AQA GCSE Paper 1 : Complete Revision Summary

4.1 Cell Biology

- Cell Biology
- Organisation
- Infection and Response
- Bioenergetics

- Eukaryotic and Prokaryotic Cell
- Animal Cell and Plant Cell
- Specialised Plant Cells
- Specialised Animal Cells
- Microscopy
- Culturing Microorganisms
- Cell Division: Mitosis
- Stem Cells
- Diffusion
- Osmosis
- Active Transport

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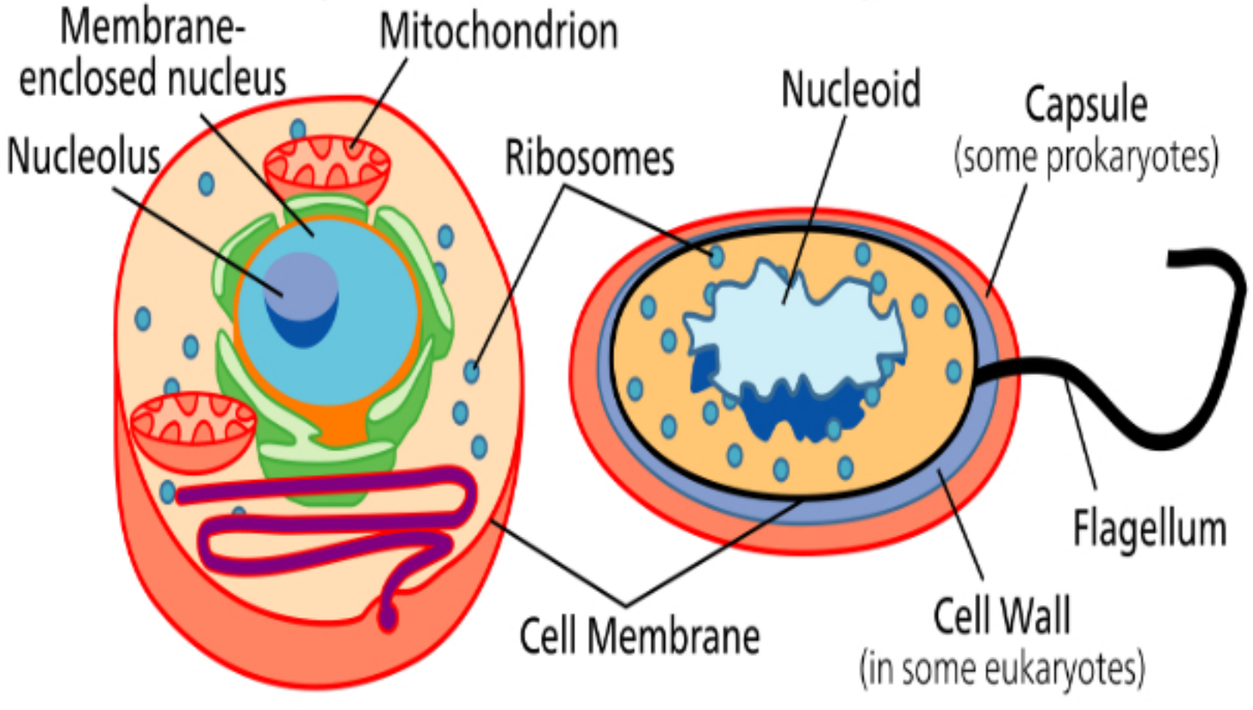
EUKARYOTIC and PROKARYOTIC CELLS

Bacteria

Eukaryote

Prokaryote

Plants and Animals



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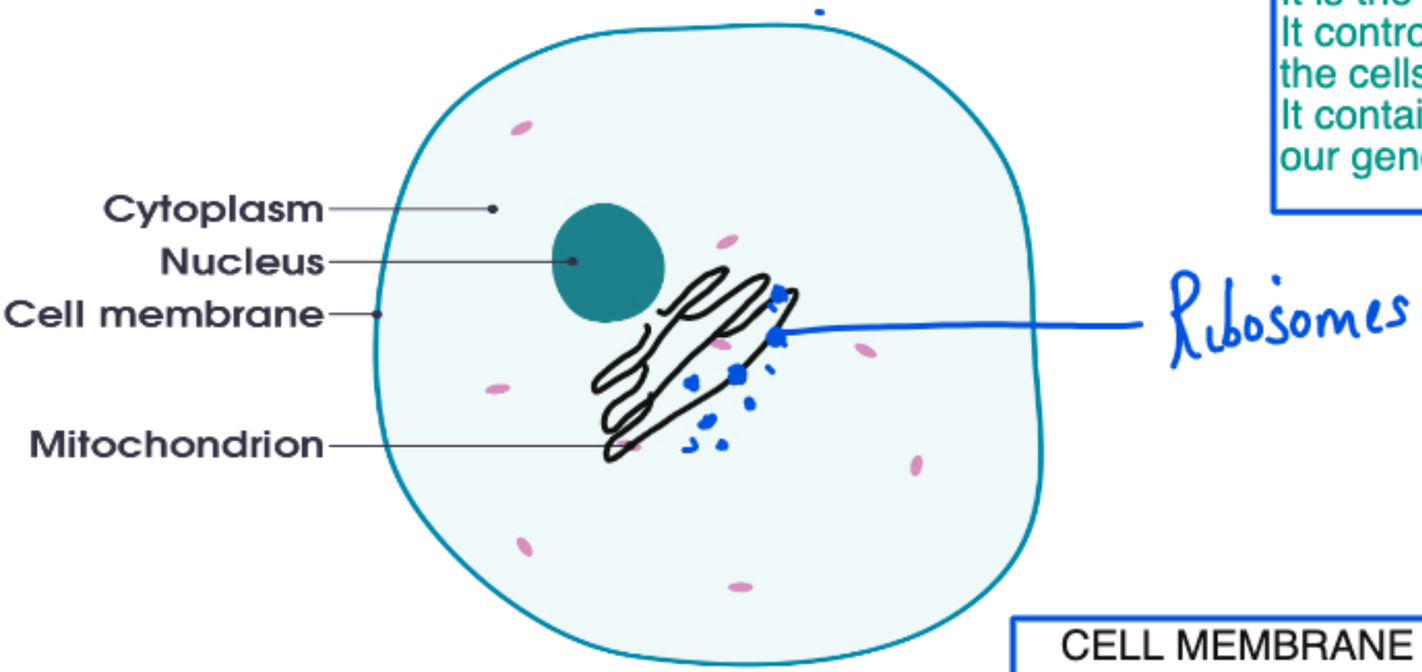
EUKARYOTIC	PROKARYOTIC
Nucleus is present.	Nucleus is absent.
All membrane bound organelles are present	Membrane bound organelles are absent.
DNA is enclosed in the nucleus	DNA lies naked in the cytoplasm.
They are multicellular	They are mostly unicellular
DNA is linear	DNA Is circular
Ribosomes are big	Ribosomes are small
They are big cells	They are small cells.
Example: Plants and Animals	Example: Bacterial Cell

ANIMAL CELLS



NUCLEUS

It is the brain of the cell
It controls the activities of the cells
It contains DNA which holds our genetic information.

RIBOSOMES

It is the site for protein synthesis.
They are involved in making of proteins and enzymes required by the cell

CYTOPLASM

Jelly like fluid which fills the cell.
It is the site where all the chemical reactions of the cells take place as it contains all the major enzymes

CELL MEMBRANE

It the membrane that surrounds the cells
It controls what goes in and out of the cell.

MITOCHONDRIA

It is the powerhouse of the cell
It produced energy for the cell as it is the site for aerobic respiration

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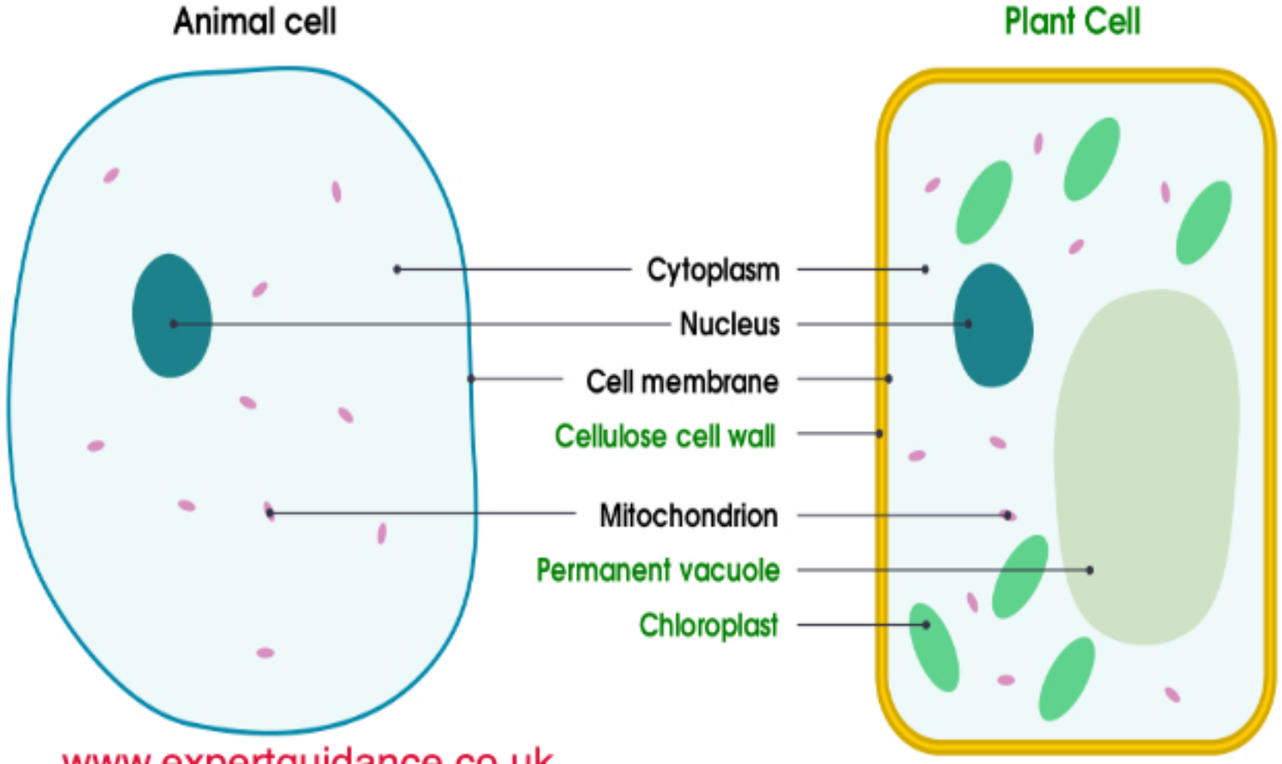
PLANT CELL



PERMANENT VACUOLE

It is filled with cell sap.

It gives rigidity to the cells and makes the cell turgid

CELL WALL

Made up of cellulose.

It is the layer outside of the cell membrane

It supports the plant and maintain its shape.

CHLOROPLAST

It is the site for photosynthesis

It contains a green pigment, chlorophyll which absorbs light and prepared food.

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PLANT VERSUS ANIMAL CELLS

ORGANELLE	PLANT CELL	ANIMAL CELL
Nucleus	✓	✓
Cell Membrane	✓	✓
Mitochondria	✓	✓
Ribosomes	✓	✓
Cytoplasm	✓	✓
Cell Wall	✓	✗
Permanent Vacuole	✓	✗
Chloroplast	✓	✗

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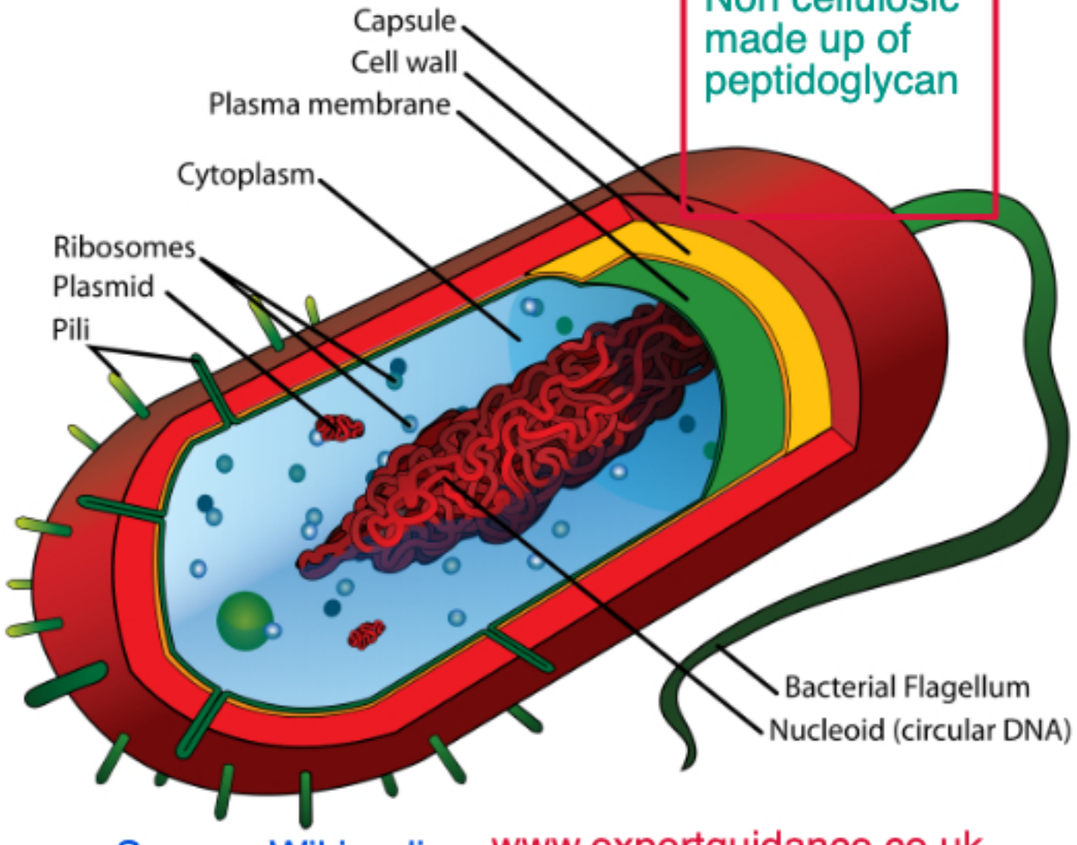
BACTERIAL CELL



Source: Wikipedia

Cell Wall

Non cellulosic made up of peptidoglycan

Circular DNA

No nucleus
Single DNA loop found naked in the cytoplasm,

Plasmid

Extra chromosomal materials
They are in the form of small rings
They give special properties to bacteria like antibiotic resistance

Pilli

Hair like structures found on the surface that helps bacteria to reproduce

Capsule

Slime layer
that protects the bacteria

Flagellum

Tail like structure helps the bacteria to move.

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BACTERIAL VERSUS PLANT VERSUS ANIMAL CELLS

BASIS	BACTERIA	PLANT	ANIMAL
Cell Type	Prokaryotic	Eukaryotic	Eukaryotic
Nucleus	Absent	Present	Present
Cell Wall	Present but non cellulosic	Present and cellulosic	Absent
Cell Membrane	Present	Present	Present
Ribosomes	Present but smaller	Bigger Ribosome	Bigger Ribosome
DNA	Circular DNA	Linear DNA	Linear DNA
Genetic Material	Naked in the Cytoplasm	In the nucleus inside chromosomes	In the nucleus inside chromosomes
CHLOROPLAST	Absent	Present	Absent
VACUOLE	Small vacuoles	Big Vacuoles	Absent

ORDER OF MAGNITUDE

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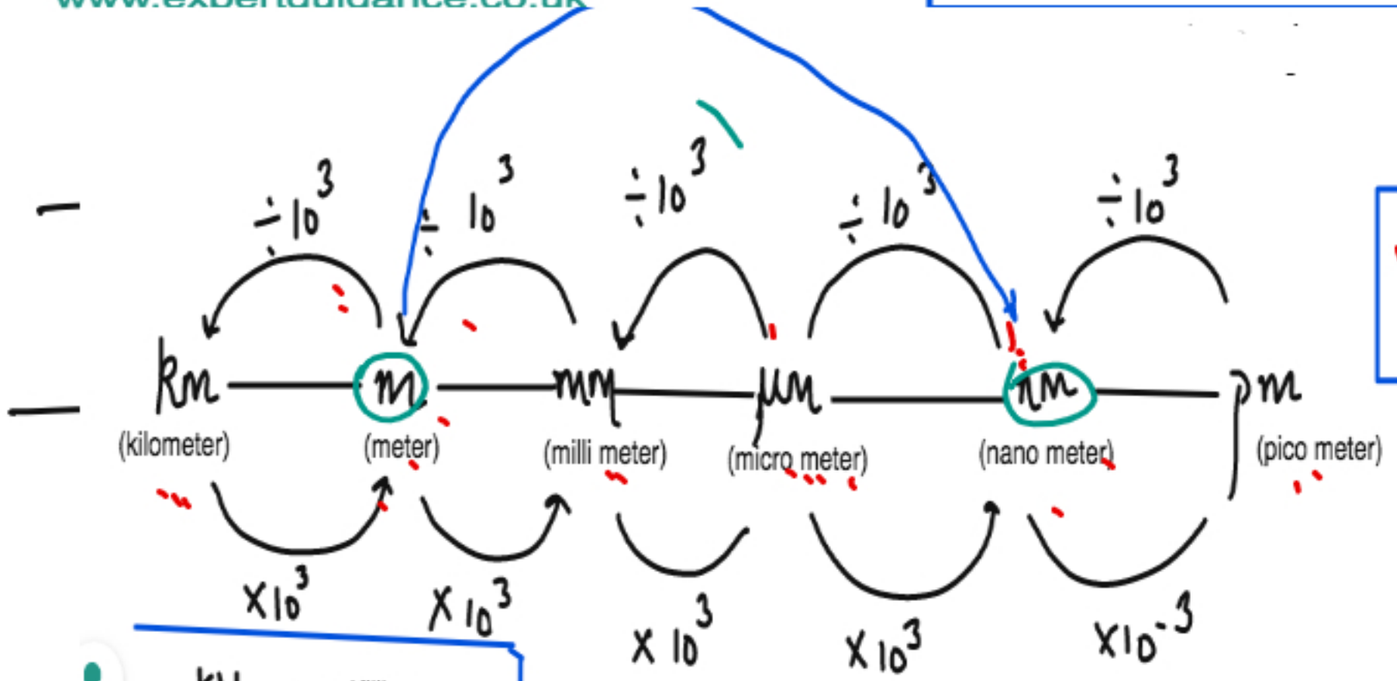


$1nm = 1 \times 10^{-9} m$

10nm 100m

$\frac{100}{10} = 10$

KIL — Killing
MET — Metal
MIL — Milo
MIC — Mickey
NAN — Nano
PIC — Pictures

Convert 10 nm to :-

a) meter — $nm \xrightarrow{\div 10^9} m = \frac{10\,m}{10^9} = 10^{-8} m$

b) micrometer — $\mu m \xrightarrow{\div 10^6} m = \frac{10\,m}{10^6} = 10^{-5} m$

Divide the relative size of the two ce
determine the order of magnitude

Make sure the units for the size is th

SPECIALISED ANIMAL CELLS

Special cells which have some extra features that allows them to perform specific functions

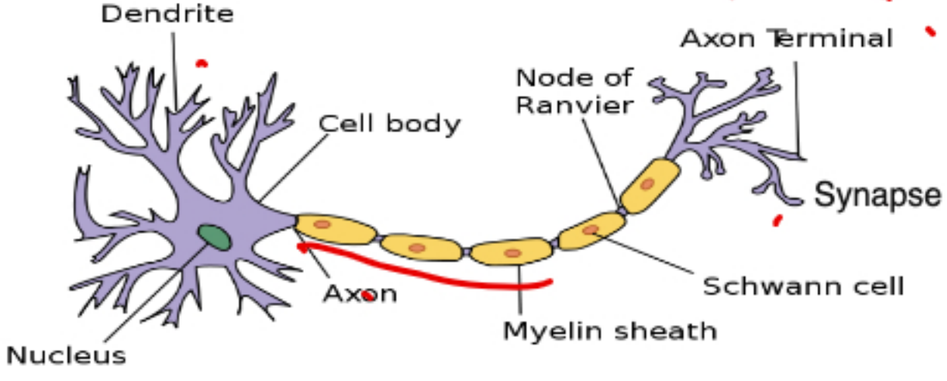
NERVE CELL

Function is to send electrical impusles round the body

They are hair like structures that receives the impulses.

Long stalk the transmits the nerve impulses

They tranmit impulses from one neurone to another.

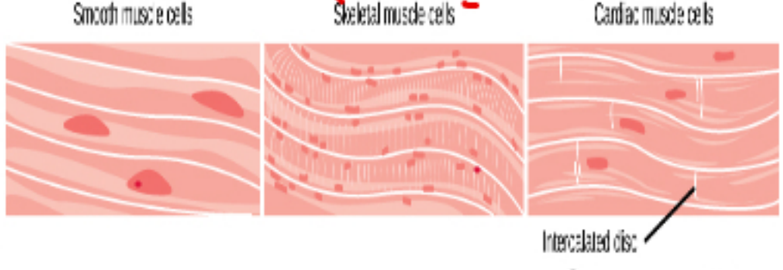


Source: wikipedia

MUSCLE CELL

Functions is to contract to bring about the movement of different parts of the body.

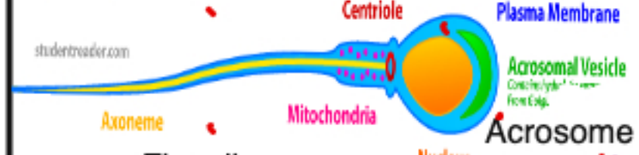
- They are made up of special fibres which helps them to contract and relax.
- Contain special proteins that allows them to contract and relax
- They have loads of mitochondria which provides them energy to contract
- They can store special storage carbohydrate called glycogen which acts as fuel for the muscles



Source: wikipedia

SPERM CELL

Functions is to swim to the egg and fertilize it



Flagella

Helps it to swim to large distances

Contains genetic information

Provides Energy to swim

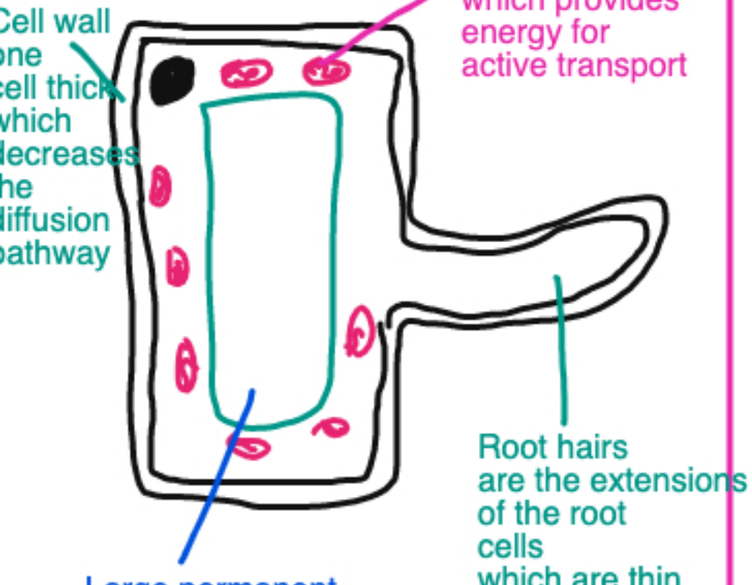
contains hydrolytic enzyme to break the egg wall and penentrate inside the egg tfuse with the egg nucleus.

Source: Flickr.con

SPECIALISED PLANT CELLS !!!!

ROOT HAIR CELLS

IT act as exchange surface and the function is to absorb water and minerals from the soil.



XYLEM CELLS

It transport water and minerals from the roots to all parts of the plant.

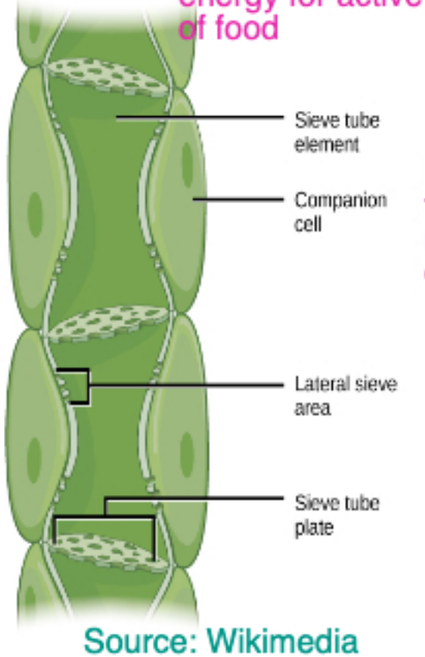
It is in the forms of vessels and the cells are dead.

PHLOEM CELLS

It transports food from the leaves to all parts of the plant.

It is in the form of tubes supported by companion cells.

Support the phloem cells as it has mitochondria and provides energy for active movement of food



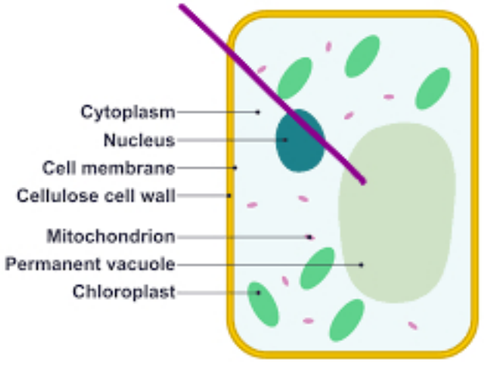
It helps the easy movement of food.

Source: Wikimedia commons

PHOTOSYNTHETIC CELLS

The main job is to prepare food by photosynthesis.

Helps in movement of water by osmosis



Helps to trap the light for photosynthesis

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MICROSCOPES !!!

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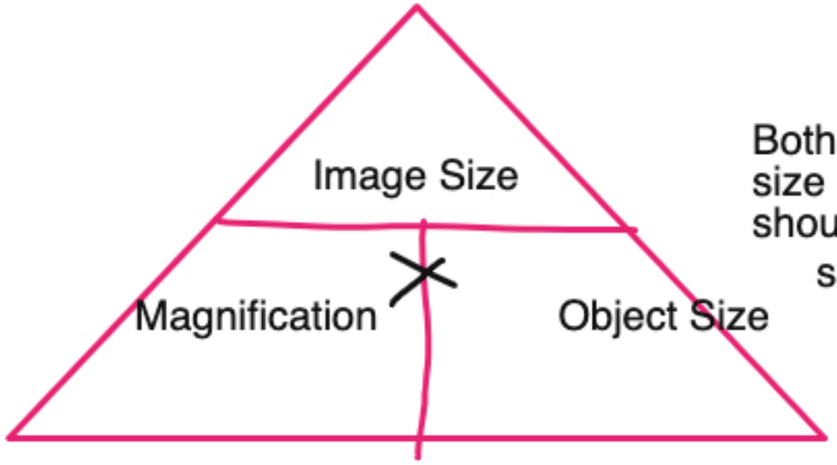
Are the devices that use to see the cells which we cannot see by our naked eye.

MAGNIFICATION

The property of the microscope to enlarge the object.



Both image size and object size should be of the same unit.

RESOLUTION

The property of the microscope to distinguish between two closed placed objects.

Source: Vimeo.com

LIGHT AND ELECTRON MICROSCOPES

LIGHT MICROSCOPES	ELECTRON MICROSCOPES
Uses beam of light to focus on the object.	Use beam of electron to focus on the object.
IT is easy to handle	It is not easy to handle
It is small and compact	It is big and non portable
It does not require much expertise to handle	It requires proper training to handle
It can view the live samples	Samples ahve to be dead
No special sample preparations are required	Special sample preparations are required
Lower resolving power 0.2μm	Greater resolving power 0.5nm
Small magnifying power X 1000 – 1500	Greater magnifying power X100,000
Can form colour images	Form 2D or 3D black and white images

MOVEMENT OF SUBSTANCE IN AND OUT OF THE CELLS !!!!

ACTIVE TRANSPORT

- Movement of particles from a region of low concentration to a region of high concentration.
- Particles move against the concentration gradient.
- It requires energy.
- Cells involved in active transport should have lots of mitochondria

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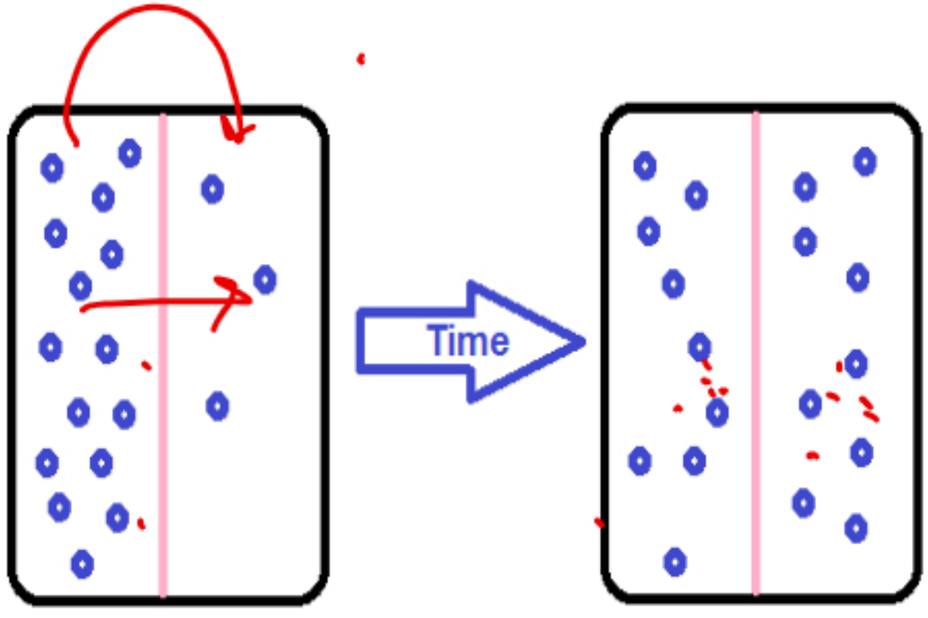
PASSIVE TRANSPORT

- Movement of particles from the region of high concentration to a low concentration.
- Particles move along the concentration gradient.
- It does not require energy
- Having numerous mitochondria is not a requirement

DIFFUSION

OSMOSIS

DIFFUSION



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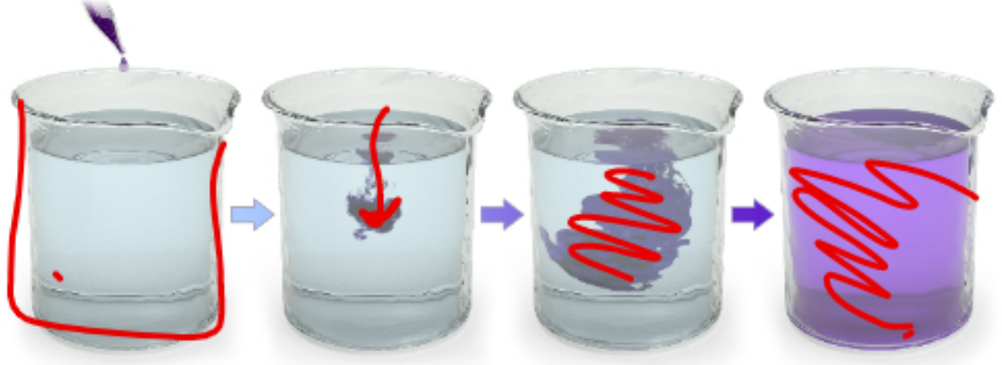
- It the net movement of particles from an area of higher concentration to an area of lower concentration.
- It is passive process
- It happens along the concentration gradient
- No use of energy.



Diffusion
Source: Wikimedia Commons

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FACTORS AFFECTING DIFFUSION !!!

SURFACE AREA

Greater the surface area greater is the rate of diffusion as particle will get more room for movement.

All the exchange surfaces have greater surface area like root cells has root hairs and intestine cells has villi.

CONCENTRATION GRADIENT

Greater the difference in concentration in the two regions greater is the rate of diffusion.

All the exchange surfaces maintain steepest concentration gradient. Like root cells are closed to xylem and villi has rich blood supply.

DIFFUSION DISTANCE

Smaller the diffusion distance greater is the rate of diffusion as the particles have to travel a smaller distance.

All the exchange surfaces maintain a smaller diffusion distance by being one cell thick.

TEMPERATURE

Greater the temperature greater is the rate of diffusion as particles will get more kinetic energy for movement

$$\text{Rate of diffusion} = \frac{\text{Surface Area} \times \text{Concentration gradient}}{\text{Diffusion distance}}$$

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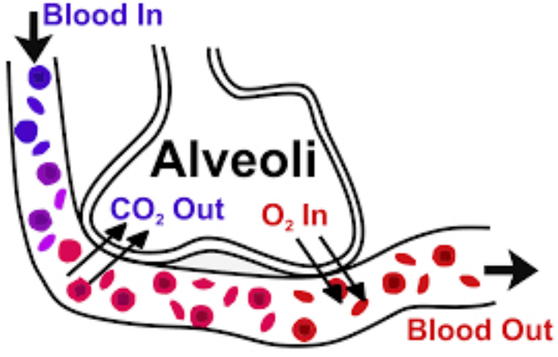
DIFFUSION IN ANIMALS

In Lungs or Alveoli (diffusion of gases)



The lungs have millions of air sacs called alveoli which increases the surface area.

Alveoli are one cell thick

They have rich blood supply

Large Surface Area

Shorter Diffusion Distance

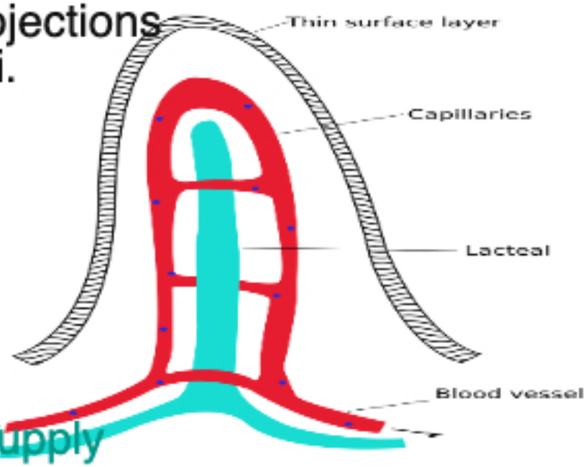
Concentration Gradient

In Small Intestine (diffusion of digested food)

The intestine wall is folded to form finger like projections called the villi.

Villi are one cell thick

They have rich blood supply



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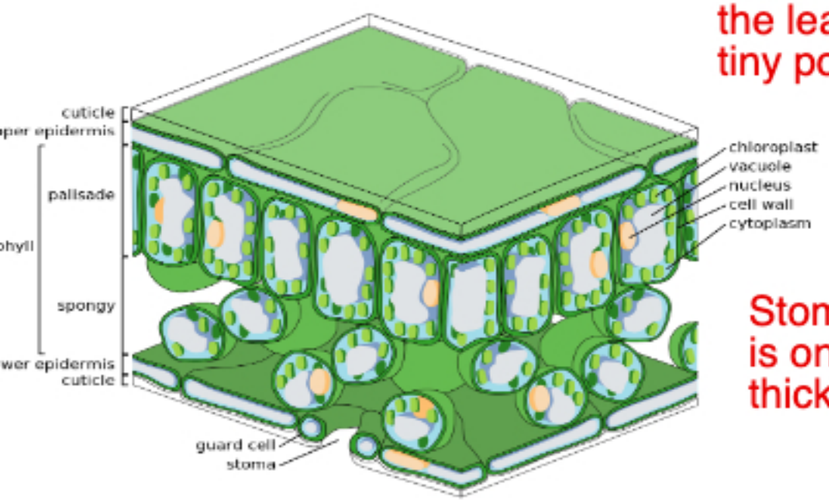
DIFFUSION IN PLANTS !!!!

Diffusion of gases through the stomate



At the surface of the leaves tiny pores called stomata

Stomata is one cell thick

Photosynthetic cells are close to stomata

Greater Surface Area

Thin Diffusion Distance

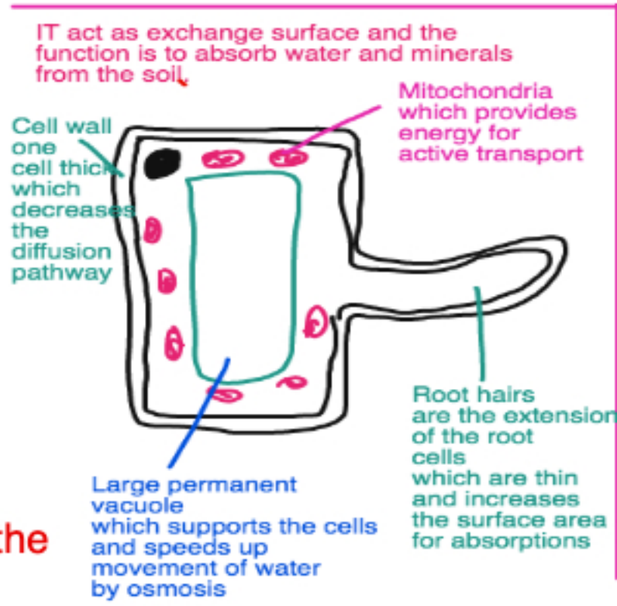
Steep Concentration Gradient

Diffusion of water and minerals through the root.

root cells project to form root hairs

Root hair cells are one cell thick

Xylem is located closed to the root cells



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OSMOSIS
.....Special Case of Diffusion

Osmosis is the net movement of water particles from the region of high concentration of water particles to low concentration of water particles across a semi permeable membrane.

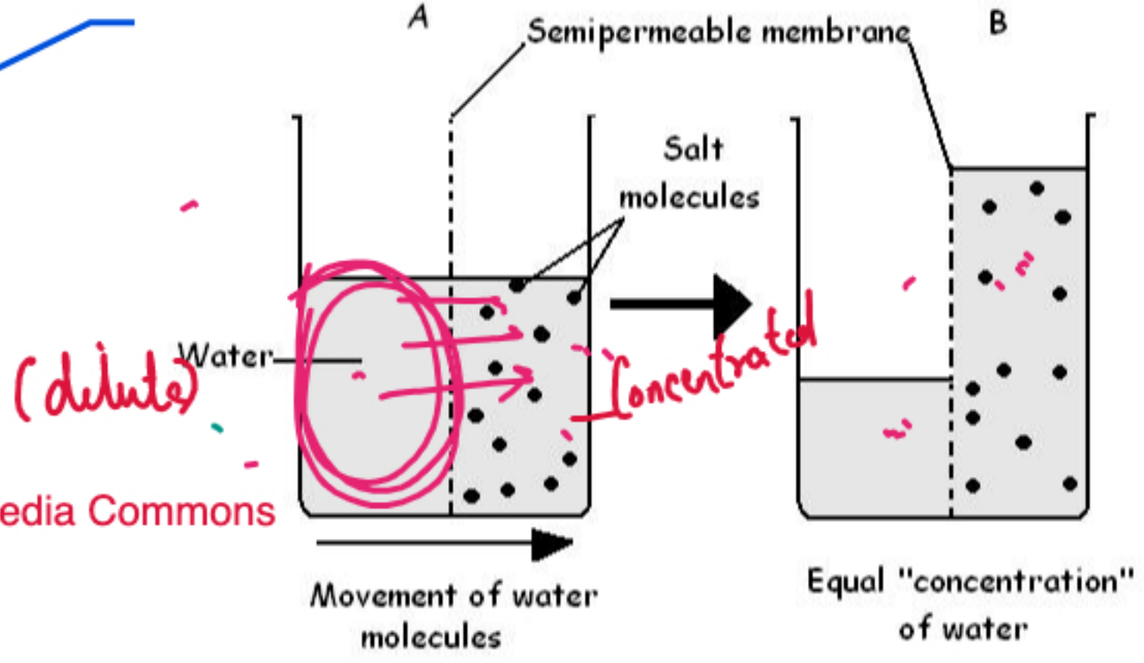
Movement of water from a dilute solution to a concentrated solution through a semi permeable membrane.

Special Case:

It is the diffusion of only water molecules

It required a semi permeable or partially membrane

membrane that allows only specific molecules to pass through like water.



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OSMOSIS IN PLANTS

Hypertonic

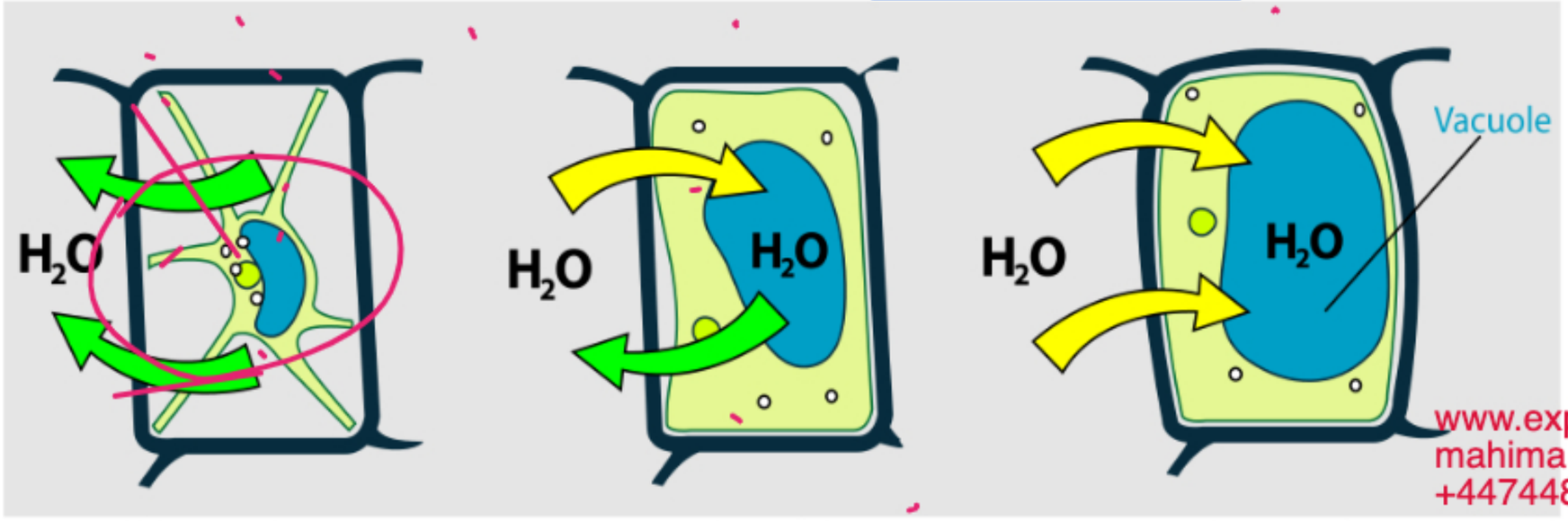
The outer solution has a less concentration of water than inside the cell.

Isotonic

The outer solution has same concentration of water than inside the cell.

Hypotonic

The outer solution has a greater concentration of water than inside the cell.



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Plasmolyzed

The water moves out of the cells due to osmosis due to higher concentration of water inside the cell than outside.
The cell membrane recetes from the cell wall.

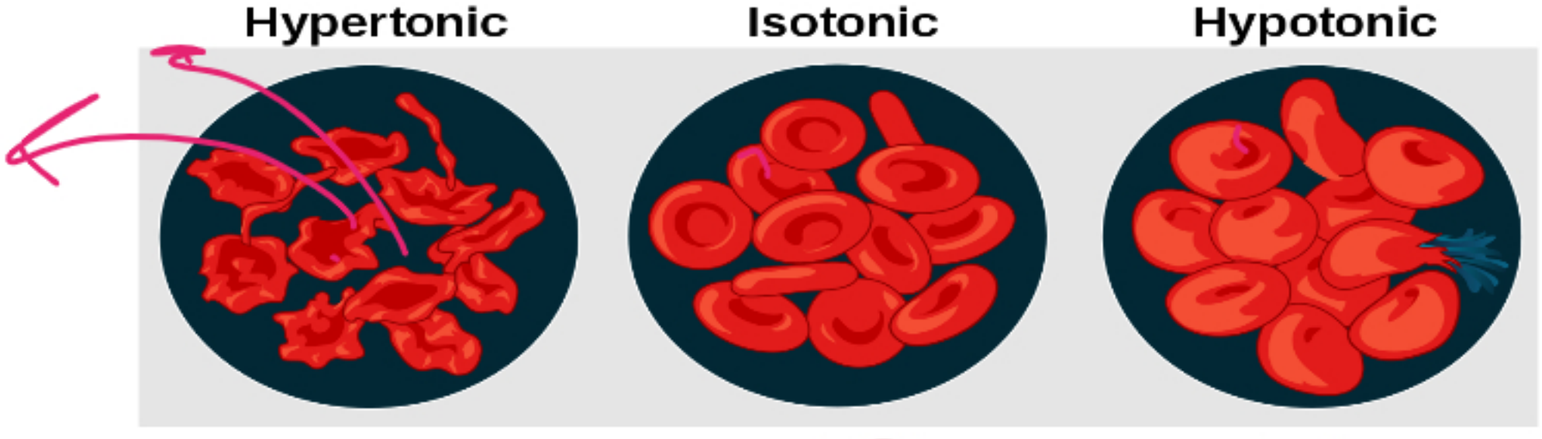
Flaccid

There will no net water movement so no pressure on the cell. It will be flaccid

Turgid

The water moves into the cell due to osmosis due to higher concentration of water outside the cell. The water will create pressure called turgor pressure on the cell wa making cell rigid and turgid.

OSMOSIS IN ANIMALS



The cell shrinks

The cell remains intact

The cell swells and can burst.

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ACTIVE TRANSPORT

Movement of substances from the region of low concentration to a region of higher concentration with the use of energy.

Dependent on respiration as it requires energy. So the cells involved in active transport has lots of mitochondria.

In Plants water and minerals are absorbed by active transport to absorb maximum of water and minerals.

In animals, the digested food gets absorbed into the blood by active transport to ensure maximum absorption.

Salt glands are present in some marine organisms which removes the salt by active transport.

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CELL CYCLE

Interphase

It is the longest phase of the cell cycle

The cell grows in size and prepares all the proteins and enzymes needed for division.

Replication of DNA where DNA duplicates its content.

Mitosis

It is the division of the nucleus in which parent cell splits into two daughter nuclei containing same number of chromsomes as the parent cell.

Cytokinesis

It is the division of the cytoplasm which takes place after the division of the nucleus.

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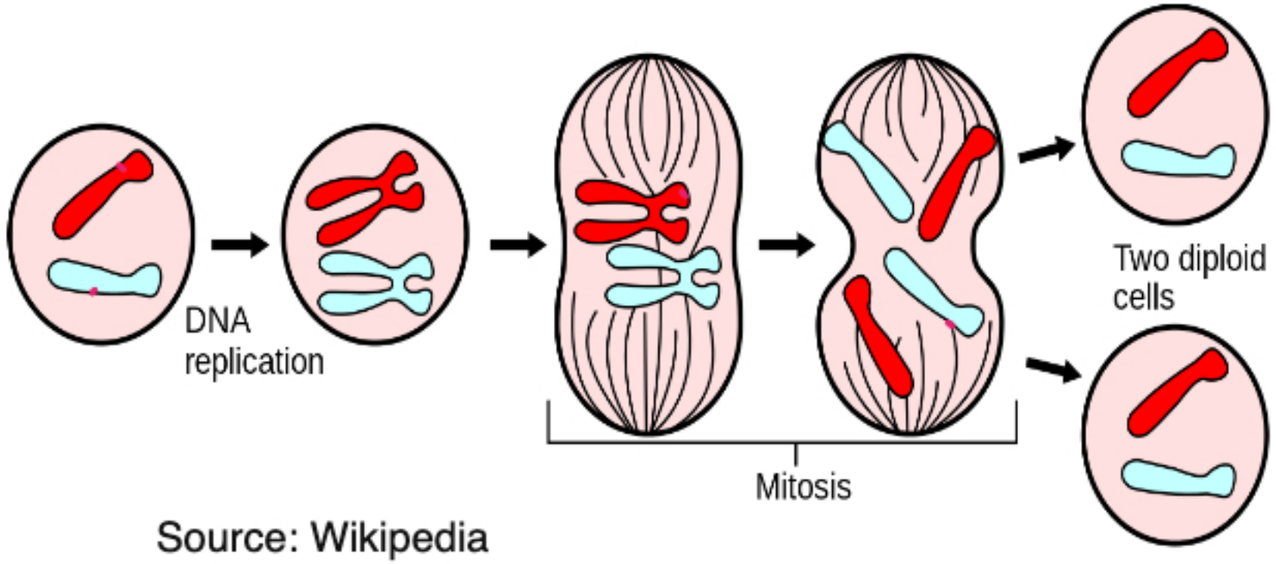
MITOSIS



Source: Wikipedia

- It is the type of cell division in which a parent nucleus divides to form two daughter nuclei with exactly the same number of chromomes as that of the parent nucleus.
- The daughter cells produced are genetically identical to the parent and are clones.
- This division is important for growth, regneration and repair.
- Mitosis is also important in asexual reproduction.

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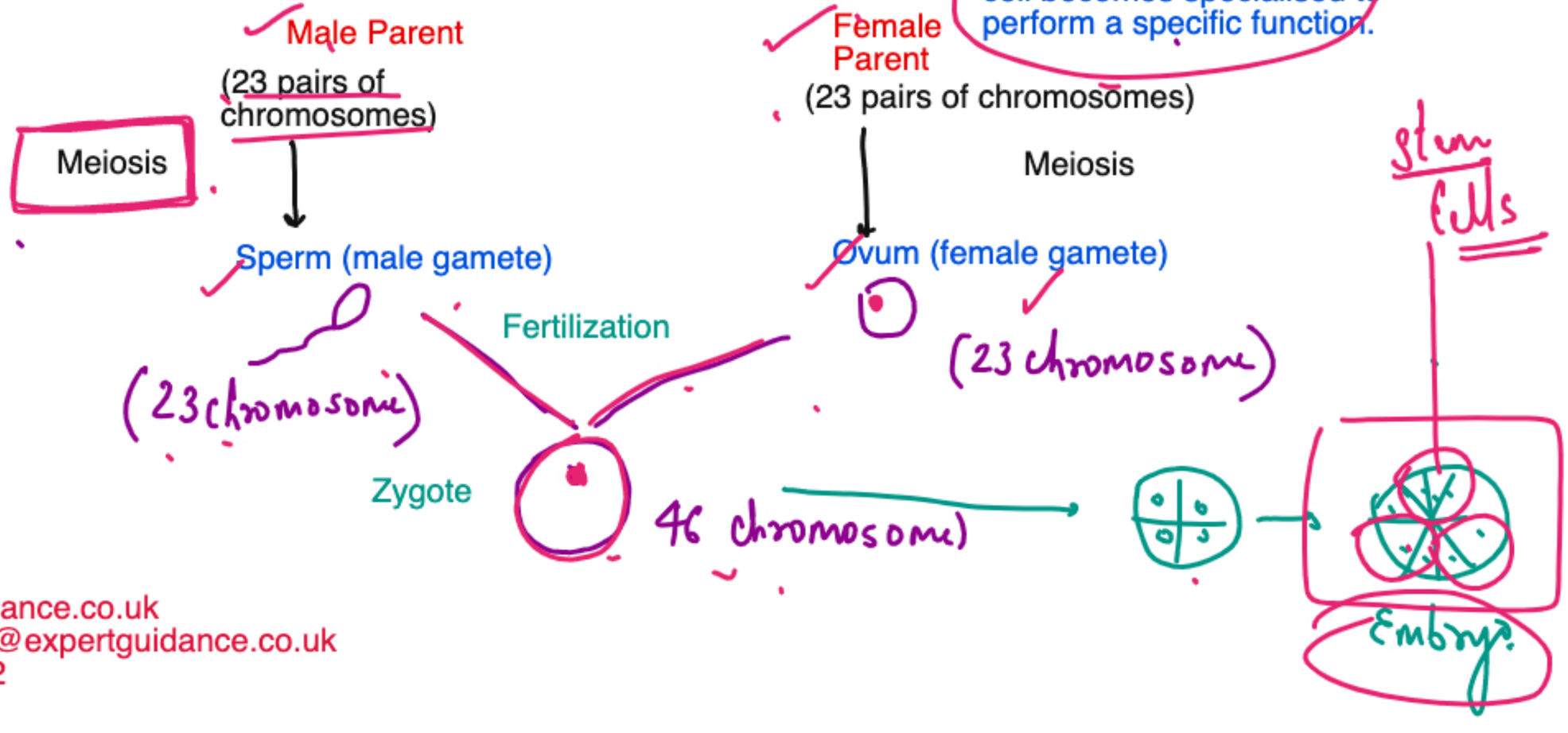
CELL DIFFERENTIATION

It is the process by which cell becomes specialised to perform a specific function.



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In animals majority of the cells are differentiated at an early stage and different cells have specific functions like nerve cell, muscle cells.

Adult stem cells replaced the old and worn out cells in human but adult stem cells have limited specialization power

Majority of the differentiation is permanent

PLANT DIFFERENTIATION

Animal

Plants are the storehouse of stem cells

Root meristems and shoot meristems are the parts of actively growing part of the cells which contains stem cells.

The plants can be cloned easily as it has many undifferentiate cells and differentiation is not permanent.

ANIMAL DIFFERENTIATION

Plant.

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STEM CELLS !!!

Undifferentiate mass of cells that can differentiate into any cell type are known as stem cells.

Sources of Stem Cells : Embryo, left over remains of the embryo and the umbilical chord are the sources of embryonic stem cells.

Bone marrow is the source of adult stem cells.

Can solve the rejection problem if the transplanted organ is made from the person's own stem cells.

Can be possible cure of neuro-degenerative diseases.

Can be the potential cure of diabetes.

Therapeutic cloning.

Organ damage problem

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ISSUES AGAINST STEM CELLS

- It can lead to cancer as the stem cells are rapidly dividing.
- The stem cells can be contaminated and can cause unwanted diseases to the partient.
- Research is still slow and expensive
- Research happens on aborted embryos which is considered as a potential source of life and many religions have ethical concerns against it.
- The knowledge of the genes switched on and off causing differentiation is still incomplete.

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KEY TERMS !!!!

Cells

Mitochondria

Nucleus

Cytoplasm

Ribosomes

Prokaryotic Cell

Eukaryotic cell

Cell Wall

Cell Membrane

Vacuole

Microscopes

Resolution

Magnification

TEST YOURSELF !!!

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Xylem

Phloem

Diffusion

Osmosis

Plasmolysis

Turgid

Flaccid

Mitosis

Differentiation

Stem Cells

Therapeutic cloning

KEY TERMS !!!!

- **Cells** — Basic structural and functional unit of the living organism.
- **Mitochondria** — The cell organelle which is the site of aerobic respiration.
- **Nucleus** — The cell organelle which controls the activities of the cell.
- **Cytoplasm** — The jelly like fluid which fills the cell and contains enzymes for chemical reactions.
- **Ribosomes** — The cell organelle which is the site for protein synthesis
- **Prokaryotic Cell** — The primitive cell without nucleus or membrane bound organelles.
- **Eukaryotic cell** — The advanced cell type with nucleus and membrane bound organalles.
- **Cell Wall** — The outer layer of the plant cell which provide shape and support
- **Cell Membrane** — The layer that controls what goes in and out of the cell.
- **Vacuole** — Organalle present in plant cell which has cell sap and make the cell turgid.
- **Microscopes** — Devices that is used to see the object which are not visible by a naked eye.
- **Resolution** — Ability to distinguish between closely placed objects.
- **Magnification** — Ability to enlarge an object.
- **Xylem** — Transport tissue in plants that transports water and minerals.
- **Phloem** — Transport tissue in plants that transports food.
- **Diffusion** — Movement of substance from a higher concentration to a lower concentration.
- **Osmosis** — Movement of water from high concentration of water to low concentration of water across semi permeable membrane.
- **Plasmolysis** — Shrinking of plant cell when placed in hypertonic solution.
- **Turgid** — Fully swollen cell which has gained water by osmosis.
- **Flaccid** — soft cell due to no net movement of water.
- **Mitosis** — Cell division that produces identical daughter cells.
- **Differentiation** — Cell specialisation
- **Stem Cells** — Undifferentiated mass of cells that can specialise to any cell type.
- **Therapeutic cloning** — Using adult stem cells to produce embryonic stem cells and differentiating them to produce a required cell type.

NEXT STEP !!!!

EXPERT GUIDANCE

NEXT STEP !!!!

- Check the specification
- Do Exam Questions

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