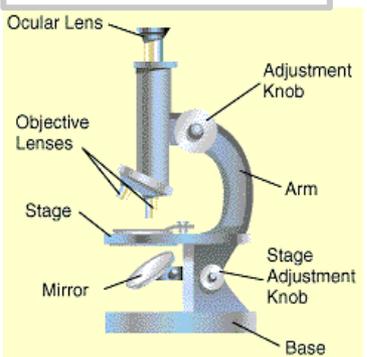


# Cell Biology – Separate Science

# Electron vs Light Microscope

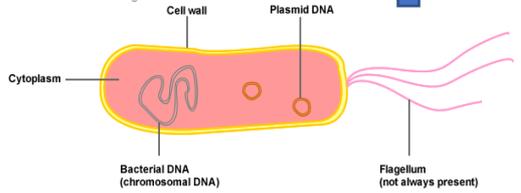
- **Light** – use light and lenses to magnify specimen
- **Electron** – use a beam of electrons to form an image
- **Electron** – higher magnification and higher resolution
- Electron microscopes allow us to see details of organelles

$$\text{Magnification} = \frac{\text{size of image}}{\text{size of real object}}$$



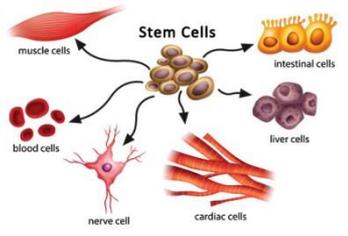
1. Prepare a thin sample to allow light to get through and stain cells (using iodine)
2. Place a cover slip over the top (avoid bubbles)
3. Place slide on stage
4. Put objective lens on lowest magnification
5. Look down ocular lens
6. Use adjustment knob to focus

## Prokaryotic Cells: Bacteria



- Bacterial Cell:
1. Circular DNA
  2. Cell wall
  3. Cytoplasm
  4. Plasmids
  5. Flagellum

## Cell Differentiation



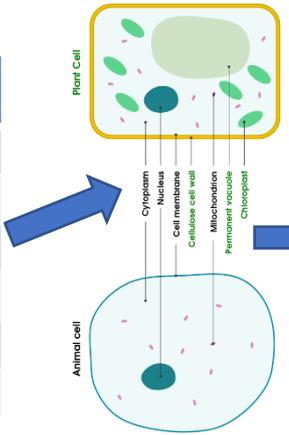
### Differentiation

In **animal cells**: happens at an early stage  
 In **plant cells**: happens throughout life of plant

START

## Eukaryotic Cells

Animal Cell Organelles	Plant Cell Organelles
Cell Membrane	Cell Membrane
Cytoplasm	Cytoplasm
Nucleus	Nucleus
	Cell Wall
	Chloroplast
	Vacuole



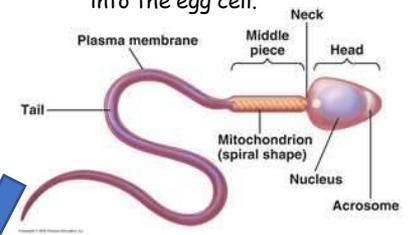
Organelle	Function
Nucleus	Contains genetic material, controls activities of cell
Cytoplasm	Where reactions happen
Cell Membrane	Controls what moves in and out of the cell
Mitochondria	Where aerobic respiration takes place
Ribosomes	Site of protein synthesis
Cell Wall	Strengthens the cell
Chloroplasts	Contains chlorophyll, site of photosynthesis
Vacuole	Filled with cell sap to keep cell turgid

### Key words:

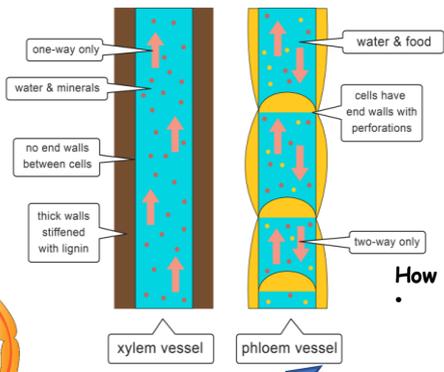
1. **Organelle**: A structure within a cell.
2. **Chromosome**: A threadlike structure of DNA containing genes.
3. **DNA**: A molecule that carries genetic information.
4. **Mitosis**: A type of cell division that produces two identical daughter cells.
5. **Specialised cell**: A cell that has features that allow it to carry out its function
6. **Microscope**: Used to enlarge very small objects
7. **Magnification**: How many times larger an object is compared to its actual size
8. **Resolution**: how close together objects can be before they blur into one
9. **Diffusion**: Movement from a high concentration to a low concentration
10. **Osmosis**: Movement of water from a less concentrated solution to a more concentrated solution through a partially permeable membrane

### How is a sperm cell specialised?

- The tail helps the sperm to move to the egg.
- Lots of energy is stored in the middle section of the sperm cell.
- The head is designed to penetrate into the egg cell.

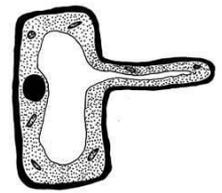


### How are Xylem & Phloem cells specialised?



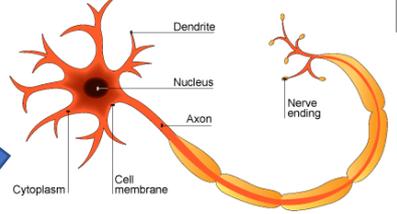
### How is a root hair cell specialised?

- They have a thin cell wall so water can be easily absorbed into the cell.
- They have a big surface area so as much water as possible is absorbed.



### How is a nerve cell specialised?

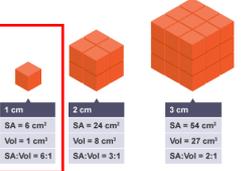
- They are long and thin so messages can be carried all over the body.
- They are specialised to carry electrical signals.
- They have connections at each end.



**Surface Area to Volume Ratio**

A large surface area in comparison to volume ratio increases the rate of diffusion

This cube has the smallest volume compared to its surface area so is best for diffusion



Organisms need specially adapted systems for diffusion to:

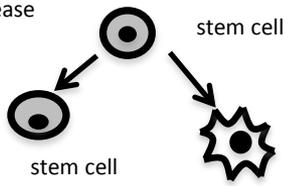
- Get raw materials for respiration e.g. oxygen
- Remove waste products e.g. carbon dioxide
- Plants also need diffusion for photosynthesis



CONTINUE

**Stem Cells**

- Found in embryos and the bone marrow
- Used to replace damaged cells
- Therapeutic cloning involves taking stem cells from an embryo and using them to treat disease



**Ethical issues:**

- Human embryos are destroyed in the process
- Religious objections



**Meristem Tissue**

- Plant growth occurs in meristems
- Stem cells from the meristem can develop into any kind of plant cell e.g. palisade cell or root hair cell

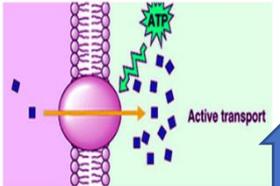
We can use meristem tissue to clone plants:

- To protect rare species from extinction
- To produce genetically identical crops with desired features

We do this by taking cuttings from a plant

**Active Transport**

1. Active transport is the movement of particles from a low concentration to a high concentration against a concentration gradient

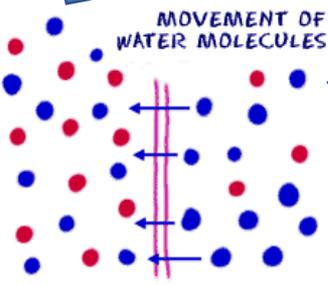


- Occurs across a semi permeable membrane
- Requires a carrier protein
- Important for processes like absorption of glucose into the small intestine

When potato is placed into a concentrated sugar solution, water particles move out of the potato and into the solution by osmosis, so the potato loses mass. When a potato is placed into water, the concentration of water outside the potato is higher and water particles move into the potato by osmosis, causing an increase in mass.

**Osmosis**

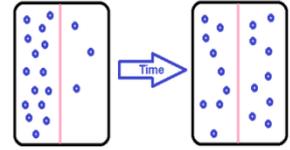
- Water may move across cell membranes via osmosis.
- Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.



**Key words:**

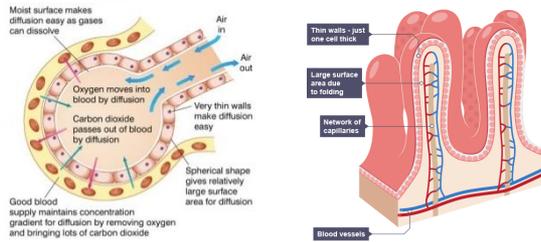
- Differentiation:** process by which stem cells become specialised cells.
- Stem Cell:** undifferentiated cells that have the potential to become any type of cell.
- Meristem Tissue:** where stem cells are found in plants

**Diffusion**



- Substances move from a high concentration to a low concentration
- Down the concentration gradient
- Faster diffusion when:
  - There is a higher temperature as particles move faster
  - There is a large concentration gradient
  - The particles have a short distance to travel
  - There is a large surface area for particles to diffuse through

Organs such as the small intestine have a **large surface area** to increase the rate of diffusion. These villi increase the rate at which food molecules are exchanged between the gut and the bloodstream. The alveoli in the lungs have several adaptations for efficient diffusion of oxygen and carbon dioxide.



ASEPTIC TECHNIQUE

What we do	Why we do it
Petri dish and agar sterilised before use	To kill unwanted bacteria
Inoculating loop passed through flame	To sterilise and kill any other bacteria
Loop used	To spread bacterium onto agar
Petri dish lid opened as little as possible	To prevent microbes from the air entering
Dish sealed with tape	To prevent microbes from the air entering
Incubate	To allow growth of bacteria

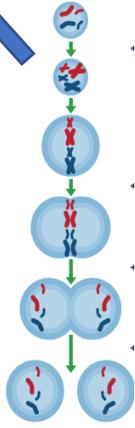
Bacteria multiply by simple cell division every 20 mins

**Why do cells need to divide?**

- To **grow** an organism
- To **repair** damaged cells

**Mitosis**

- Cells divide in a series of stages called the cell cycle.
- Before a cell can divide it needs to grow and increase the number of sub-cellular structures such as ribosomes and mitochondria. The DNA replicates to form two copies of each chromosome.
- In mitosis one set of chromosomes is pulled to each end of the cell and the nucleus divides.
- Finally the cytoplasm and cell membranes divide to form two



# Questions:

1. State 3 cell parts found in both animal and plant cells and 3 found only in plant cells
2. What is the difference in genetic material between eukaryotic and prokaryotic cells?
3. Describe the differences between light and electron microscopes
4. Describe what is meant by the term differentiation
5. Give 3 ways in which the sperm cell is adapted for its function
6. Describe the special features of the root hair cell that make it adapted for its function
7. Explain why the nerve cell has branched ends
8. Why do cells need to divide by mitosis?
9. Which 4 factors affect the rate of diffusion?
10. How does increasing the temperature increase the rate at which diffusion happens?
11. Describe the process of osmosis
12. Give two main differences between active transport and diffusion
13. How are exchange surfaces adapted for efficient diffusion?
14. Describe how the villi in the small intestine are adapted for efficient diffusion
15. Describe 2 differences between eukaryotic and prokaryotic cells
16. A specimen is  $50\mu\text{m}$  wide. Calculate the width of the image of the specimen under a magnification of  $\times 100$ . Give your answer in mm. (Hint:  $1000\mu\text{m} = 1\text{mm}$ )
17. How can stem cells be used to preserve rare plant species?
18. What is the function of the cytoplasm?
19. Explain what is meant by therapeutic cloning
20. Describe the 3 main stages of mitosis
21. Describe the similarities between osmosis and diffusion
22. Give 2 reasons why organisms need specially adapted systems for diffusion
23. Describe the difference between differentiation in animal and plant cells
24. Explain why we must pass an inoculating loop through a flame in the aseptic technique
25. If we start with one bacterial cell, how many bacterial cells will there be after 3 hours?