

## **BL-101 END SEMESTER ANSWER SHEET**

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SECTION-BA1

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## Section - A

1. Write a note on the mechanism through which neurons communicate to a gland.

Ans-1. Neurons communicate information through chemical synapses and action potential development. To various glands.

Action potential is the electrical signals into which neurons convert stimuli and neurons conduct these action potentials to other neurons, to muscle tissues or to a gland.

And chemical synapses are biological junctions through which neurons' signals can be transmitted to each other, or to muscle tissues or to a gland.

The axon terminal of a neuron and the glandular cells are separated by a space called synaptic cleft.

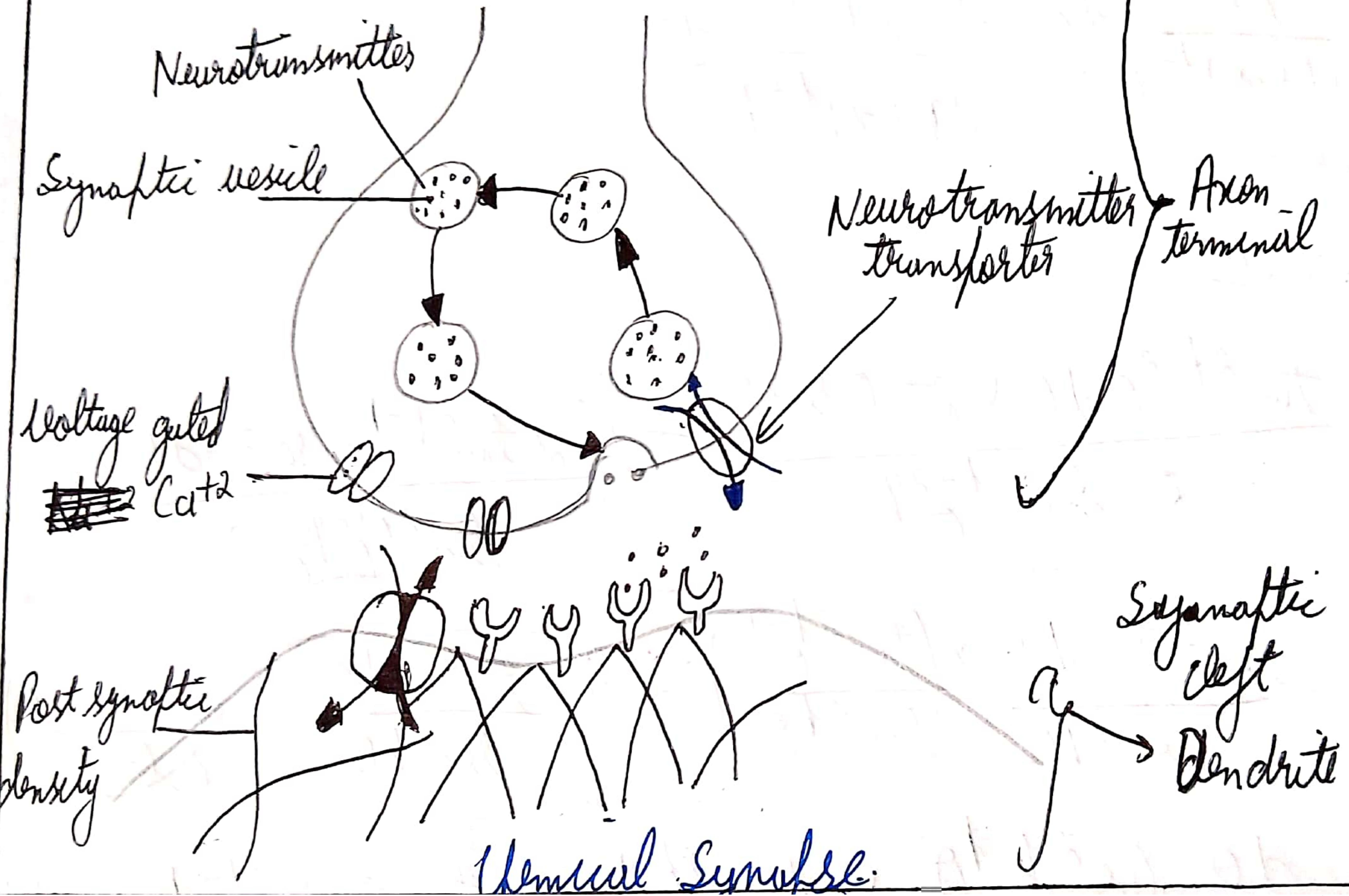
Chemicals called neurotransmitters are used to send signals from neurons to glands; This process is called synaptic transmission.

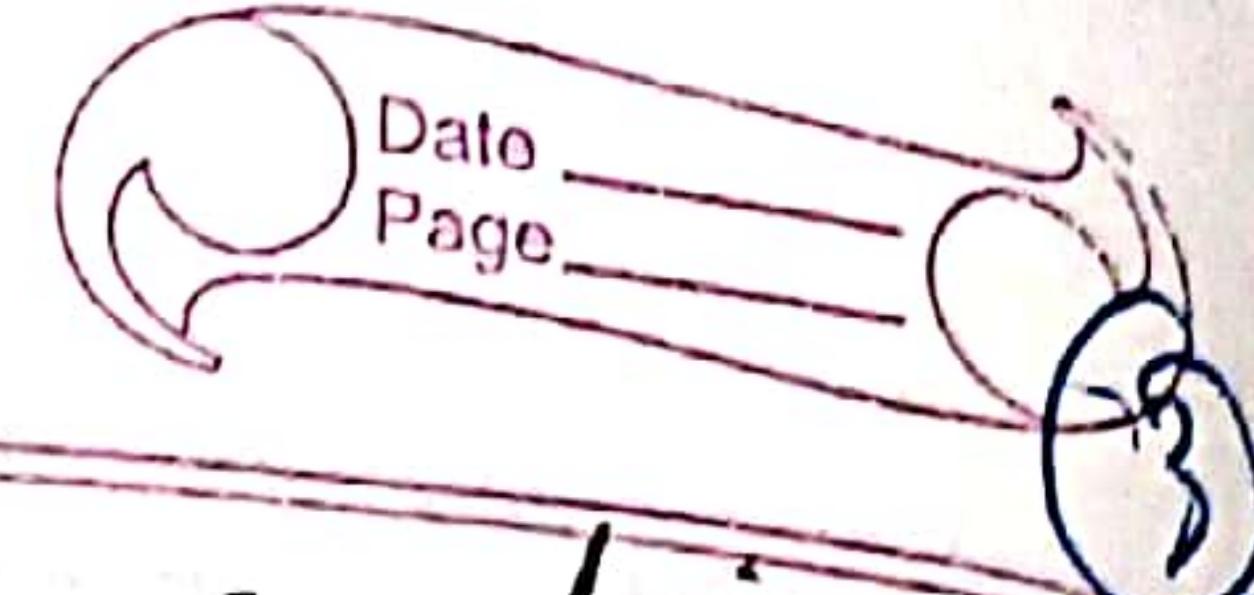
A basic chemical reaction at the synapse undergoes the following steps:-

1. The action potential travels along the membrane of the presynaptic cell first and reaches the synapse. The depolarization of the membrane at the synapse causes the channels to open that are selectively permeable and this

allows the entry of  $\text{Na}^+$  ions.

- 2) These ions flow through the pre-synaptic membrane, rapidly increasing their concentration in the interior.
- 3) The high concentration activates a set of ion sensitive proteins attached to vesicles that contain a neurotransmitter chemical.
- 4) These proteins change shape which causes the membranes of the same "locked" vesicles to fuse with the membrane of the presynaptic cell. This opens the vesicles, which releases the neurotransmitter contents into the synaptic cleft.
- 5) The neurotransmitter diffuses with the cleft and binds with the chemical receptor molecules located on the post-synaptic cell and pass on the signal.
- 6) After its recognition by the receptor, the neurotransmitter is either reabsorbed by the presynaptic cell and repackaged for ~~the~~ further release or else it is broken down metabolically to avoid constant stimulation of post-synaptic cells.





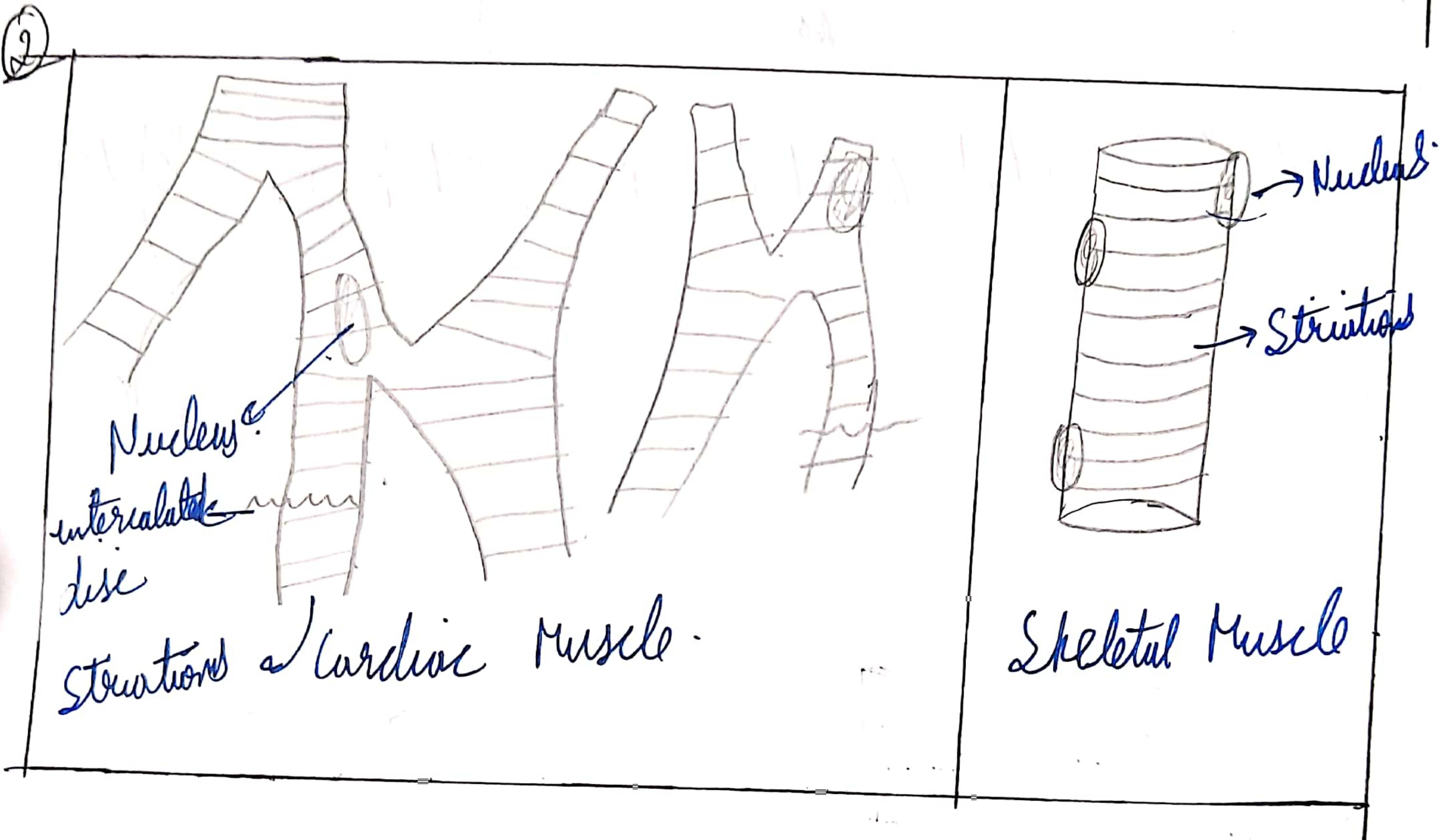
Q3  
2. b) Write a differential statement between cardiac muscle tissue and skeletal muscle tissue.

### Ans Cardiac Muscle Tissue

1. b) These tissues are found only in heart.
2. b) The cells of these tissues are shorter in length.
- 3.) The cells are spindle shaped.
- 4.) These muscles can't be made to contract / relax by conscious control, so they are involuntary in nature.
- 5.) The cardiac muscle fibres are branched and usually have only one centrally located nucleus.
- 6.) The main function of these tissues is the pumping of blood and ~~constitutes~~ constitutes the wall of the heart.

### Skeletal Muscle Tissue

1. b) These are found attached to the bones of the body.
- 2.) The cells of these tissues are comparatively longer in length.
- 3.) The cells are cylindrical in shape.
- 4.) These muscles can be made to contract / relax by conscious control, so are voluntary in nature.
- 5.) The skeletal muscle tissue is roughly cylindrical in shape and has multiple nuclei which are generally located at the periphery.
- 6.) These tissues helps in the movement of the body and are attached to bones by bundles of collagen fibres known as tendon.



Ques 3.4. What is melanoma? Discuss the importance of translational photoacoustic microscopy in the diagnosis of melanoma.

Ans) Melanoma is a type of skin cancer. It is the most serious type of skin cancer because it often has a tendency to spread. It develops when melanocytes (that produce melanin, which gives the skin its colour) begin to divide in an ~~uncontrolled~~ uncontrollable manner.

Melanoma can develop anywhere on the skin, but most common sites of start is on the trunk (chest and back) for men and on legs for women. The face and neck are other common sites. Melanoma can also happen in the eyes and also rarely inside the body, such as in the throat.

Cause - The exposure to Ultra violet radiation increases the risk of melanoma and is the most important or contributing factor in the development of melanoma.

Melanoma spread very rapidly hence for efficiently curing it, it should be identified at the early stages.

### Translational Photoacoustic Microscopy.

a) It is an imaging modality which allows high resolution, sufficient imaging depth and is free from ionising radiation.

b) It can be used to detect melanoma and can also be used to determine the depth of the tumor. This handheld device and the deep melanoma imaging ability, this

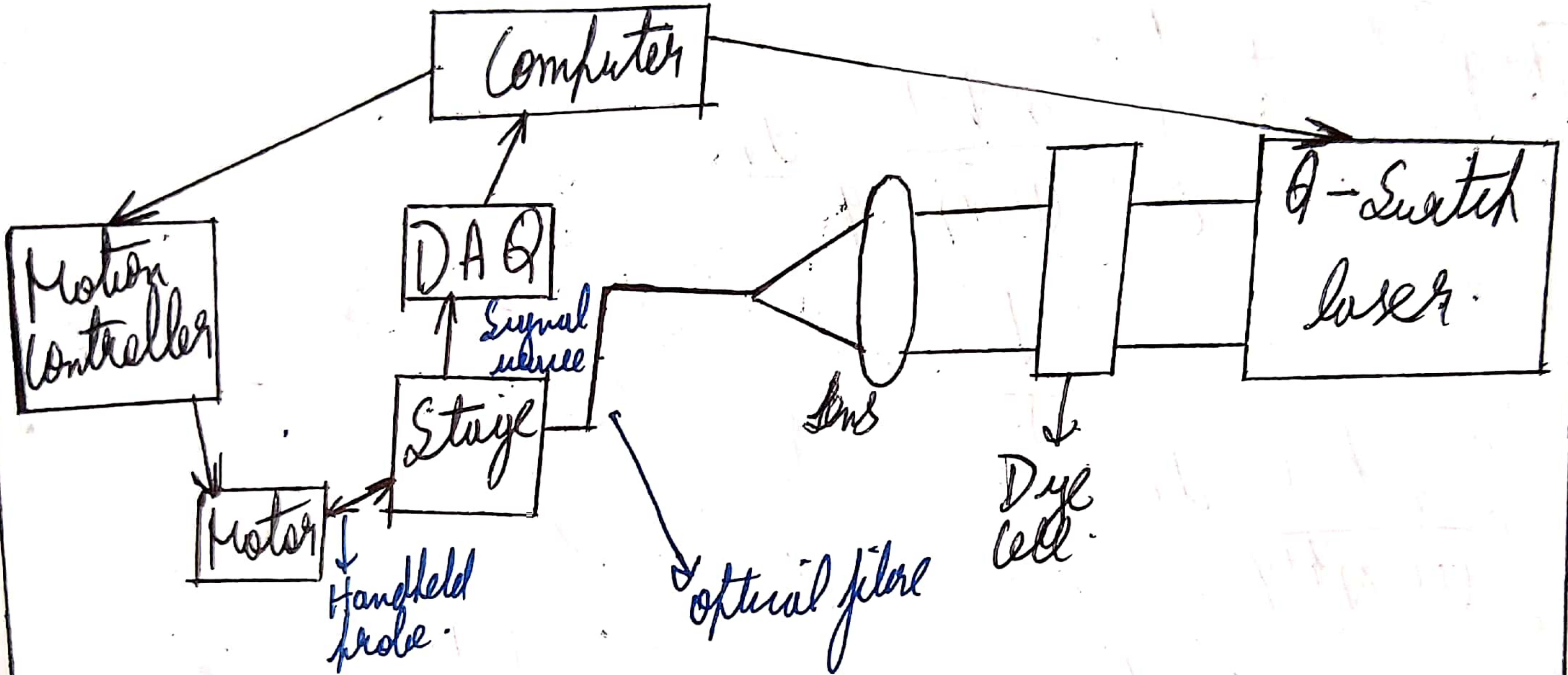
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(5)

System is used for melanoma diagnosis, prognosis and surgical planning effectively.

In this technique, a short laser pulse illuminates the object, after the absorption of photons, ultrasonic waves are induced thermoelastically through the photo acoustic effect. As melanin has a very broad and strong absorption spectrum, it can be imaged with high contrast. Also as acoustic scattering is low in the tissue, high resolution is achieved with deep penetration.

### Advantages:

1. This device can identify melanoma at a very early stage hence increases the chances of efficient cure.
2. Because of the handheld compact design, it is really easy to be available at clinics and because it is ~~easy~~ ~~to use~~ not much training is required.
3. It is an check the thickness of thicker melanomas so it aids the surgical treatment also.



Q.6 What is osteoarthritis? Discuss the importance of focused cold therapy in the management of osteoarthritis.

Ans Osteoarthritis is the most common form of arthritis. It occurs when the protective cartilage that covers the end of the bones gets worn out with time.

### Symptoms

The symptoms of Osteoarthritis includes

- pain
- stiffness
- loss of flexibility
- swelling

### Risk factors

- Old age
- Obesity
- Injury
- Genetics

### Focused Cold Therapy

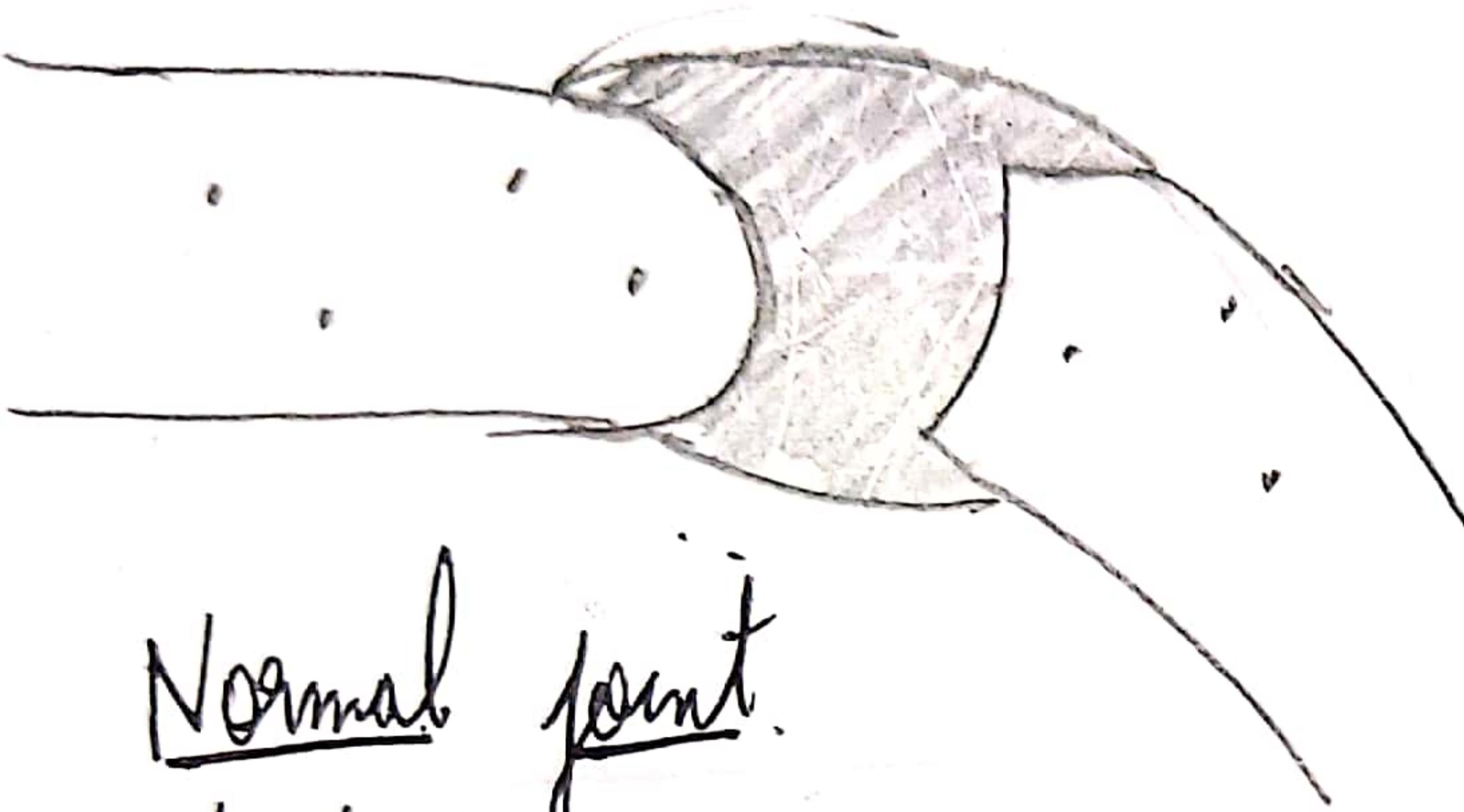
i) Focused cold Therapy provides immediate relief from pain to patients without any medication. It involves the freezing of the affected nerve, causing an interruption of pain impulses to the brain. It precisely targets the affected part for long lasting relief.

ii) This technique involves the injection of a local anaesthetic to numb the skin using a small needle. Then a small incision is made on the skin and a small probe is inserted. Then a machine is connected to the probe which

forms a small ball of ice is formed around the tip of the spike. This results in the freezing of the nerve and hence causes an interruption of the pain impulses.

3) Once the nerve are frozen, Wallerian Degeneration of the frozen Schwann cells takes place which degenerates the axon and myelin sheath but not the endoneurium, thus blocking the conduction of signals.

4) Unaffected Schwann cells then activate macrophages which engulf and digest the debris of degenerated cells. After that, Schwann cells generate a growth cone which generates new Schwann cells and axon and completes the conduction channel.



Normal joint  
of finger



Orthoarthritis  
affected fingers

Inflammation  
at joint

Q8 Explain Apoplastic and Symplastic movement in plants.

Ans) There are two ways through soil which water absorbed by root hairs is moved deeper into root layers:-

1. Apoplast pathway      2. Symplast pathway.

### 1. Apoplastic Movement

a) Apoplast is system of adjacent cell walls that is continuous throughout plant, except at caspary strips of endodermis.

b) Apoplastic movement occurs exclusively through intercellular spaces and walls of the cells.

c) Movement through apoplast does not involve crossing the cell membrane.

d) It does not provide any barrier to water movement. Movement is dependent on gradient and occurs via mass flow.

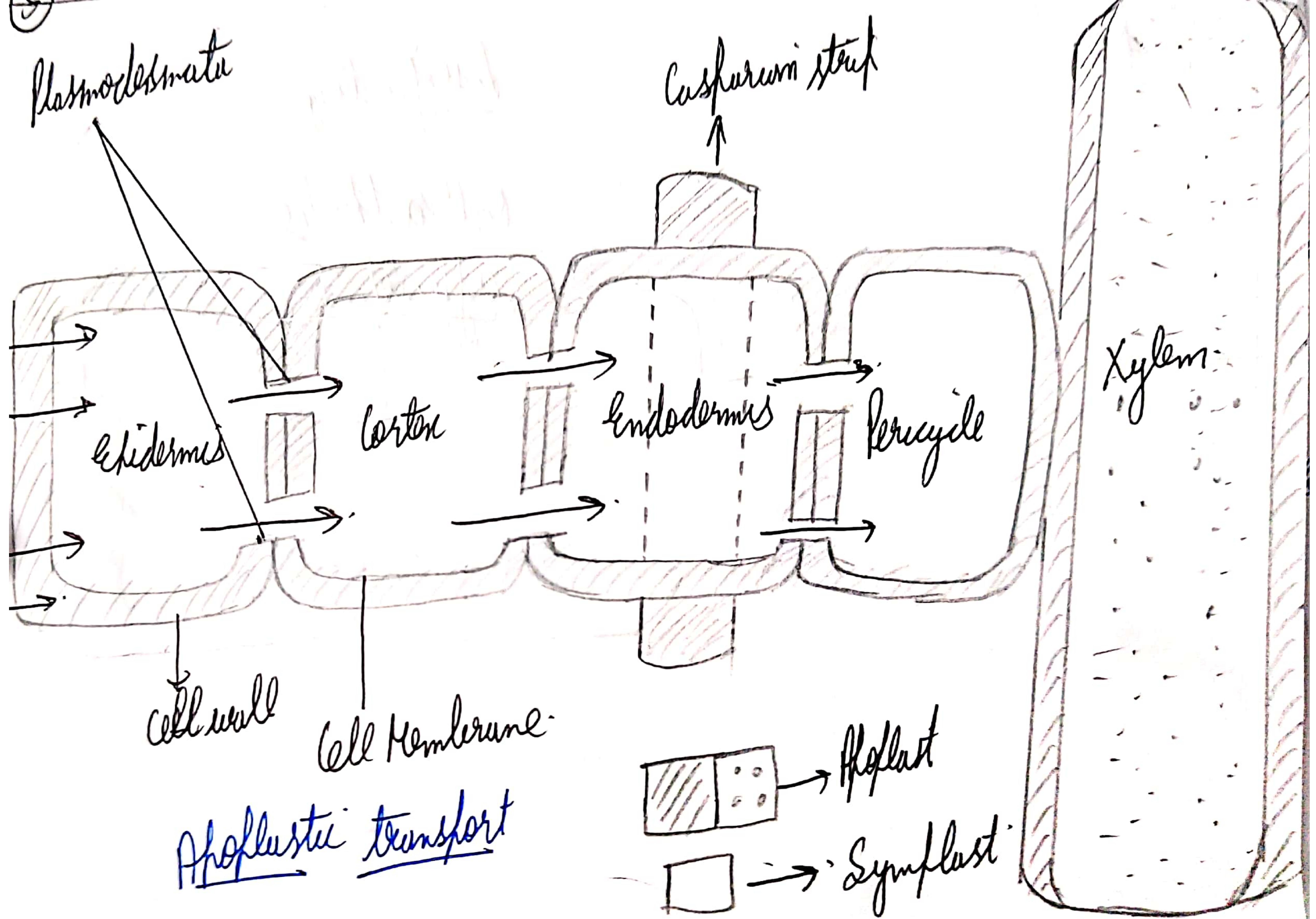
e) As water evaporates into intercellular spaces, tension develops in continuous stream of water in apoplast, hence, mass flow of water occurs due to adhesive and cohesive property.

f) Most of the water flow in roots occurs via

aphloitt bury the cortical cells are loosely packed and hence offer no resistance to water movement.

## ② Symplastic Movement

- a) Symplast is system of interconnected protoplasts
- b) During symplastic movement, water travels through the cells - their cytoplasm; intercellular movement is through plasmodesmata.
- c) Water has to enter the cells through cell membranes, hence movement is relatively slower.
- d) Movement is again down a potential gradient.
- e) However the inner boundary of the cortex, the endodermis, is impervious to water because of a band of suberinized matrix called the Caspary strip. Water molecules are unable to penetrate the layer so water moves, through the symplast and crosses a membrane to reach the cells of the system.
- f) Once inside nylem, water is again free to move between the cells as well as through them.

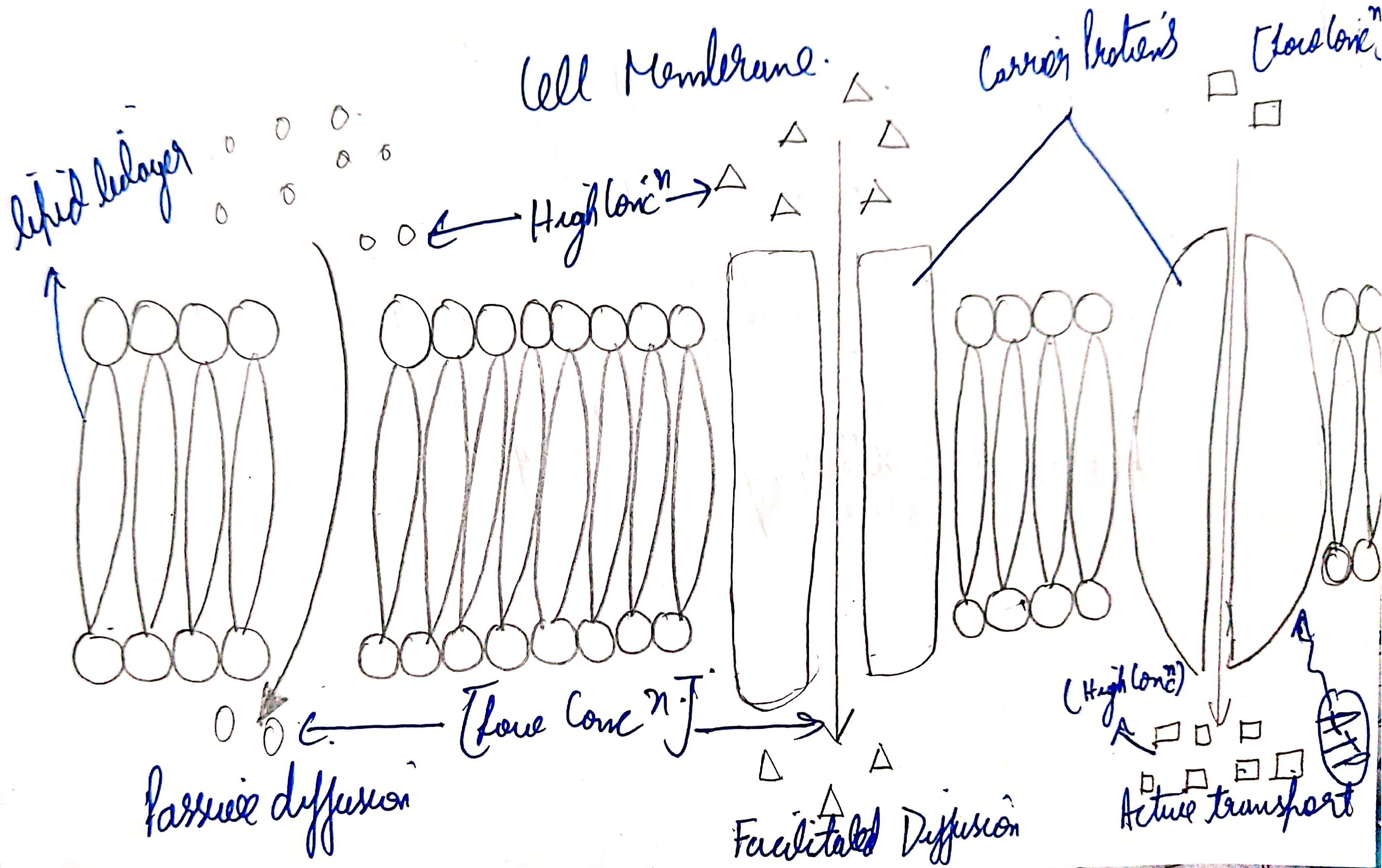


2. Y Major difference in passive diffusion, facilitated diffusion, and active transport in that former also make figures for the above - mentioned transport system.

<u>Passive Diffusion</u>	<u>Facilitated Diffusion</u>	<u>Active Transport</u>
1. Y No energy expenditure	1. Y No expenditures of ATP energy	1. Y Energy required in form of ATP.
2. Y Occurs from higher to lower concentration	2. Y Higher to lower concentration	2. Y Lower to higher concentration (uphill)
3. Y slow process	3. Y faster than passive diffusion	3. Y fastest of all
4. Y no special proteins involved	4. Y membrane proteins provide sites for movement	4. Y carried by specific membrane proteins.
5. Y Transport never saturates.	5. Y Transport saturates when all protein transporters are being used.	5. Y Transport saturates when all carriers are being used.
6. Y Not specific	6. Y Highly specific in nature.	6. Y Highly specific in nature.
7. Y Driving force is concentration gradient	7. Y Driving force is concentration gradient	7. Y Driving force is ATP hydrolysis.
8. Y Tries to maintain equilibrium.	8. Y Tries to maintain equilibrium.	8. Y Disrupts equilibrium.
9. Y Eg:- Osmosis in plants	9. Y Glucose and amino acid transport	9. Y Eg:- Uptake of mineral ions into root hair cells.

7.

## Active, Passive and Facilitated



Q. Explain the effect of hypertonic, hypotonic and isotonic solutions on the shape of cells.

A: Hypotonic, hypertonic and isotonic solution affect both plant cells and animal cells similarly.

### ① Isotonic Solution

If the pressure of the internal solution balances the osmotic pressure of cytoplasm, it is said to be isotonic. In this case, very small movements occur in both directions but net movement is zero.

### ② Hypertonic Solution

If ~~internal solution~~ is:

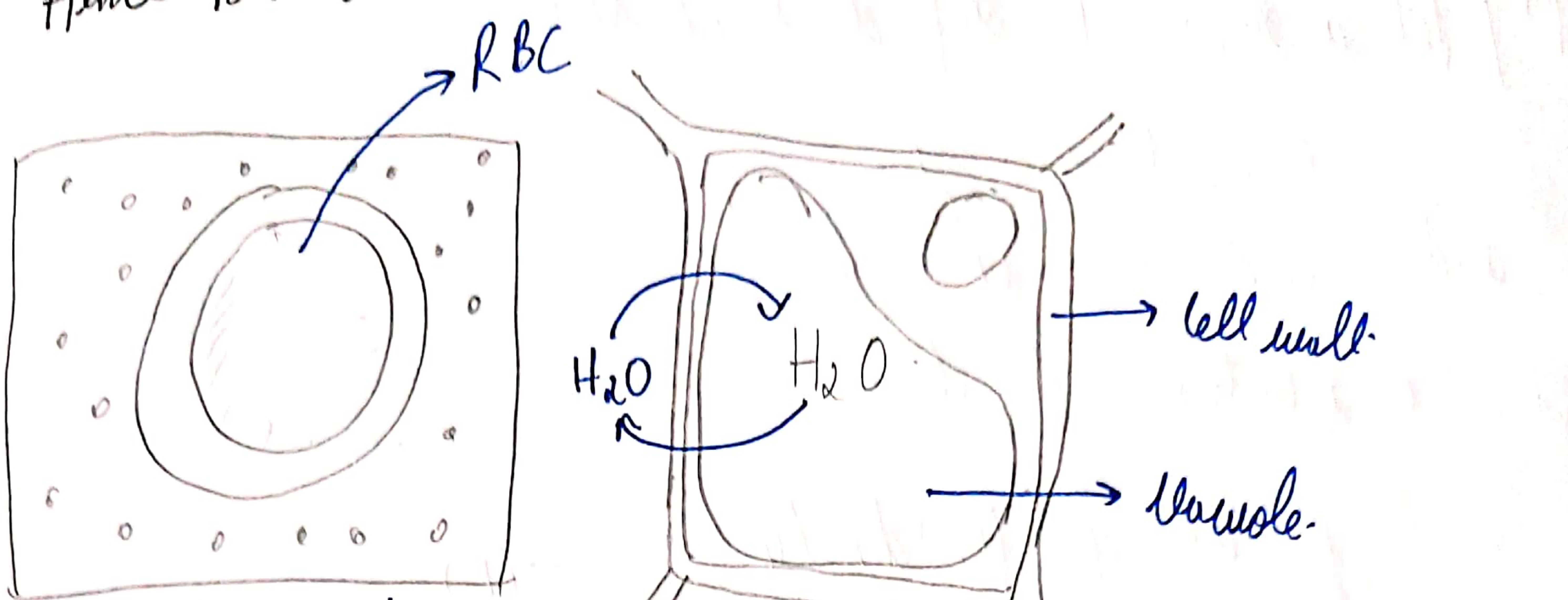
If the external solution is more concentrated, it is said to be hypertonic. There is a net movement of water out from the cell. So the cell shrinks.

This happens because of the pressure difference.

### ③ Hypotonic Solution

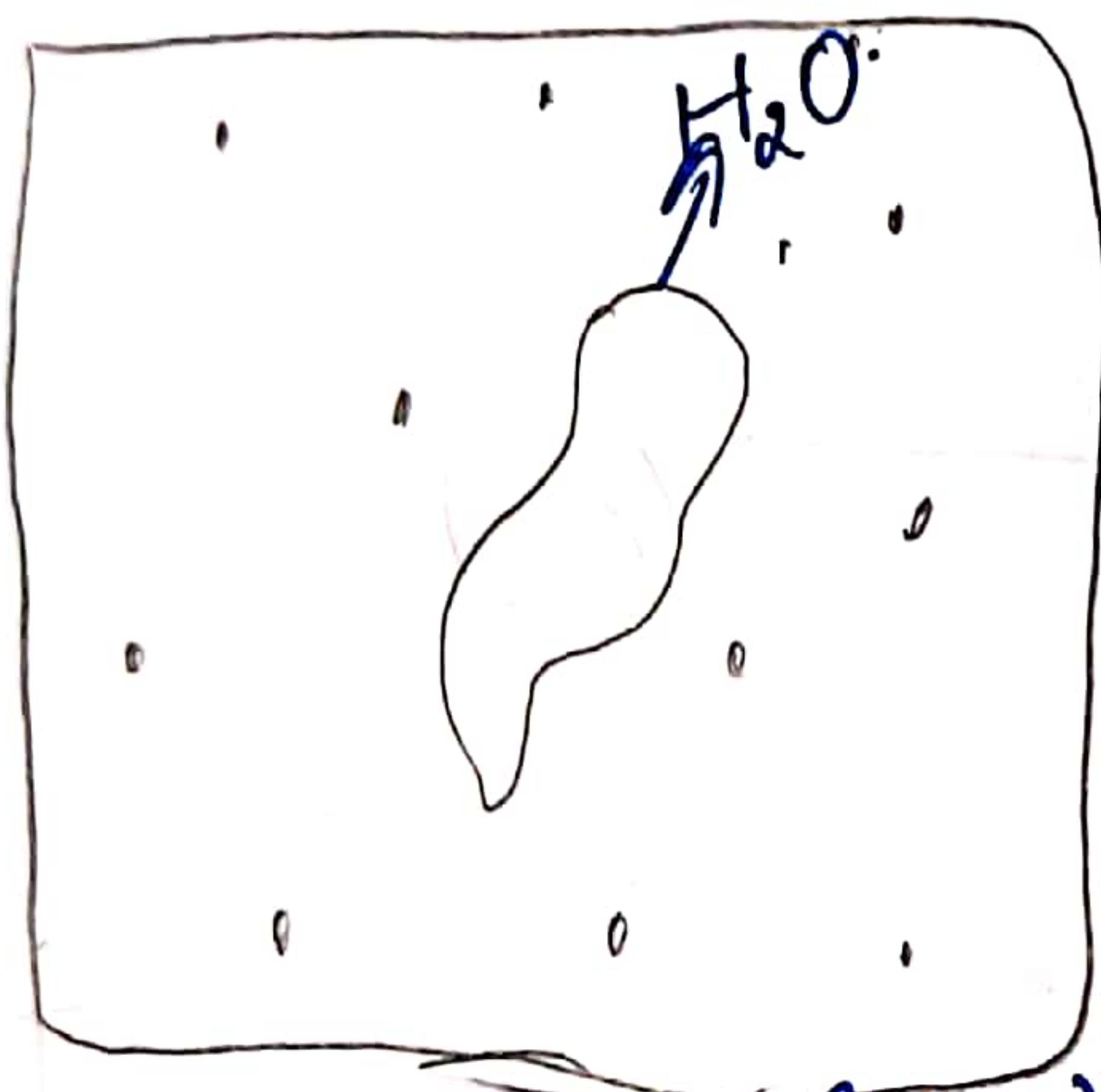
If external solution is more dilute, it is said to be hypotonic. There is a net movement of water into the cell.

So, cell gets swollen.

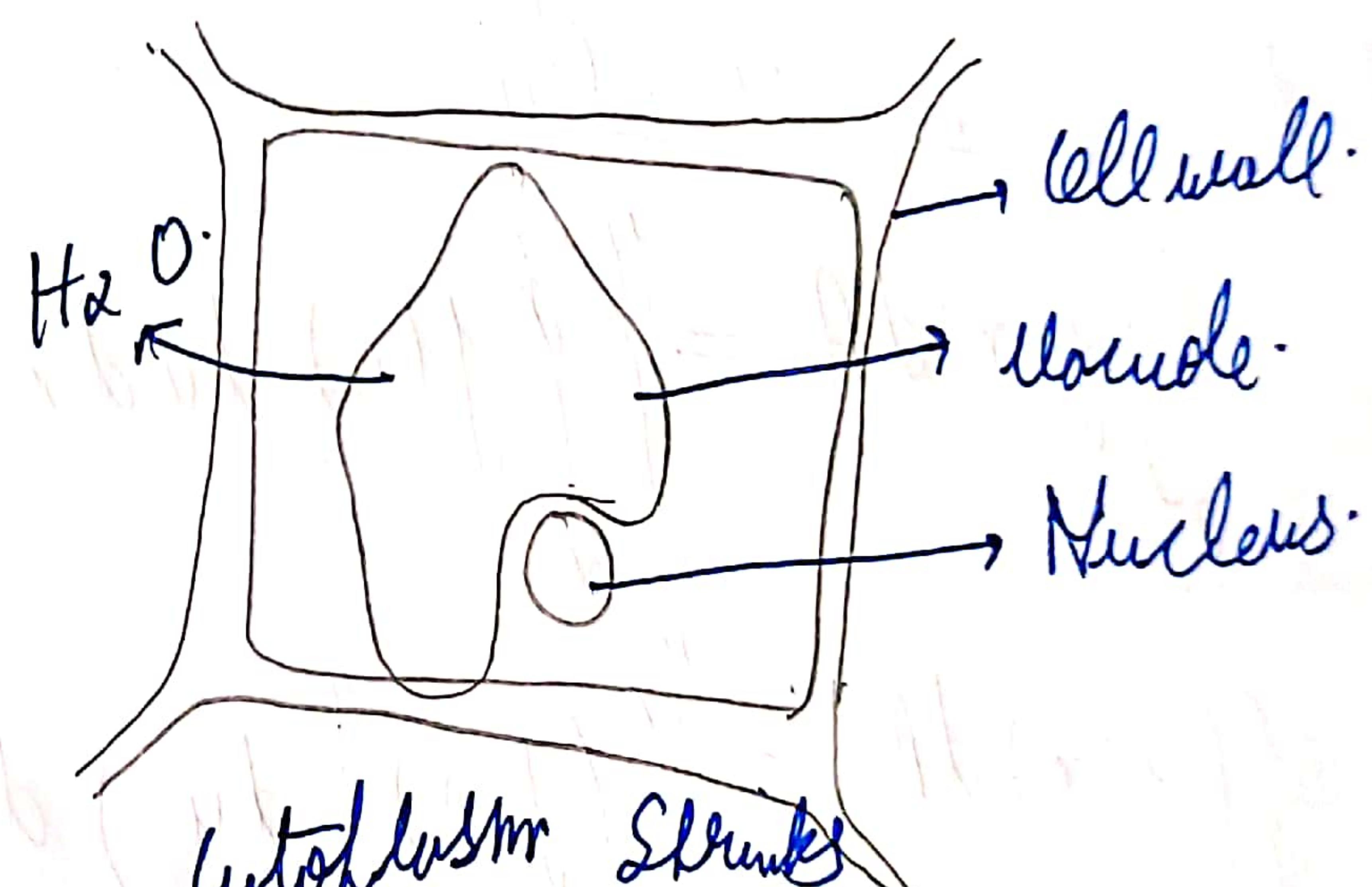


No effect on shape of  
RBC  
(Isotonic).

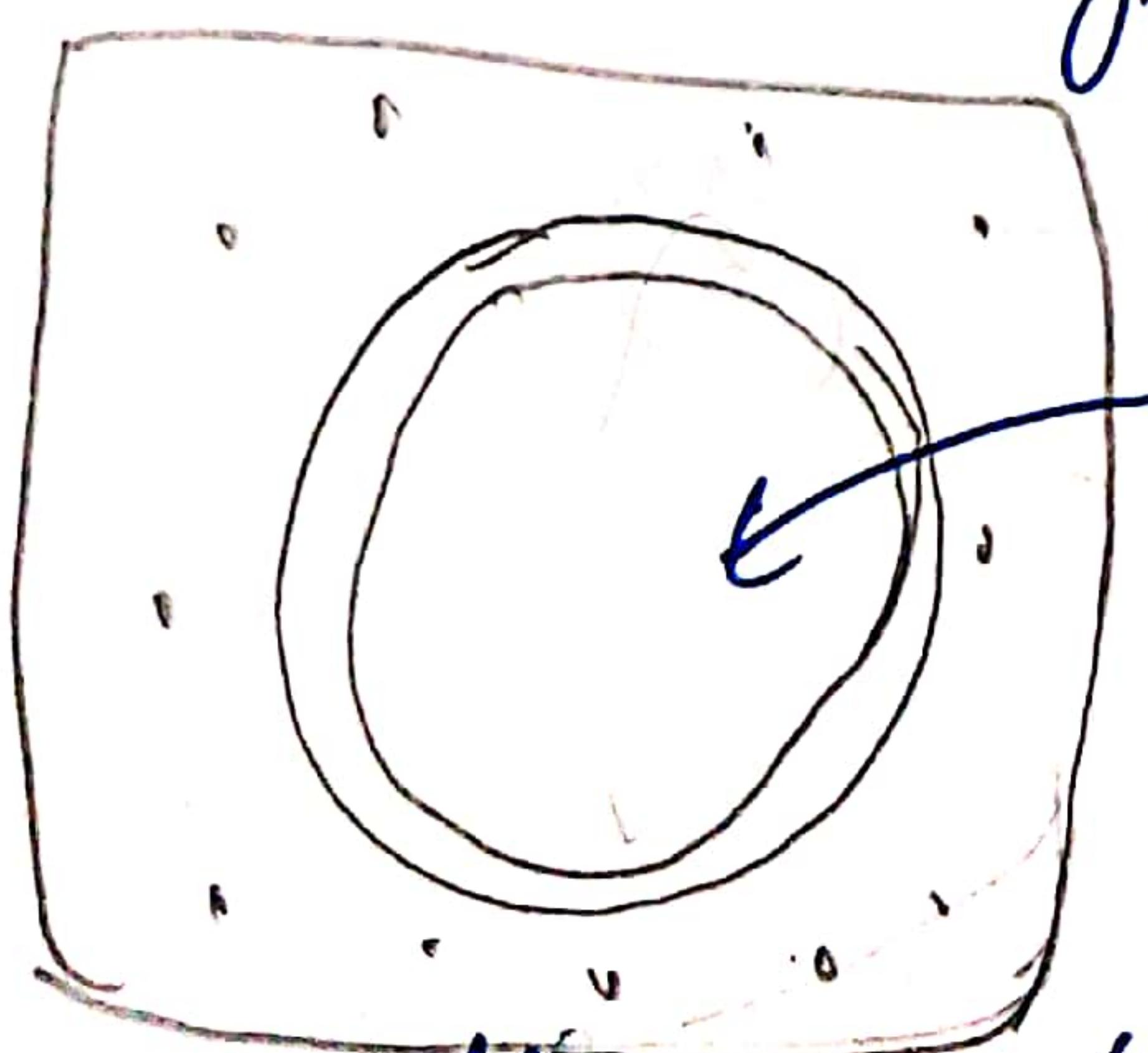
Normal plant cell.



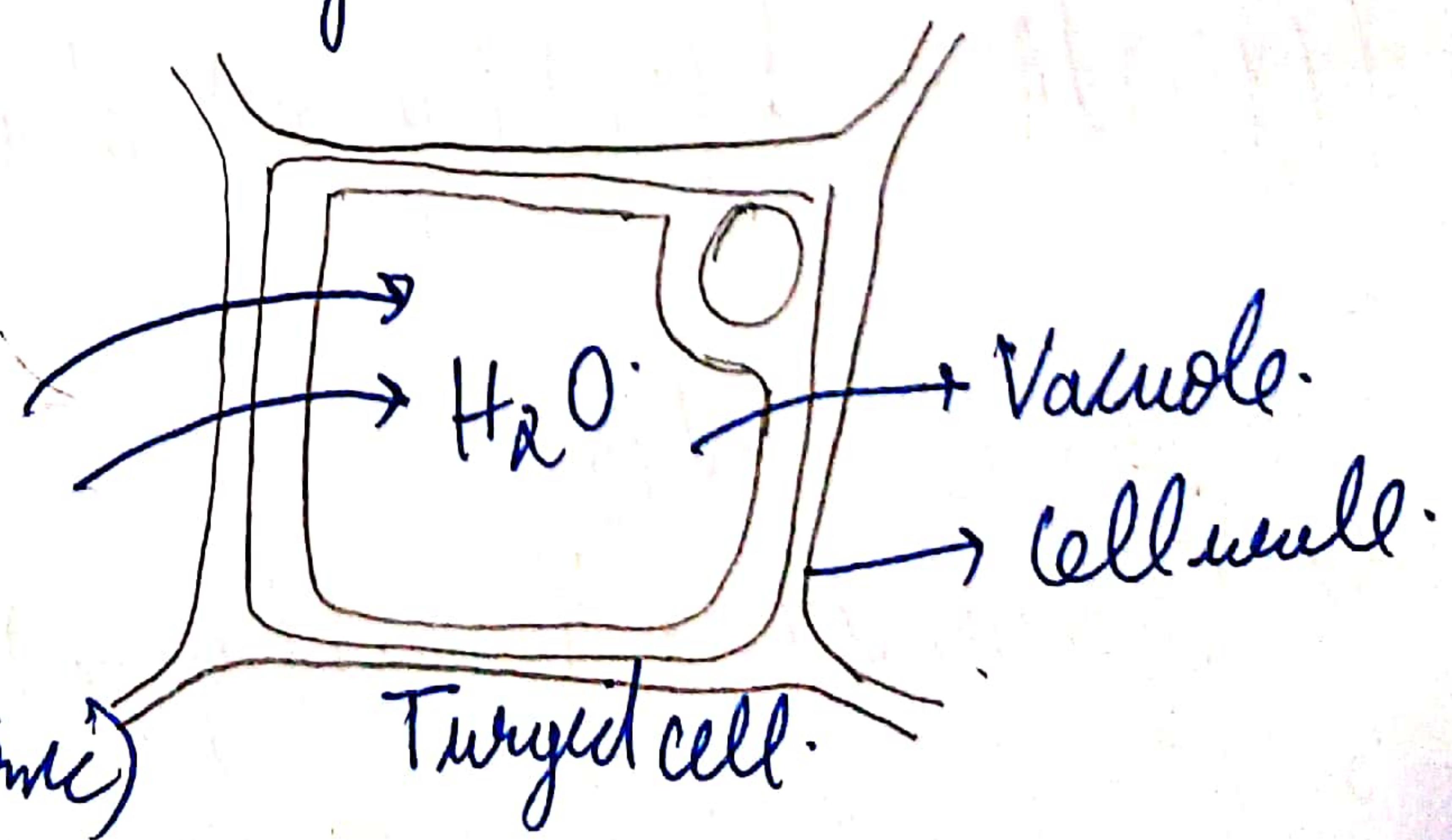
(Shrunk RBC)



Cytoplasm shrunk  
from cell wall.



Swollen RBC (Hypotonic)



Turgid cell.

Q.4 What is golgi apparatus. Explain its functions

Ans. Golgi apparatus is a cell organelle present in most of the cells of the eukaryotic organism. It is a densely stained peculiar structure near the nucleus.

- The structure contains flat, disc shaped sacs or cisternae of  $0.5 \mu\text{m}$  to  $1.0 \mu\text{m}$  diameter. They are stacked parallel to each other.
- The golgi cisternae are concentrically arranged near the nucleus with distinct convex, cis or the forming face and concave trans or the maturing face.
- It is also called manufacturing and shipping centre of the cell.

### Functions

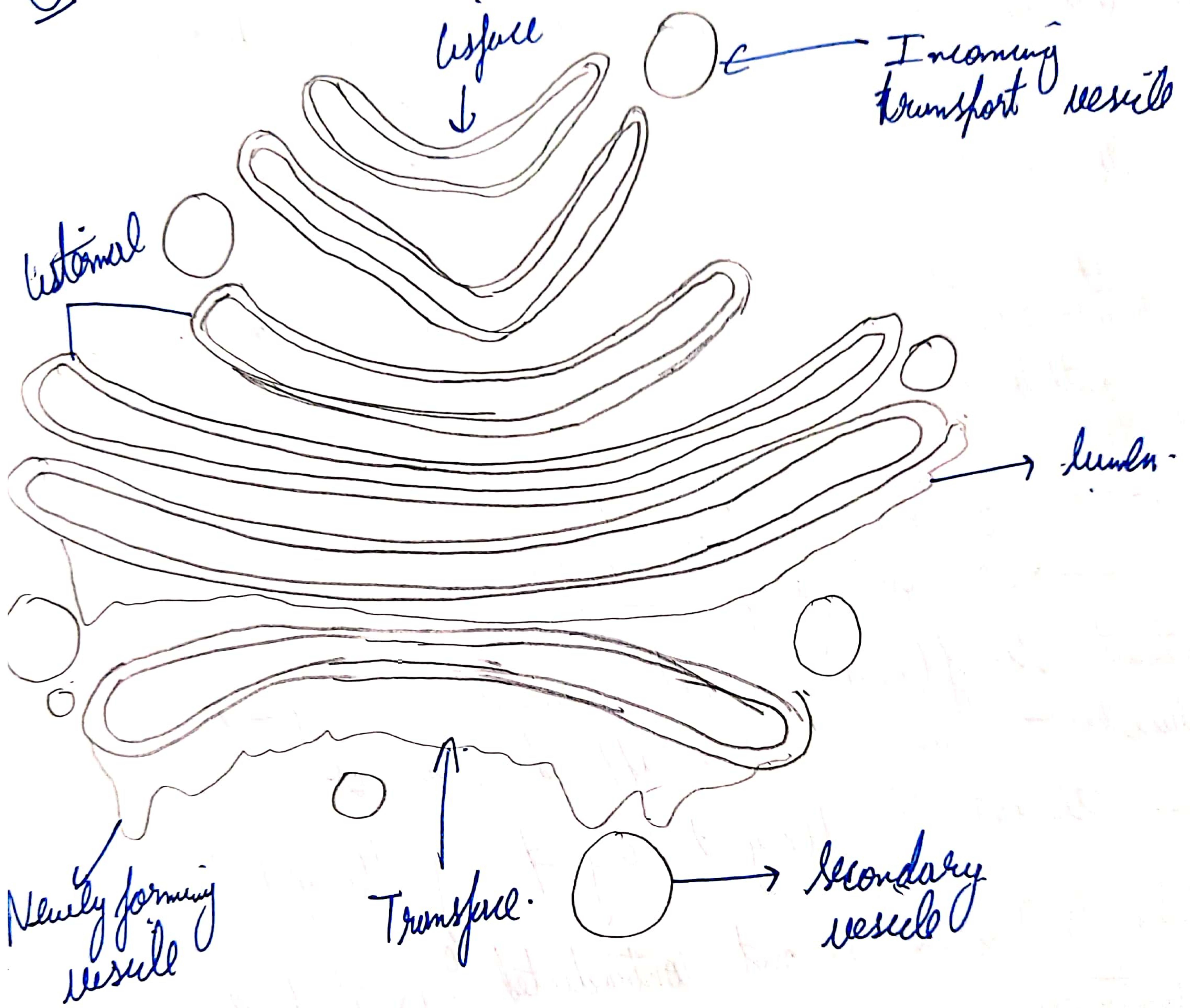
- ① Packaging materials → It packages material to be delivered either to the intra-cellular targets or secreted outside the cell.
- ② Modification of proteins → A number of proteins synthesized by ribosomes on the endoplasmic reticulum are modified in the cisternae of the golgi apparatus before they are released from its trans face.

③ Formation of glycoproteins and glycolipids — Golgi apparatus

is the important site of formation of glycoproteins and glycolipids

④ Maturation of vesicles — Vesicles fuse with cis face

of golgi apparatus and move towards maturing face.



## Section - C.

- 1) Explain in detail the processing and packaging of proteins by Golgi complex.


Processing and packaging of proteins by Golgi complex  
is completed through the following steps:

- The protein synthesized by ribosomes on the rough Endoplasmic Reticulum forms transport vesicle.
- The transport vesicle moves towards the entry face of the Golgi Apparatus complex.
- Then fusion of several transport vesicles creates the exit lumen.
- The proteins then move from the entry face to one or more medial cisternae, and the enzymes there modify the protein to form glycoproteins, glycolipids and lipoproteins. The transfer vesicle that buds from the edges of the cisternal space move some specific enzymes back toward the entry face and move some partially modified proteins toward the exit face.
- The products of the medial cisternae move into the lumen of the exit face.
- Within the exit face cisternae, the products are sorted and packaged.

g.) Some of the processed proteins leave the exit face and are sorted in secretory vesicles -

i.) Other processed proteins leave the exit face in membrane vesicles that deliver their contents to the plasma membrane for incorporation into the membrane. In doing so, the Golgi complex adds new segments of plasma membrane. as existing segments are lost and modifies the number and distribution of membrane molecules.

ii.) Finally some processed proteins leave the exit face in transport vesicles that will carry the proteins to another cellular destination.



## 2. Differentiate mitosis and meiosis in detail.

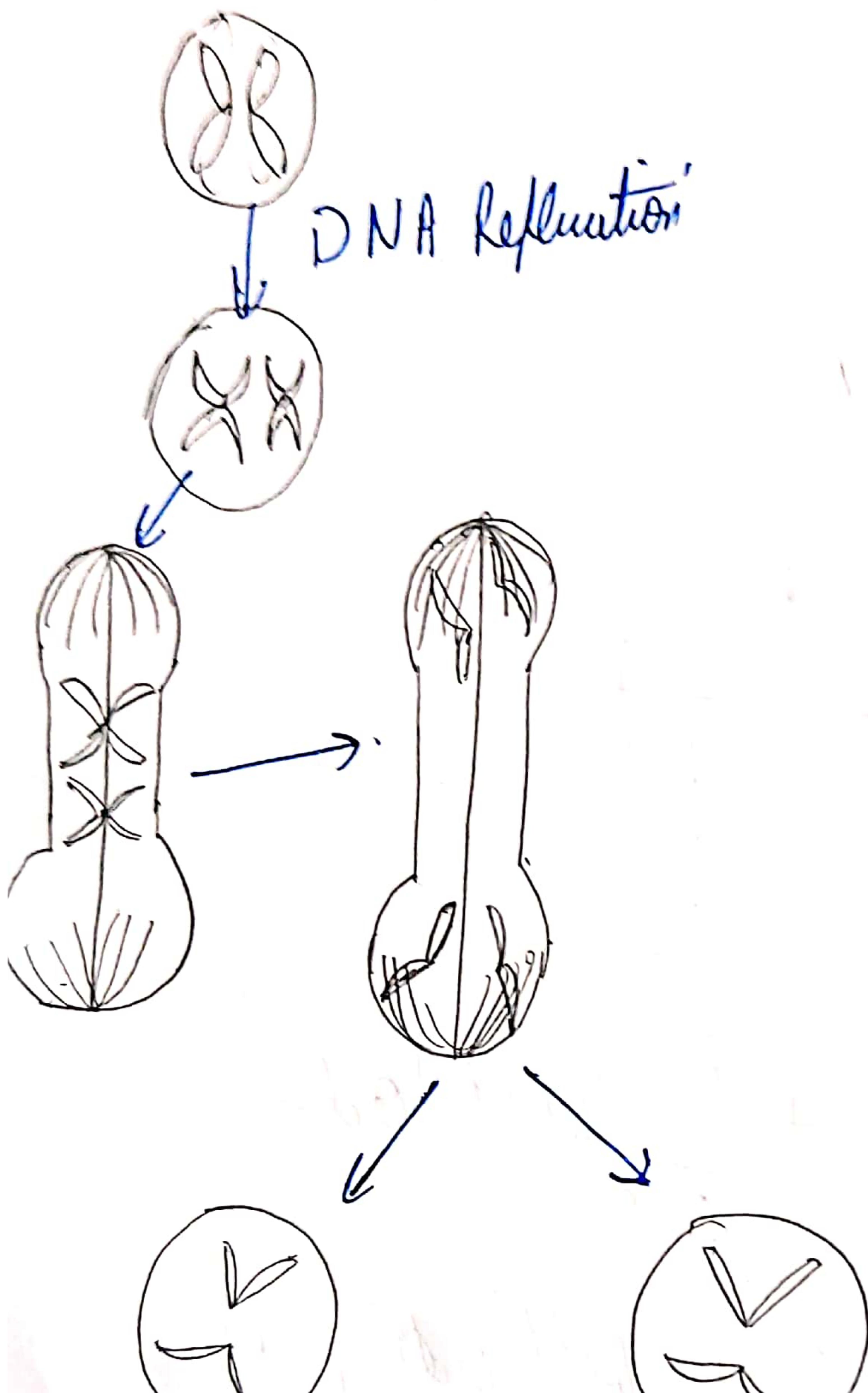
Mitosis and meiosis both are the ways by which cell divides and reproduces. Below are the differences between the two ways:-

### Mitosis

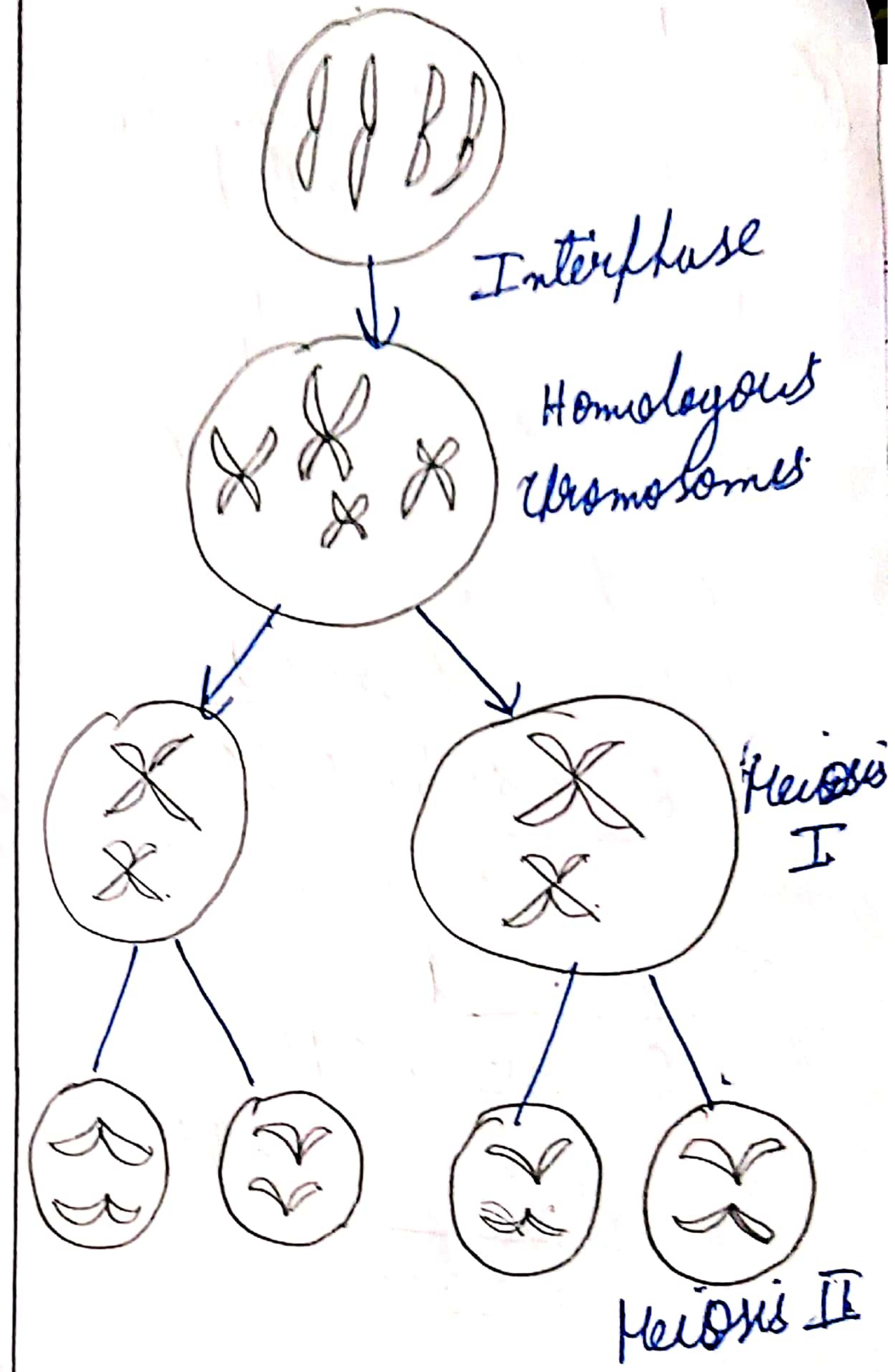
1. Mitosis is the process of cell division or reproduction, during which one cell gives rise to two genetically identical daughter cells.
2. This requires only one cell division if cell is divided only one time.
3. It produces two daughter cells.

### Meiosis

1. Meiosis is a special type of cell division of germ cells in sexually-reproducing organisms like sperm or egg cells.
2. This requires two successive cell divisions if cells are divided two successive times.
3. It produces four daughter cells.
4. Daughter cells are genetically different and the number of chromosomes are half the parent cell.
5. It occurs only in animals, plants and fungi.
6. It creates germ / sex cell



Mitosis



Meiosis

3) Define the following theories of aging.

### 1) Cellular Senescence Theory

Aging is a progressive physiological change in an organism that leads to a decline of biological functions and of the organism's ability to adapt to metabolic stress, and also an increased risk of debility, disease and death.

Cellular senescence is a stable cell cycle arrest in which proliferating cells become resistant to growth-promoting stimuli, mostly in response to DNA damage.

In this theory the length of the telomere end of the DNA chain shortens with

In this theory the length of the telomere and the telomere activity are taken as indicators of human aging: A telomere is a region of highly repetitive DNA at the end of a chromosome that functions as a disposable buffer.

The length of the telomere end of the DNA chain shortens with each division and less telomerase activity is observed. If telomerase hyperactivity is linked to cellular transformation and cancer, each cell already gets divided a maximum number of divisions before it enters senescence.

## b) Oxidative Stress Theory

This theory states that, Oxidative metabolism produces reactive Oxygen species which damage protein, lipids and DNA and age-associated functional losses are due to the accumulation of RONS - induced damages. Oxidative stress occurs due to the imbalance between RONS (Reactive oxygen and nitrogen species) production and the antioxidant defenses (which neutralize the negative effects of RONS).

Some support statements about this theory are:-

- 1) Mutations in Oxidative stress pathway can extend life span.
- 2) Mutations in other pathways that increase longevity resist oxidative damage.

Some opposing statements about this theory are:-

- 1) Antioxidants don't delay human senescence or disease

## c) Apoptosis Theory

Apoptosis occurs normally during development and aging and as a homeostatic mechanism to maintain cell population in tissues. The cell death occurs due to a series of molecular steps that occur. This is one of the methods that our body uses to get rid of abnormal cells. Apoptosis is also known as 'programmed' cell death. Apoptosis can be initiated by two paths.

(1) intrinsic and 2) extrinsic. In the intrinsic pathway the cell kills itself because it senses all stress, while in the extrinsic pathway the cell kills itself because of signals from other cells.