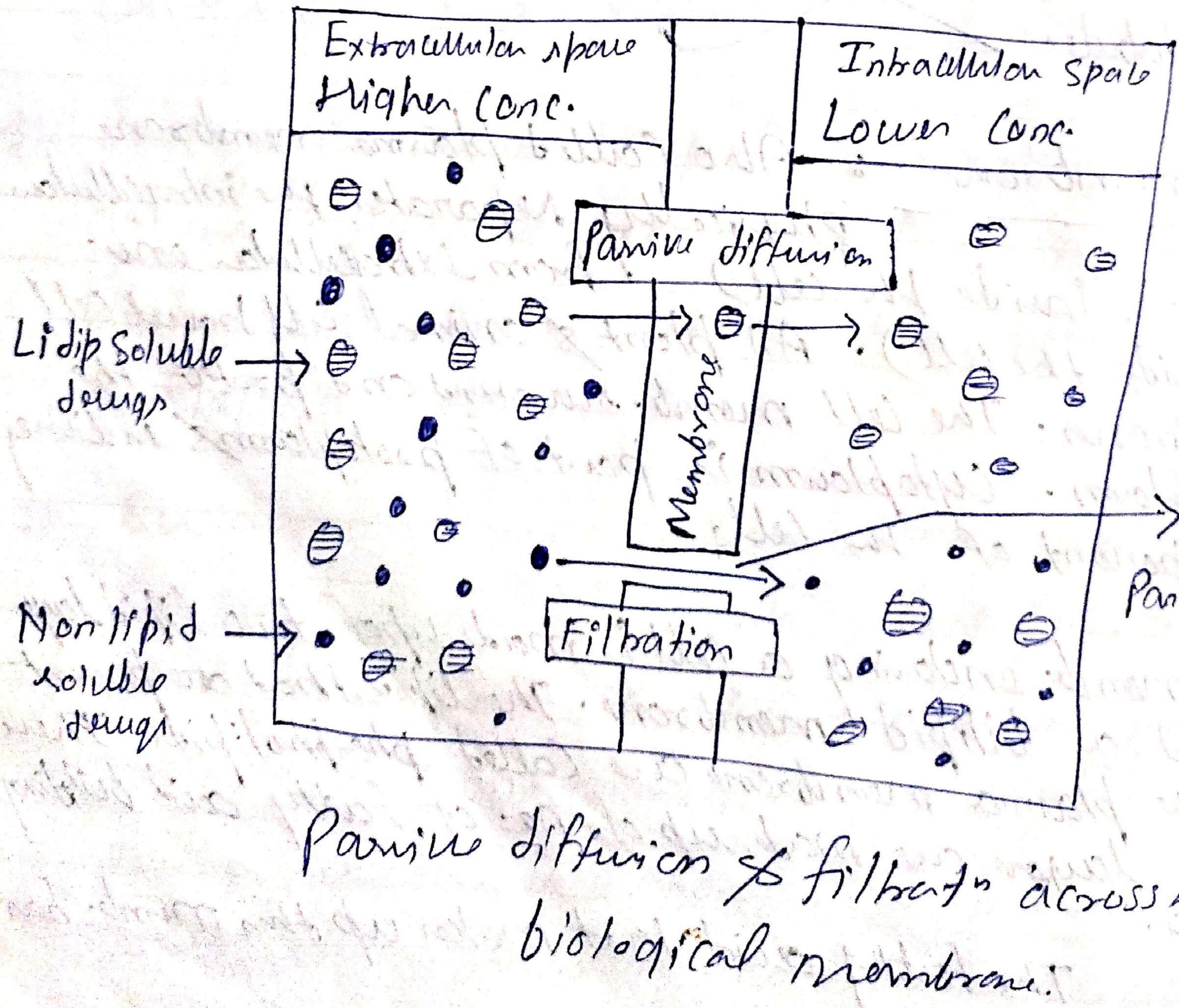
two diff. parts to it - small water loving head-
-phillic head. The other part of this fatty
is a long water repelling or water hating tail.

* This tail is hydrophobic - The plasma memb. is a
in such a way that the tails face each other
the inside and heads face towards outside of m

→ (molecule of large size (macromole) or not
in nature do not
Plasma



Intracellular Space



Passive diffusion & filtration across the lipi
biological membrane.

Date
Page

⇒ Golgi Apparatus :- It is an organelle present in most eukaryotic cells. It is made up of membrane bound sacs and is also called golgibody, Golgi complex or dictyosome. Its func" is to process and bundle macromolecules like protein and lipids so they are synthesized within cell.

The Golgie apparatus sometimes compared it as post office inside the cell since one major func" is to modify, sort and package proteins to be sented and also transport of lipids throughout the cell and creation of lysosomes.

folding

The principal func" of Golgi complex is secretn, In neural cells, synthetic products from the roughER are transferred to Golgi region, from where they are liberated from the cell through plasma membrane by Pinocytosis secretory func" of Golgi seems to be well founded.

⇒ Nucleolus :- It is a distinct str present in the nucleus of eukaryotic cells. It is mainly involved in assembling the Ribosomes, modifica" of tRNA transfer and sensing cellular stress.

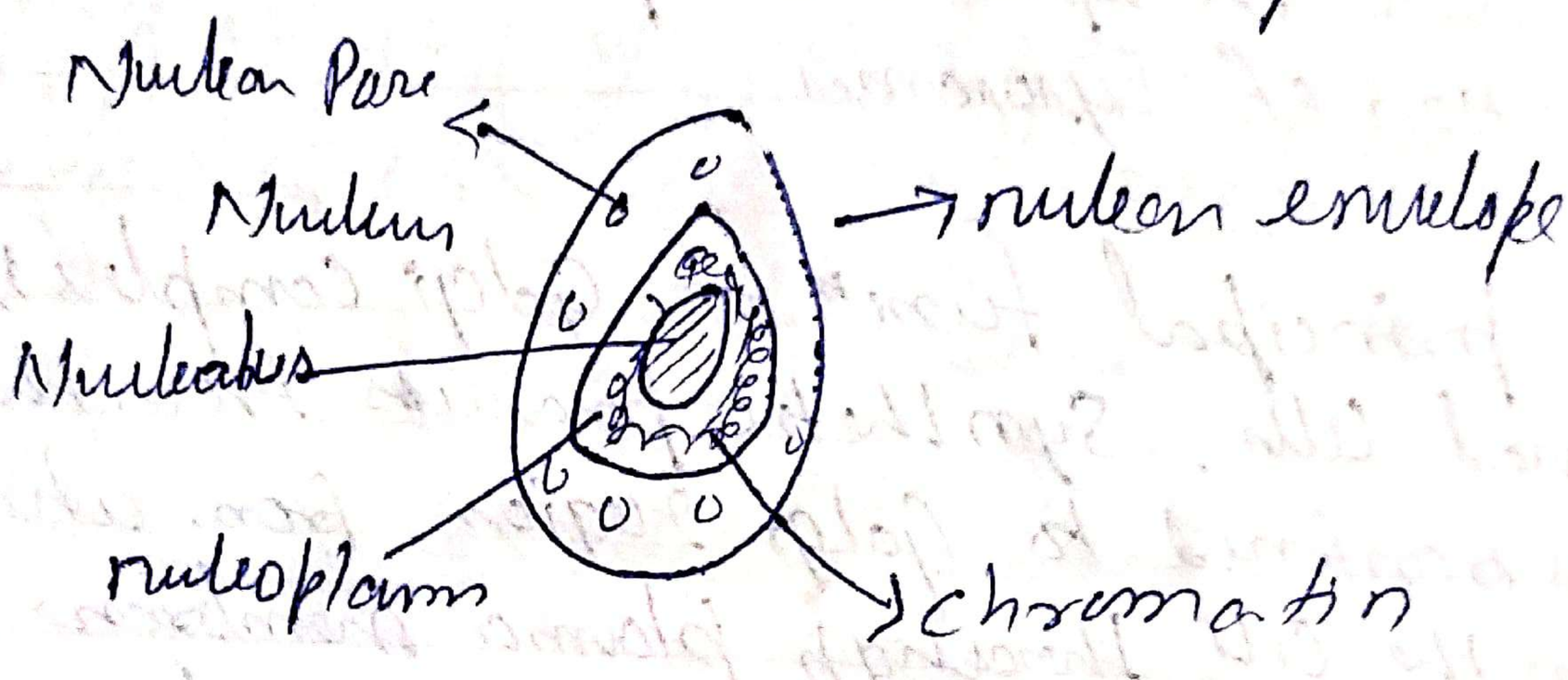
The nucleolus is composed of RNA and proteins which form around specific chromosomal region. The nucleus is control center of the cell. It is the largest organelle in the cell and it contains the DNA of the cell. The main func" of nucleolus is to produce and assemble subunits which form Ri

soon

* Riboreme is the site of protien Synthesis, Nucleolus is on indirect but crucial role in protein Synthesis assembling ribosomal Subunits.

* The nucleolus carries out 50% of total RNA that taker place in cells. This functionality to hundreds of 91-genes that are present in nu

* It produces 70-90% of Cellular RNA in many it is a source of RNA. The chromatin in nucleolus genes or ribosomal DNA for Coding rt-RNA.



→ Lysosomes: Its funcn is to remove wast well as destroying a cell after it died, called autolysis. A lysosome is a organelle co digestive enzymes which is uses to funcn as the dige and waste removal for cells, food particles, bacte etc.

The membrane contain acids and enzymes ca of digesting and decomposing macromolecules. Macrom are molecules with a large no. of atoms, su as nucleic acid, synthetic polymers and protein.

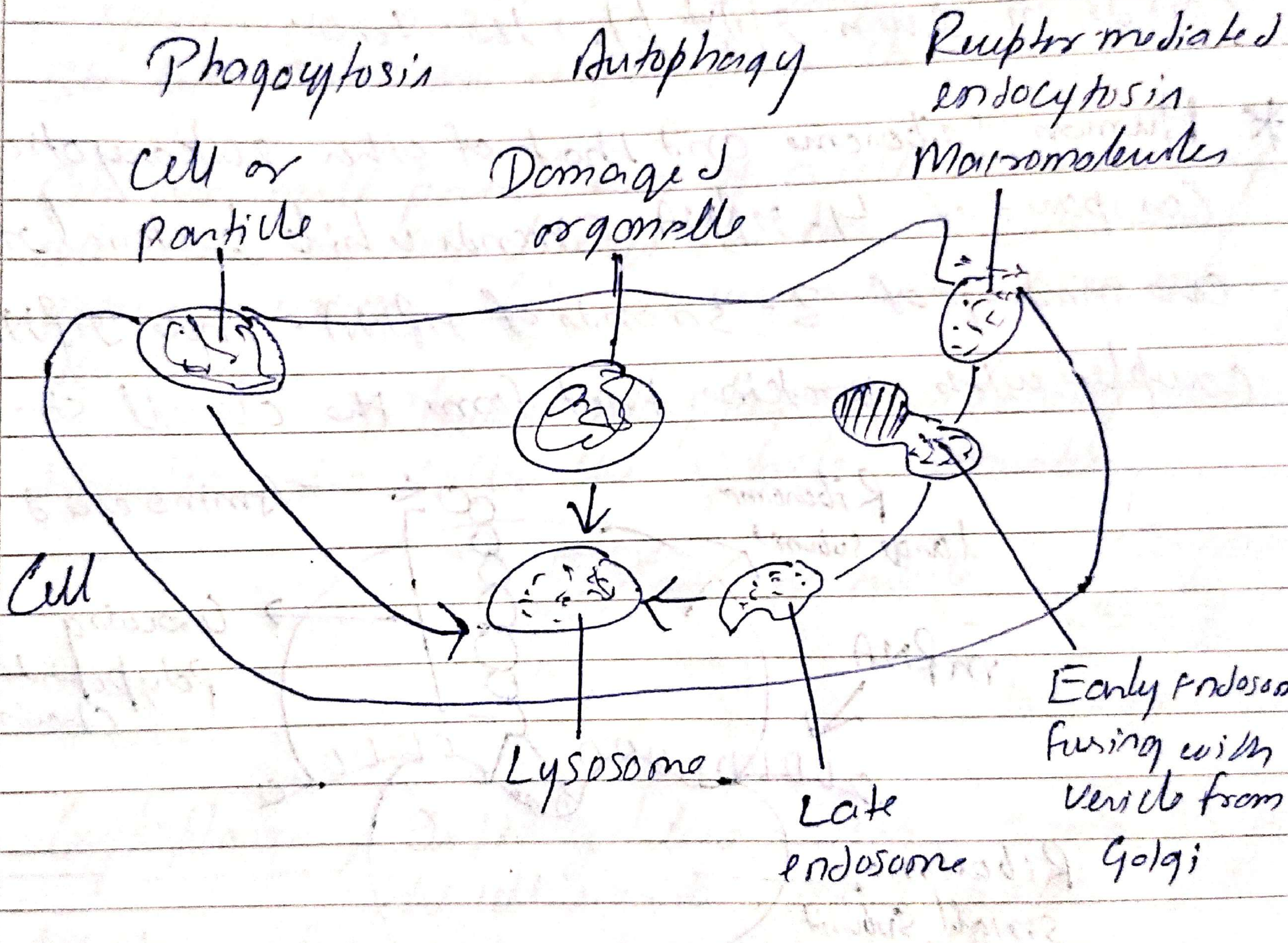
* Its general funcn is to degrade or break down ma molecules, which include replacing old and worn out cell parts to provide

Lysosome secret

Date
Page

harmful toxin or bacteria safe by degrading them. They proteins many Vacuoles which make either in or out of the cell, ensuring things run smoothly

* Exocytosis is how materials leave a cell through the cell membrane. ATP energy, is used to transport the vacuole containing material outside the cell. The lysosomes which are responsible for this process are called secretory lysosomes.



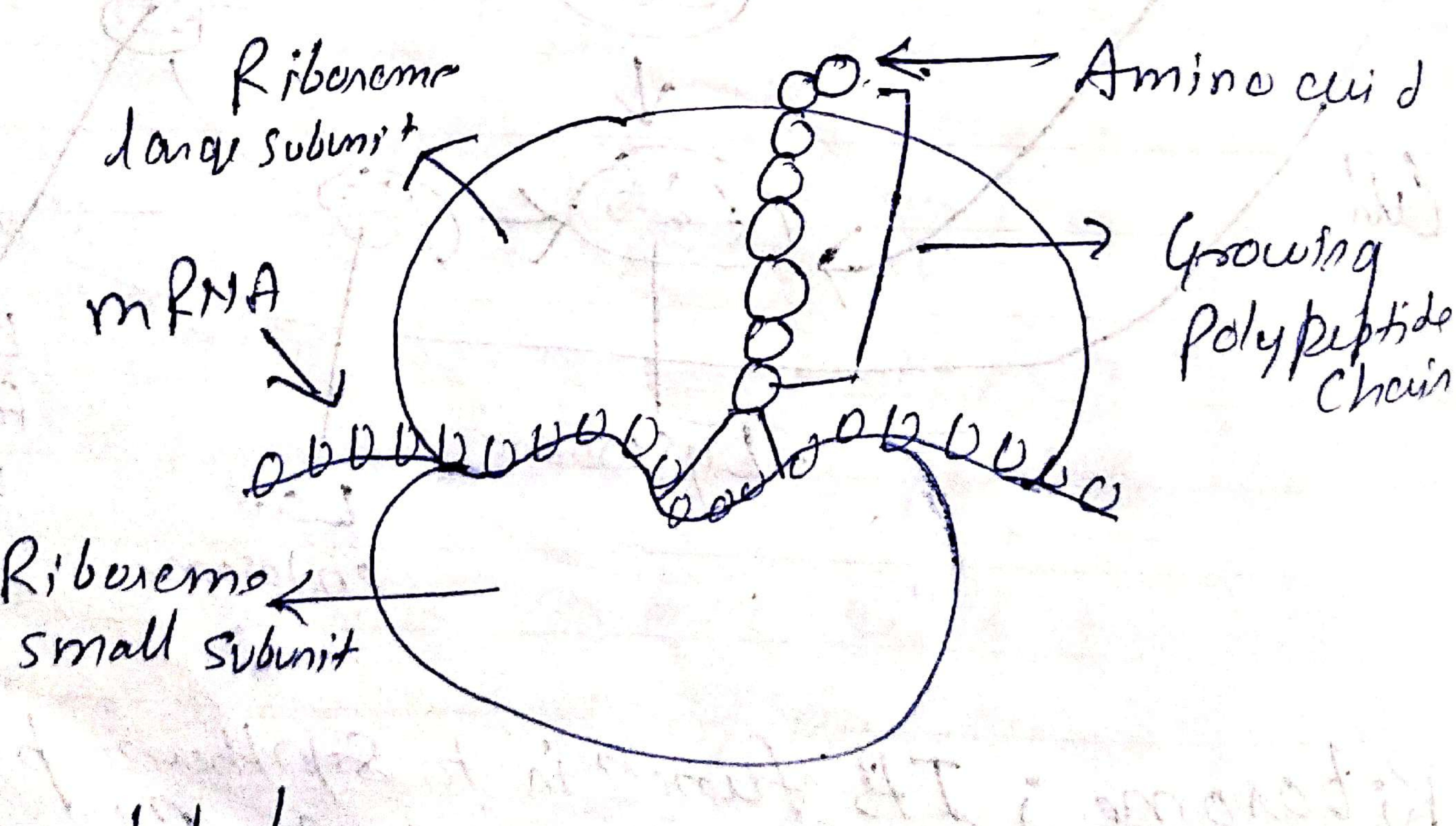
⇒ Riborsome ; Its funcⁿ is to synthesize protein as directed in mRNA. Riborsome help in producing proteins with many diff. funcⁿ in body they can be found within cytoplasm or ER.

Ribosom are responsible for protein synthesis, they are located

as free particles throughout the cell in both prokaryotic eukaryotic (bacteria & an) cells. They can also be att to Rough ER b/c the rough ER help in producing movement of proteins.

* Ribosomes also found in mitochondria & chloroplast. R-osomes are composed of r-RNA and r-Protein. The ratio b/w the two components varies as prokaryotes are 60% rRNA and 40% r-protein while eukary can be an even split b/w the two.

* Human ribosome and that of other eukaryotic are composed of 4-rRNA strands while bacterial ribo are made up of 3-strands of rRNA. These rRNA coupled with proteins that form the overall str. of



→ **Microtubules**; Are microscopic hollow tubes made up of proteins α & β-tubulin that are part of cell's cytoskeleton, a network of protein fila-ments that extends throughout the cell, give cell shape and keep its organelles in place

Date
Page
Staller

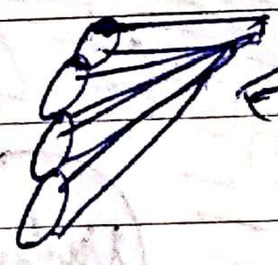
* Microtubules are polar molecules, with a only charged end that grows relatively fast and a only charged end that grows slow.

protofilaments arrange themselves parallel to each other in a microtubule, so the one end of the microtubule always has β-subunit exposed, while on end has α-subunit exposed.

* Having polarity allows the microtubule to assemble in a specific way and function correctly. Microtubule give str. like cilia and flagella their str.

* Cilli are small protuberance of a cell, in human they are found on cells linings the trachea, where they prevent materials like mucus and dirt from entering the lungs.

Microtubule play key role in forming mitotic spindle, also called the spindle apparatus.



(longitudinal view

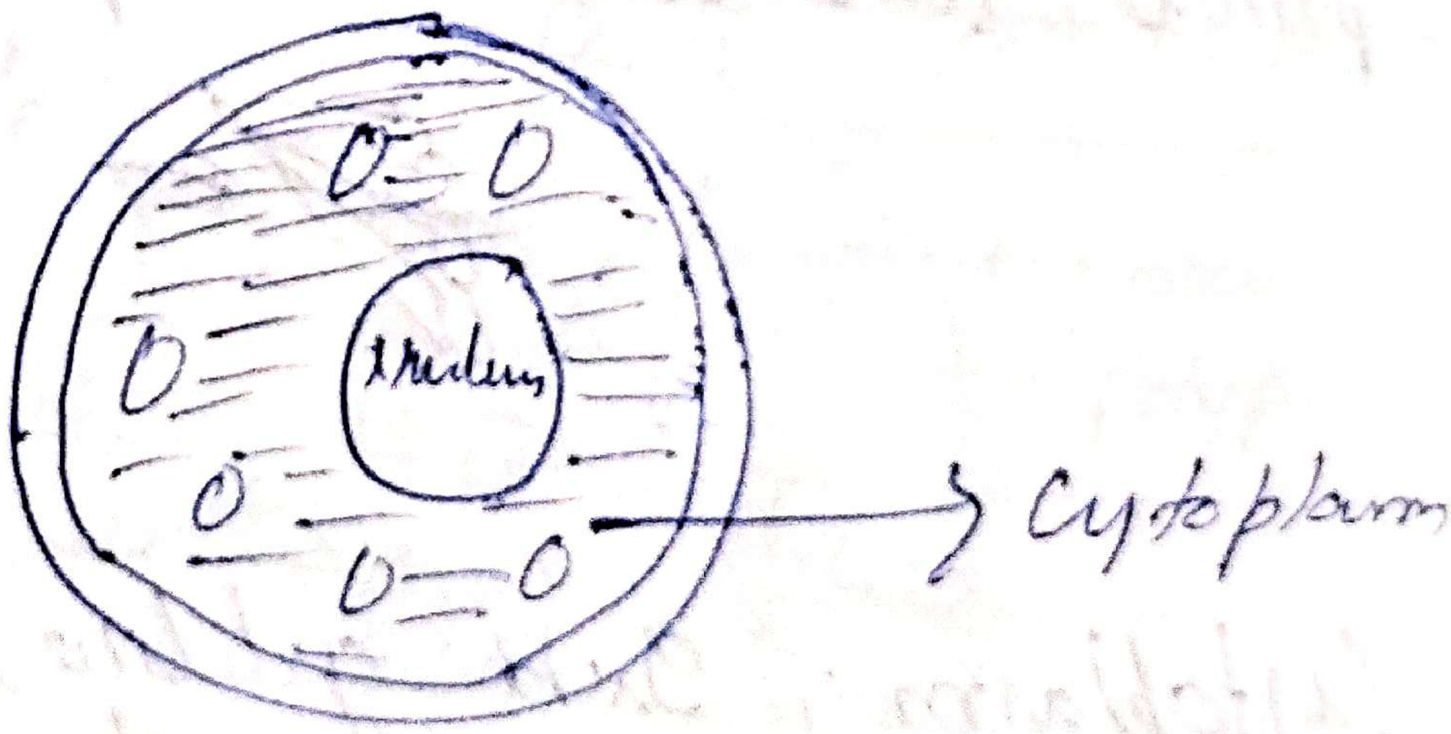
⇒ Cytoplasm; is the gel like substance enclosed within the cell memb., made up of water, proteins, lipids, nucleic acids, inorganic salts etc.

* Most metabolic activities take place within cytoplasm and subcellular str., such as ribosomes, plasmids, and cytoplasmic granules, are located in cytoplasm. In eukaryotic cells, cytoplasm refers to the contents of the cell with the exception of nucleus.

distinct membrane compartment separate from cytop
The physical nature of the cytoplasm is variable.
- times there is a quite diffusion across cell, ma
the cytoplasm resemble a colloidal Soln.

* At other times, it appears to take on the properties
gel-like substance / glass-like. The cytoplasm fun
support and suspend organelles and cellular ma

* Many cellular proces occurs in cytoplasm som
these include protein synthesis the first stage
Cellular respirn (Kla. glycolysis, mitosis and m
in addn, the cytoplasm helps to move materials
as hormones around the cell and also dissolve cell
waste.



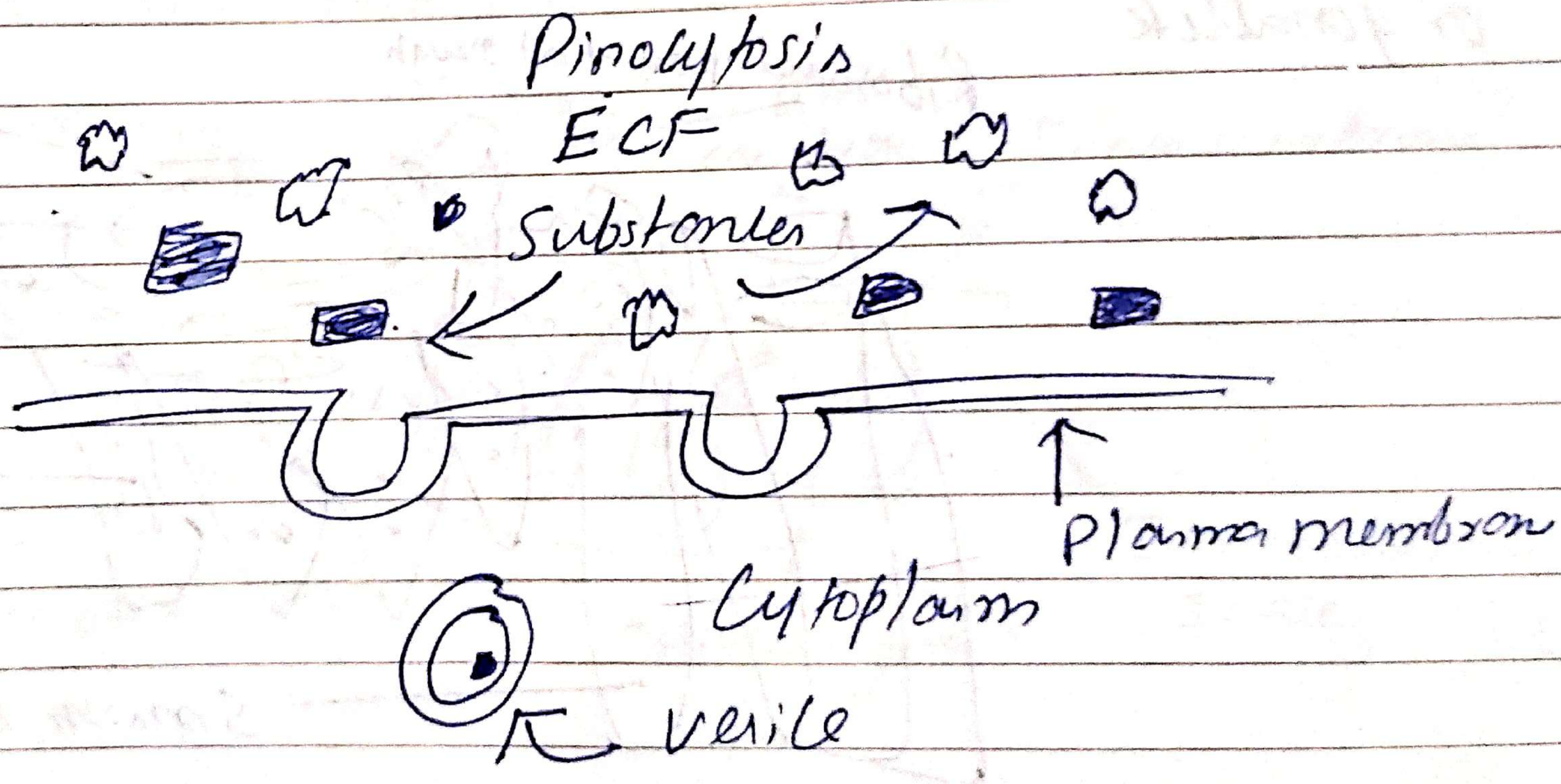
⇒ Pinocytic Vesicles ; Pinocytosis is a method
which cell absorb small
particles outside the cell and bring them inside for
cell drinking. During this proces, the cell surrounds
particles and then pinches off part of its membr
enclose the particles within vesicles which are small

Date
Page
Staller

Sphere of the membrane. This process is usually used for taking in extracellular fluid. Pinocytosis is a type of endocytosis, where cell takes in particles by engulfing them with its membr.

Small particles of substances in ECF are absorb in to cell via pinocytosis. this process require cellular transport. Microvilli in the gut use this process to absorb nutrients from food.

Cells in the kidney consume pinocytosis to separate nutrients and fluids from the urine that will be expelled from the body. In addition human egg cells also use it to absorb nutrients prior to being fertilized.



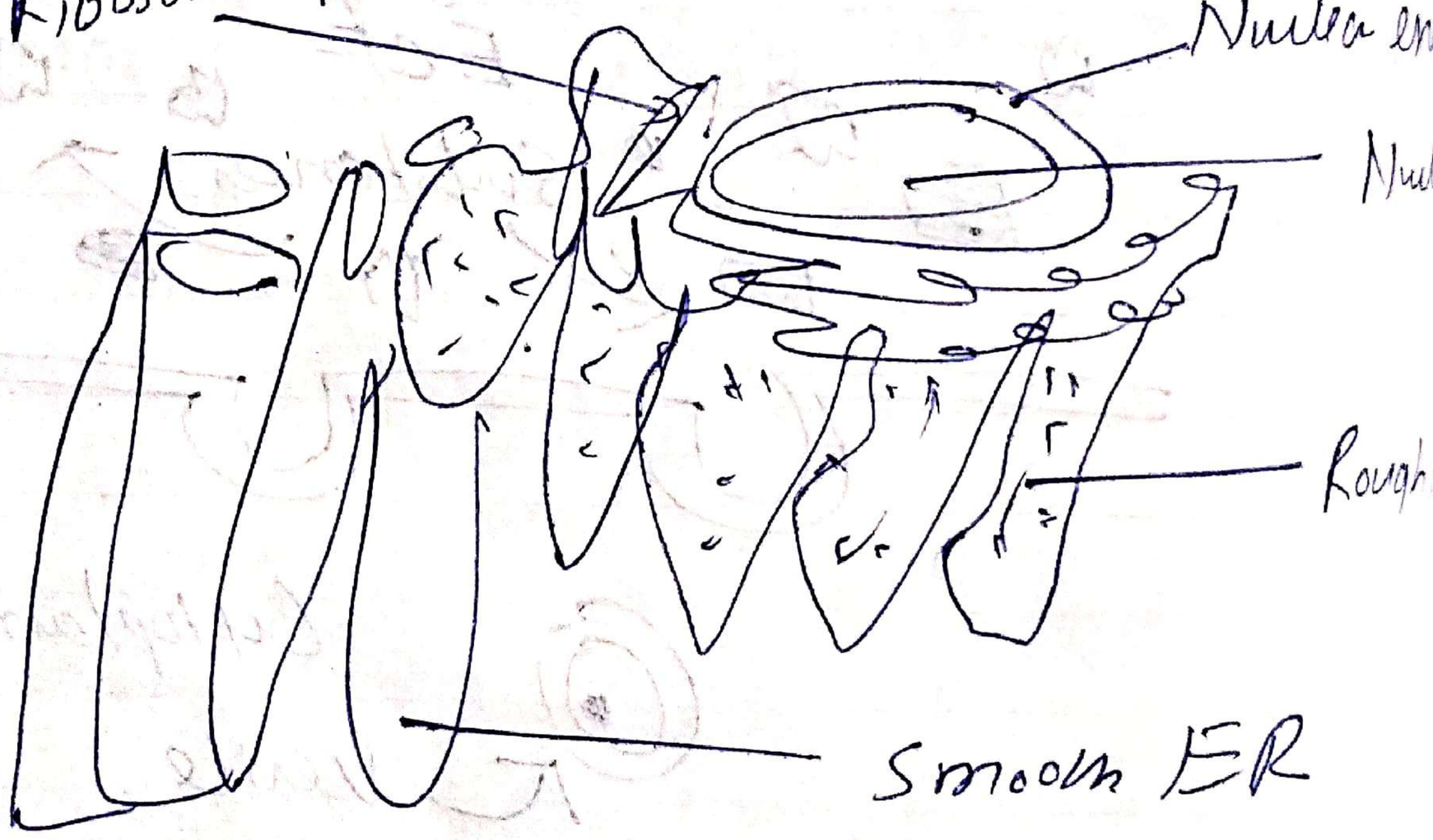
Endoplasmic Reticulum: The rough ER plays a no. of roles within a cell. Largely associated with protein synthesis. Polypeptides are synthesized, modified, folded into their correct 3-D shape and sorted toward an organelle or marked for secretn. It also plays imp. role in modulating the response of cell to stress and in quality control

for correct protein folding. When no. of unfold prote
↑, cell alter their tubules; sheet ratio. This cou
arise from the greater area available within the sh
of rough ER to ensure unfolded protein. Or cou
reflect the need for distinct proteome of rough

↓

After processed of mRNA transcript is exported
the nucleus. Translation begin with the binding of a
to a mature mRNA transcript.

* Two types of ER (smooth & rough) are presen
in animal/plant cell, both often appear as if
separate, but they are sub-compartments of the same
organelle



⇒ Mitochondria: Are well-defined cytoplasmic orga
of the cell which take part in various
of cellular metabolic funcn. Survival of cell requires ener
to perform diff. funcn. This organelle supply releva
biological energy to the cell, and they obtain this energy
by oxidizing the substrates of the Krebs cycle.

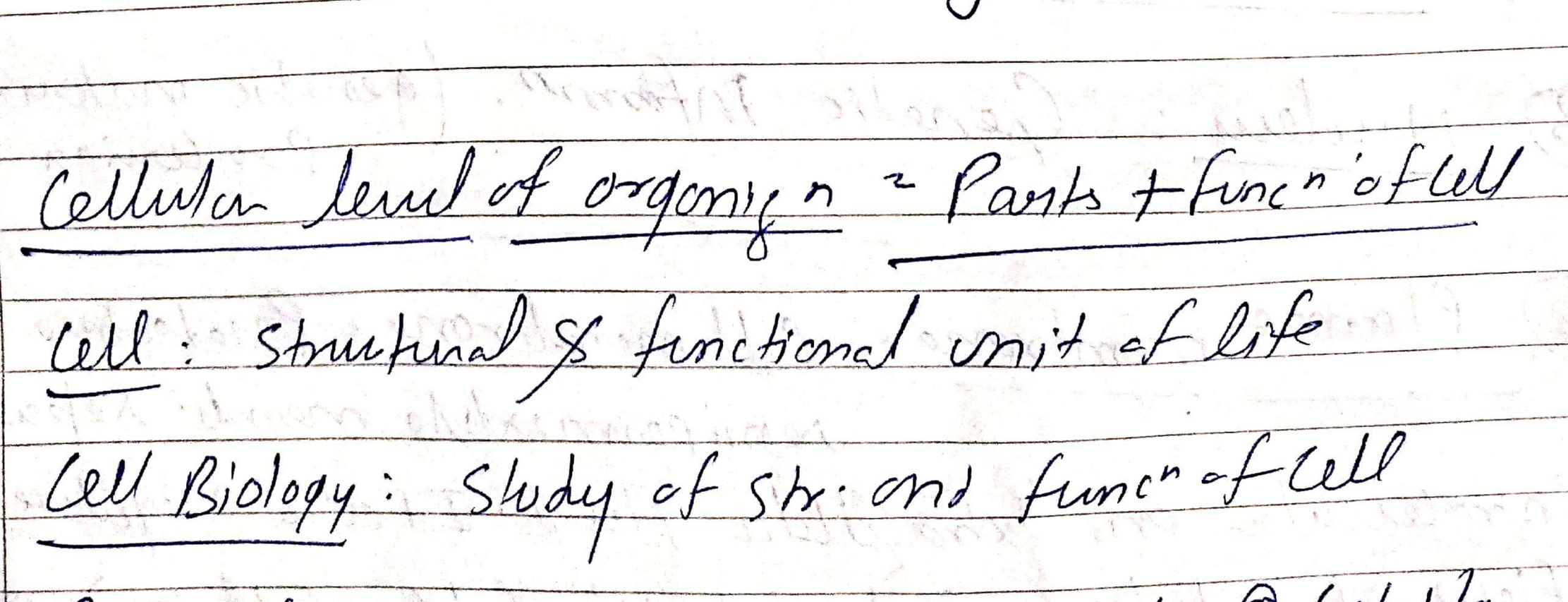
Date
Page

Staller

* Here mitochondria is referred as Power house of all although all eukaryotic cell have mitoch., though they are lost in the later stages of development of cell like in RBC or in elements of Phloem sieve tube.

Mitochondria is a memb. bound cellular str. and is found in most Euk. cells. It ranges from 0.5 to 1.0 μm in diameter. It generate most of the energy of the cell in the form of Adenosine Tri phosphate (ATP) and it is used as a source of chemical energy.

* It involved in other cellular activities like Signalling Cellular differentn, cell senescence and also control of cell cycle and cell growth.



⇒ Cellular level of organisⁿ = Parts + funcⁿ of cell

→ Cell: Structural & functional unit of life

→ Cell Biology: Study of str. and funcⁿ of cell

→ Parts of Cell: Main ① Plasma memb. ② Cytoplasm ③ Nucleus

① Plasma membr : Give protection & exchange of s

② Cytoplasm : (A) cytosol (B) organelles

organelles

i) Mitochondria = Power house

ii) lysosome = Autophagy = Suicidal bag.

iii) Peroxisome = Decompose Hydrogen peroxid H_2O_2 = Protect cell
→ By which cell do not oxid

iv) ER : Rough & Smooth
↓ → Synthesis of lipid
Protein synthesis ‖ hormone like Est
and Testosteron

v) Riboxome : Protein factory (role in Protein Synth.

vi) Golgi Apparatus : Processing, Packaging and deli
protein molecule to different pa
the cell.

vii) Cytoskeleton : Provide structural framework for

viii) Centrosome : Mitotic spindle = Support in cell di

③ Nucleus : Genetic Inform. (genetic mater
Pro tein

— x —

① Plasma membrane : Cell membrane = Protective semipermeable memb. separat
intracellular and extracellular fluid. It also regulate the
flow of substance into and out of the cell ⇌

Structure: Given by fluid-mosaic model. It is a lipid bilayer = made up of 3-types of lipid molecules.
i) Phospholipids = 75%
ii) Cholesterol = 20%
iii) Glycolipids = 05%

* Phospholipids molecule consist of = Head & tail (H)< tail

— **Head**: Polar = Hydrophillic = water loving Arrangement

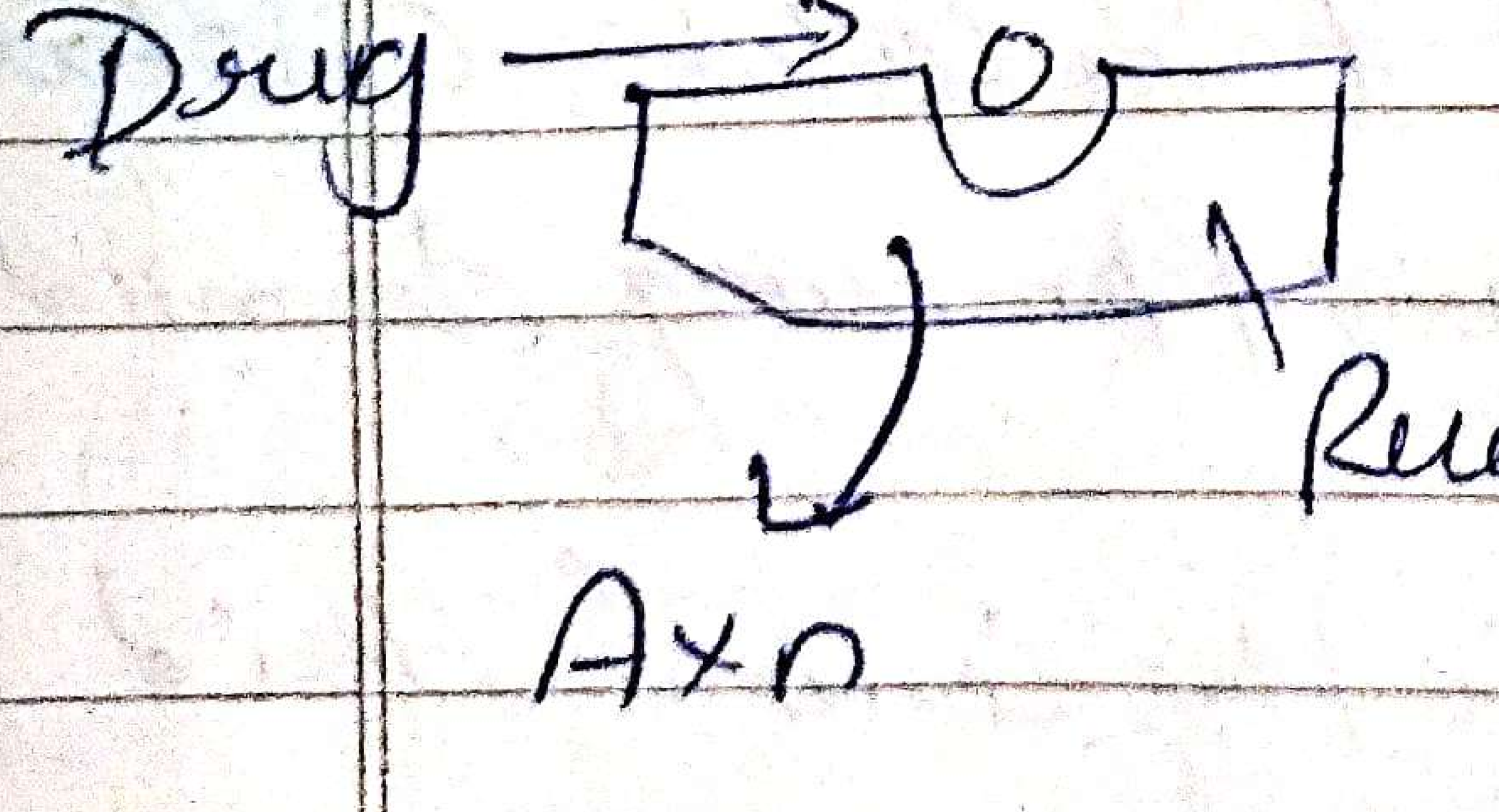
— **Tail**: Non-Polar = Hydrophobic = water hating

* Funcⁿ of P.M

i) Protect Cytoplasm, provide size & shape to cell
ii) Shows selective permeability = maintain homeostasis
iii) Memb. protecting embedded in lipid bilayer perform follow tasks
* forms ion channel = Specific ion moves in or out of the memb. =o↑o=

* Some protein act as a channel or transporter that move selective ion from outside to inside.

* Some protein serve as a receptor for hormones or NT



* Some form enzyme = Catalyze substance = metabolize
* Glycocalyx = Cell identifying markers

② Cytoplasm = Cyto = Cell, Plasm = fluid / liquid
It is a fluid protein present inside the cell b/w Cell memb. and nucleus

① Cytosol = watery fluid of the cytoplasm in which various organelles are suspended / Composed of ~75% water, and other substances like — glucose, ions, amino acid and products.

② Organelles: Small organs, highly specialized subcellular st having characteristic shape & function

ex:- Cytoskeleton, ribosome, ER, golgi app., lysosome, Mito all work together to maintain homeostasis

* Organelle types: ① Non-membranous ② membranous

i) Non-memb: There lack the membs. and are indirect (or with the cytosol

ex:- Ribosome Cytoskelton (no membrane present)

ii) Membranous: Surrounded by lipid bilayer membs.

ex:- ER, golgi app., mitochond., lysosome. (All have

3) Mitochondria: Sigular = mitochondrion = Power hou

* Small, oblonged shaped, enclosed by ~02 membranes. The mitochonin layer is - smooth, however inner mitochond membrane is — arranged in series of folds called — Cris that provide large surface area for energy producing chem reactions

* Enclosed by inner memb. & Cristae is the central flui cavity in mitochontria called — matrix

→ function:

i) Energy produ" in the form of ATP by chem. rxn of aerobic respir" that is citric acid cycle & ETC/system that

occurs in matrix and cristae.

2) Matrix also contain various enzymes that catalyse there rxn.

3) A cell may have as few as - 100 or as many as several thousands of mitochondria

4) Physiologically active cell like - liver, muscle, kidney have many mitochondria as ATP need is higher.

(4) Lysosome : Are memb. enclosed vesicles formed by golgi app., they contain powerful digestive or hydrolytic enzyme that are capable of breaking down a wide variety of molecules like: DNA, RNA, Protein Carbohydrates etc.

→ Funcn: Lysosomal enzyme also called lysozyme

i) Digestion of lipid, carbohydrate, protein and release of their final breakdown into cytosol.

ii) Autophagy: Auto = self, Phagi = eating, Digestion of worn out organelles and release of digested compound into cytosol for reuse — by doing this they are recycling the str. of the cell.

iii) Autolysis : Auto = self, lysis = digestion or destruction, digestion of entire cell in certain pathological condition or and immediately after death. In this process lysosome expel all their enzyme directly into the cytosol to destroy cell and its organelles

Lysosome in WBC digest the foreign bodies = Antigen

Pathogen / Antigen → (Cell) → Lysosome → ✗ Pathogen → ◎ → Self kill

5) ER: Series of interconnecting canals of membrane in cytoplasm. These canals form flattened sacs or tubules called Cisternae.

- Types: (1) Rough ER (2) Smooth ER

(1) Rough ER: outer surface of rough ER is attached with ribosome hence named - rough ribosome or si of protein synth., Protein synthesized by ribosome is proc -ed within ER and then released from cell like - hormon and enzymes.

* Rough ER is involved in the synthesis of Glycoprotein an Phosphalipids that are incorporated in plasma memb.

(2) Smooth ER: It extend from rough ER to form network of membranous tubules. They do have ribosome in their outer surface of membrane

* Smooth ER Synthesis — lipids and Steroid hormone estrogen & testosterone

* It also associated with the detoxifica of certain toxic substance such as drugs & carcinogen.

6) Ribosomes: Are tiny granules composed of RRNA & Proteins, Site of protein synth. = Protein factorie

* Some ribosome are present as - free ribosome in cytoplasm and are involved in the synth. of protein for use within cell

Ex: (i) Enzyme req. for metabolism and the protein part of th

(ii) The remaining ribosomes are attached to the outer surface of the nuclear memb. & ER and are called as memb.-bou ribosomes

Date
Page
Staller
Insertion

* There Ribosome synthesize protein for insertion in the plasma membrane or to release outside the cell
ex:- Phospholipids enzyme and hormones

7) Cytoskeleton ; Cyto = cell, skeleton = framework

* Complex network of tiny strands of protein that extends throughout the cytosol
* Provide structural framework for cell and give its shape
* Responsible for cellular movement, including movement of chromosome during cell division and movement of whole cell such as - Phagocyte.

→ Composed of 3-types of Protein fibres

i) Microfilaments 2) Intermediate - filament
iii) Microtubules.

i) Microfilaments : Thinnest fibres of cytoskeleton most of them are composed of protein = Actin and are concentrated at the cell periphery.

* They provide structural support, maintain the shape of the cell.
* Responsible for cellular movement like - Contraction in muscle cell and migration of skin during wound healing.

ii) Intermediate filament : They are thicker than the microtubules they form a network around the nucleus and extend around the cell periphery

* They form the shape of the cell and hold the organelles

3) Microtubule : They are the largest of the cytoskeletal component and are mainly compond of a protein called tubulin.

* They give structural strength to the cell
* Responsible for the treatment of organelles within the c
chromosome during cell division
* Extension of cell like - Cillia and flagella.

4) Nucleus ; The most prominent, oval/spherical shaped str.
* Every cell in the body has nucleus, except mature RBC
* Nucleus is covered by double layered membrane called nuclear memb. which is similar to plasma memb. but h
tiny perforation called nuclear pores = that regulate th
movement of substance blw nucleus & cytoplasm.
* Various str. of the nucleus include nucleoplasm, nucle

i) Nucleoplasm ; It is the fluid medium of nucleus tha
contain large cont. of genetic materi
the form of DNA this forms cell's heredity materia
called gene = Activity of cell

ii) Nucleoli ; Spherical bodies present inside the nucl
and they compared of cluster of DNA an
RNA and protein that are not enclosed by membrane
* They serve as the site of the assembly of ribosome =
protein factory

Date
Page

* Many genes makes — DNA, many DNA makeup Chromosomes.
* Chromosomes ; Thread like linear strand of DNA that carries - gene
— Human body = 46 - chromosomes
— When Chromosome are not dividing = looks like thread called - Chromatin.

⇒ Transport of substance across cell membrane

It is essential for transport of substance for cell to survive.

→ Transport = → Nutrient water electrolyte = Move inside
← cellular waste, CO_2 other toxins = move out

→ Transport Mech :

i) Passive transport : Movement of substance along the conc. gradient (downhill) = from the region of higher conc. to the region of lower conc. without using energy also diffusion.

* Diffusion :

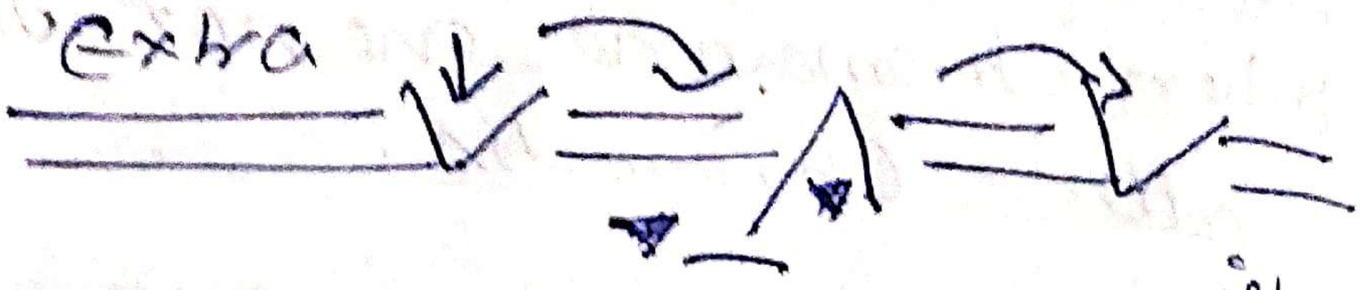
a) Simple diffusion : Substance = high conc. → Low conc.
occurs mainly in - gas, liquid, influenced by — temp., conc. of substance
ex:- Transfer of O_2 from lungs O_2 → Body ← CO_2 Body

* Movement of non-polar lipid soluble substance like = O_2, CO_2, alcohol through lipid bilayer of plasma memb.

large molecule that can unable
diffuse through semipermeable memb.

Ex: Gluco, amino acid.

* These substances are transported through in-togo pro
that act as transporter



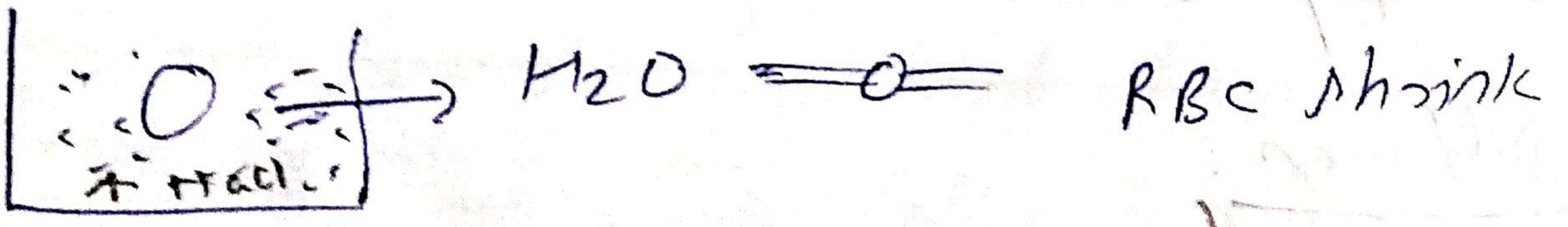
→ Osmosis: Applies only to movement of solvent

* Def: movement of water through a semipermeable memb. from an area of high water conc. (pure water) to an area of lower conc. (water + sugar or salt)

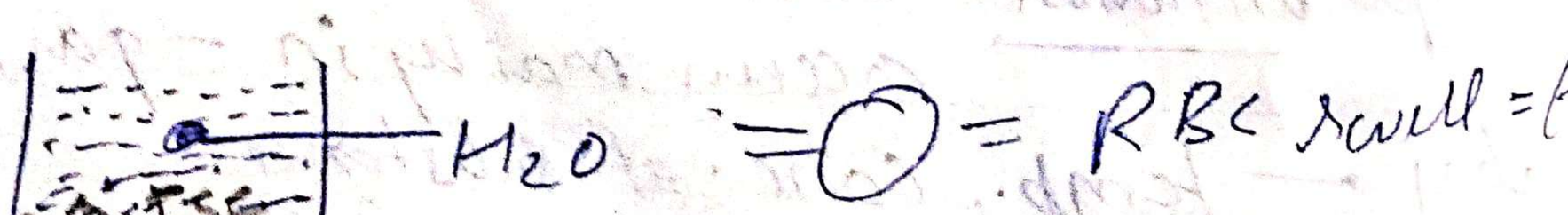
* Osmotic pressure of a solu" is directly proportio the conc. of solute.

* Demo.: Effect of osmosis on RBC = hyper. hypo. iso.

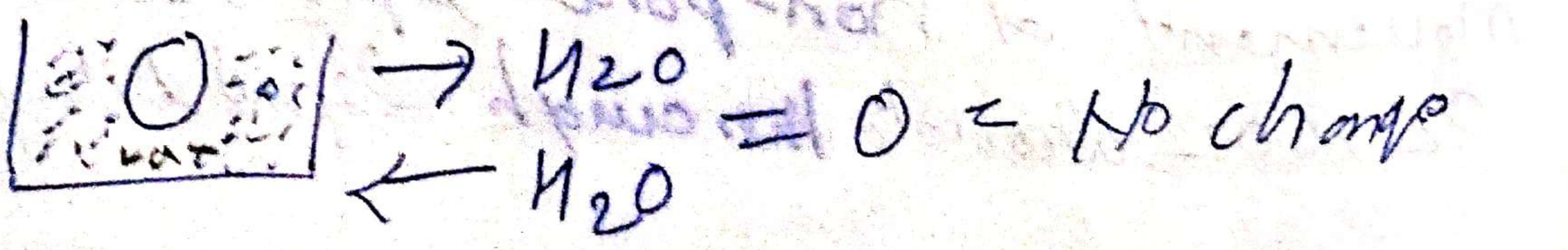
① Hypertonic soln (nacl)



② Hypotonic soln (tri-sodium citrate)



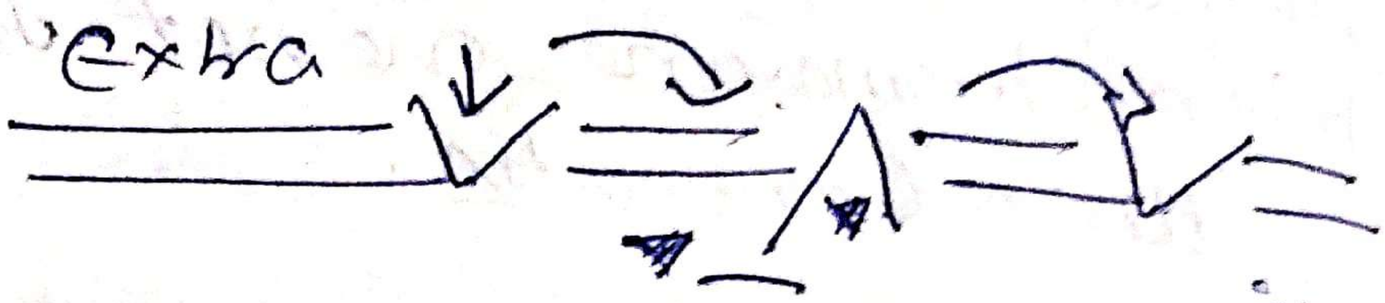
③ Isotonic soln (Lavative, mannitol, Glucose, oxytocin, i.m inj)



b) Facilitated diffusion: Facilitated to the movement of large molecule that can't diffuse through semipermeable memb.

Ex: Glucose, amino acid.

* There substances are transported through in-lego pr that act as transporter



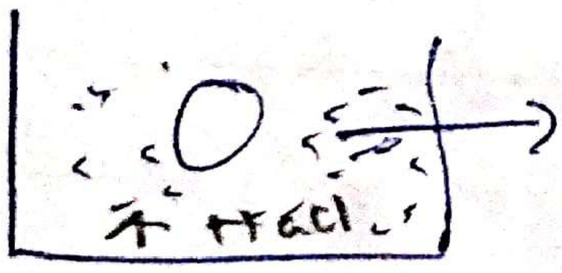
→ Osmosis: Applies only to movement of solvent

* Def: movement of water through a semiperm memb. from an area of high water c (pure water) to an area of lower conc. (wate sugar or salt)

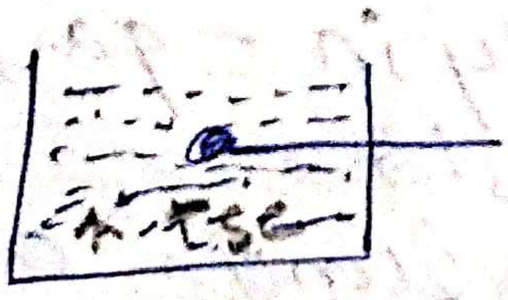
* Osmotic pressure of a sol" is directly propo the conc. of solute.

* Demo: Effect of osmosis on RBC = hyper. hy iso

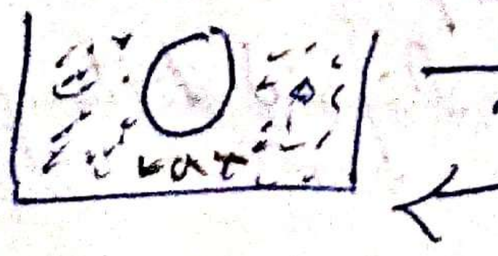
① Hypertonic soln (NaCl)



② Hypotonic soln (tri-sodium citrate)



③ Isotonic soln (Glucose, mannitol, Gluco, oxybarb, i.m i



Date
Page
Staller

* Factor affecting rate of diffusion

i) Conc. gradient : Directly proportional

ii) Temp. : "

iii) Size of diffusion molecule : Inversly proportional

iv) Surface area : Directly proportional.

⇒ Active transport : Movement of substance against their conc. gradient (uphill) = Low to higher conc.

* Substances that are actively transported across cell membrane = Na^+, K^+, H^+, Ca^+, amino acid & glucose

Types

1) Primary active transport : Energy is directly obtained from hydrolysis of ATP

Transporter protein are called : Pump.

* The Na^+/K^+ pump is most prominent primary active mech.

* The Plasma memb. maintains a diff. in the distribut° of ions b/w 2-sides. Typically K^+ present intracellularly and Na^+ extracellularly. These ion to diffuse down their Conc. gradient - K^+ out & Na^+ into cell.

Thus to maintain their Conc. gradient Na^+/K^+ pump

work ... the membr
in the exchange of Ict

* The transporter protein in Na/Ict pump has 6 binding
03 for Nat towards the cytoplasm O_2 for Ict towa
ECF. 01 for enzyme ATPase.

→ Special transport mech.: There mech. are used to tra
- port large particles like
whole bacteria, RBC alongwith macromolecules like - polysa
- hrides and protein

ex:

Ⓐ Endocytosis: Process by which large molecule enter
cell in the vesicle formed from the plas
memb.

* Steps:- plasma memb. → surrounded the substance →
From vesicles

Subtypes: Ⓐ Phagocytosis Ⓑ Pinocytosis Ⓒ Receptor
mediat
endocytosis

Ⓐ Phagocytosis: Phage = eating = Solid = Process to eat
particles larger than macromolecule like -
whole bacteria and virus.

* Cells which shows phagocytosis are called phagocytes
= Neutrophils
monocytes. They engulf and destroy bacteria other than
foreign substance. = When bacteria or foreign substa
bind to plasma memb. the phagocytic cell extends
projections of ph p.m and cytoplasm called - Pseudopo
around them.

Date
Page
Staller

* The pseudopods then form a Vesicle called - Phago - some, which enter the all and ingested materials is broken down by lysosome.

→ Pinocytosis : Process in which fluids are taken up by cell, it is also called cell drinking - tiny droplets are ingested

* Steps : fluid droplet bind to outer surface of P.M
↓
Area of that P.M folds inwards around the droplet to form a Vesicle called - endosome
↓
Detached from the P.M → enter into interior of all
↓
Within the cell, the lysosome comes in contact with endosome and adhere to it → leads to the rupture of lysosome → release lysin → breakdown of the memb. of endosome = Release of substance into cell

→ Receptor mediated endocytosis : Process in which ligand bind to receptors present on cell membrane and are taken inside the cell
ex: Intake of Vit., hormones like - insulin and LDL

* Binding of ligand to receptor form - ligand - receptor complex

→ Exocytosis : Process by which substance moves out from the cell

* It mainly involve release of secretory substance like hormone, digestive enzyme and NT

* Substance stored in secretory vesicles → come cl
to memb. → fuse → release outside.

⇒ Cell Division : Parent Cell = Daughter cells
* Process by which cell divide into tw
and duplicate its genetic material.

* Types ① Somatic Cell division
② Reproductive cell division.

① Somatic (General body cells) cell division : Cell undergo nuclear cell-divi
called mitosis and a cytoplasmic
division called — Cytokinesis to produce two genetically id
-tical daughter cells.
* Mostly body cells divide by this to replace dead or dama
ce

② Reproductive cell division : Special type of 2 step
division called — meiosis
that occurs only in — gonads = sex cells = Ova in fem
and spermatozoa in males.
* In this process genetic material must not only be du
-licated but also reduced to ½ half in daughter cells
that the female egg and sperm cells carries half of
genetic materials.

→ Stages of Cell division ; Somatic Cell division

i) Interphase
ii) Mitosis
iii) Cytokinesis

Date
Page

1) Interphase: Most longest and dynamic phase of all divisio

— Subtypes: i) 1st growth phase — G1
ii) Synthesis phase — S
iii) 2nd growth phase — G2

i) G1-phase: Primary growth phase of cell in which all dup-
- licate its organelles and cytosolic component

ii) Synthesis phase: Interval b/w G1 & G2. Here DNA Strands
duplicate itself, chromosome resembles a
fine network of dark thread called - chromatin.

* Chromatin become tightly coiled and replicate, therefore
forming identical double chromosome — Sister chromatid
that attached to each other at a central region called
Centromere.

* Replication of Centrosome begin at this phase

iii) G2-Phase: final phase for preparation of cell for cell
division

* Here enzyme and other protein are synthesized and cell
growth continues. Centrosome finish its replica

— Note: Some cell remain in G1-Phase for longer time
they are said to be in G0-Phase. They
never divide again.

Mitosis or Mitotic Phase: Occurs in nucleus and result
in the formation of 2 identical
nuclei

→ Subphases

1) Prophase: Sister chromatid that are attached to one
- then at centromere become visible within

* Each centrosome moves to an opp. pole of the cell, wh
the pericentriolar area of the centrosome start to form
mitotic spindle, a football shaped assembly of microtu
* The lengthing of microtubules b/w the centrosome pushes
centrioles to the end of the cell.
* Now, nuclear memb. break and nucleolus disappear
* As prophase continue, microtubules of mitotic spindle ex
from the pole towards the centromere of centrosome.
* The microtubules coming from 2-poles attached to the
opp. side of the centromere in such a way that each of
the 2-sister chromatid attached to microtubules from
different poles.
* This alignment can ensure the separation of 2-Si
chromatid to the opp. pole of the cell.

2) Metaphase: During this microtubules align the cen
- centromere of the sister chromatid at th
exact centre of mitotic spindle. The mid point region is
called — meta-phase plate or equatorial plane
M for middle = (:)

Date
Page
Staller

3) Anaphase : Shortest stage of the mitosis, during which Centromere split and thus two sister chromatids get separated.

* The divided Centromere each with the sister chromatid moves toward the opp. pole of the cell. The sister Chromatid take on a 'V' shape as they are pull towards their respective pole.

* Once separated the sister chromatid are called - daughter Chromatid A for Ana = 

4) Telophase : The sister chromatid which can called as chromosome reach the opp. poles of the of the cell and begin to uncoil and revert back to thread like chromatin.

* Nuclear memb. form around each mass of chromatin and nucleoli reappear in daughter nuleus.

* The mitotic spindle disappear as the microtubules are broken down as the unit of tubulin → develop cytoskeleton of daughter cell.