

# AQA BIOLOGY UNIT 1: CELLS

## Cells

**Eukaryotic cells**

**Animal cell**

- Cytoplasm
- Nucleus
- Ribosome
- Mitochondrion
- Cell membrane

**Plant cell**

- Chloroplast
- Vacuole
- Cell wall

*Found in plant cells*

**Prokaryotic cells** - no membrane bound organelles (loose DNA)

**Bacterial cell**

- Cell wall
- Cell membrane
- Molecule of circular DNA
- Cytoplasm

**Yeast cell**

- Cell wall
- Cell membrane
- Nucleus
- Cytoplasm
- Mitochondria

**Cell Membrane**  
Controls what goes in and out the cell

**Mitochondria**  
Respiration

**Chloroplast**  
Photosynthesis

**Cytoplasm**  
Where chemical reactions occur


## Magnification

Fraction of a metre	Unit	Symbol
One thousandth = $0.001 = 1/1000 = 10^{-3}$	millimetre	mm
One millionth = $0.000001 = 1/1000\ 000 = 10^{-6}$	micrometre	$\mu\text{m}$
One thousand millionth = $0.000\ 000\ 001 = 1/1000\ 000\ 000 = 10^{-9}$	nanometre	nm

**To calculate actual size:**

1. Measure the organelle with a ruler.
2. Multiply this by 1000 to get a value in micrometres
3. Divide this by the magnification

e.g. The diagram below is a drawing of an organelle from a ciliated cell as seen with an electron microscope.



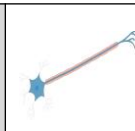



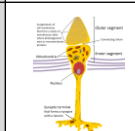
Calculate the actual length of the organelle as shown by the line AB in the diagram. Express your answer to the nearest micrometre ( $\mu\text{m}$ ).

1. Measure it in mm = 40mm
2. Multiply by 1000 = 40000 $\mu\text{m}$
3. Divide by magnification  $40000 / 20000 = 2\mu\text{m}$

**Magnification** is the number of times larger an image is compared with the real size of the object.

**Resolution** is the ability to distinguish between 2 separate points.

## Specialised Cells - Cells that have differentiated

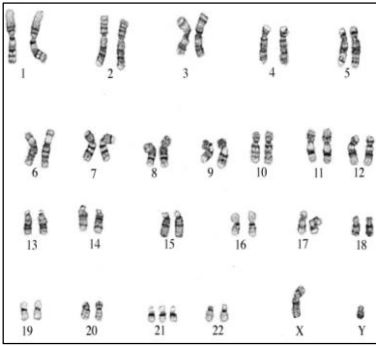
Neurone		<ul style="list-style-type: none"> <li>• Long and thin.</li> <li>• Have a myelin sheath to prevent loss of impulse.</li> <li>• Form connections with other neurones.</li> <li>• Can carry electrical impulses in one direction.</li> </ul>
Sperm		<ul style="list-style-type: none"> <li>• Contain digestive enzymes for breaking down the outer layer of an egg cell.</li> <li>• Many mitochondria.</li> <li>• Have long tail.</li> </ul>
Red Blood		<ul style="list-style-type: none"> <li>• Large surface area.</li> <li>• Small diameter.</li> <li>• No nucleus.</li> <li>• Contain haemoglobin.</li> </ul>
Root Hair		<ul style="list-style-type: none"> <li>• Found close to xylem</li> <li>• Thin membrane.</li> <li>• Large surface area.</li> </ul>
Cone Cells		<ul style="list-style-type: none"> <li>• Outer segment filled with visual pigment that changes chemically in coloured light.</li> <li>• Lots of mitochondria so that you constantly see in colour.</li> <li>• Specialised synapses connecting to the optic nerve.</li> </ul>

## Chromosomes

Humans have **23 pairs** of chromosomes (46 in total) in all adult cells.

Chromosomes 23 = sex chromosomes (**XY = male XX = female**)

**Karyotype** - visual appearance of our chromosomes.



**What are the differences?**

1. 47 instead of 46
2. Extra chromosome 21 (called Trisomy-21 (Down's Syndrome))
3. Normally 21 should be 2 chromosomes

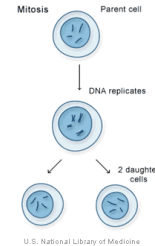
Bacteria multiply by **binary fission**.

Growth is exponential i.e.  $1 \rightarrow 2 \rightarrow 4 \rightarrow 8 \rightarrow 16 \rightarrow 32 \rightarrow 64...$

## Mitosis and Meiosis - cell division

### Mitosis (in humans)

- Occurs all over the body
- Makes new cells with 23 pairs of chromosomes
- Cells divide once
- Makes new body cells.



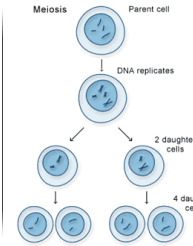
**Interphase:** DNA copies

**Different stages of mitosis:**

- Prophase** - chromosomes condense
- Metaphase** - chromosomes line up in the middle
- Anaphase** - chromosomes pulled apart by spindle fibres
- Telophase** - 2 new nuclei form

### Meiosis (in humans)

- Occurs in testes and ovaries
- Makes cells with 23 chromosomes
- Cells divide twice
- Makes gametes (sperm and egg)



**Advantages:**

- Treat blindness
- Organ transplants
- Treat paralysis

**Disadvantages:**

- Ethical issues with embryos
- Religious issues

## Diffusion

**Movement of particles from a high concentration to a low concentration (down a concentration gradient)**

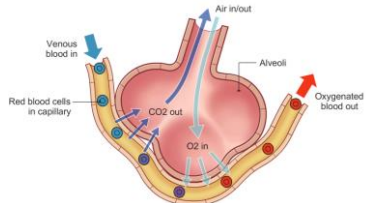
**To increase rate of diffusion:**

- Increase temperature
- Increase surface area
- Increase concentration gradient
- Shorten distance

Large organisms have a small **surface area:volume** so require specialised exchange surfaces with large surface area so diffusion is fast enough.

**Small Intestine:** Villi increase surface area  
Blood flow maintains conc. Gradient  
Thin wall 1 cell thick

**Lungs:** Alveoli increase surface area

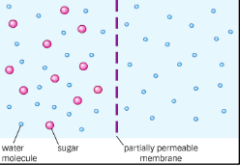


**Blood flow and thin walls like the villi**

### Osmosis

Water travels from a **dilute solution** (high water concentration) to a **more concentrated solution** (low water concentration).

The water moves across a **partially permeable membrane**.

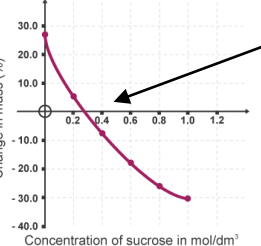


**Isotonic** means the amount of dissolved solutes is the same on the outside of the cell as the inside, so there is no difference in concentration of water.

**Hypotonic** means there are more solutes inside the cell than outside, therefore inside the cell has a lower concentration of water.

**Hypertonic** means there are more solutes on the outside of the cell than on the inside. So there is a lower concentration of water on the outside of the cell.

- **Turgid** - When a cell fills with water (plant cell wall protects cell from bursting)
- **Flaccid** - When a cell loses water



The solution is isotonic where the line crosses the x-axis i.e. 0.3 mol/dm³.

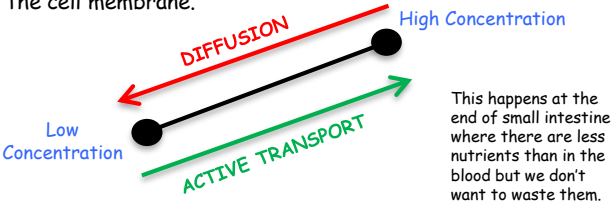
Potato gains mass in a hypotonic solution but loses mass in a hypertonic solution.

### Active Transport

This is the opposite of diffusion.

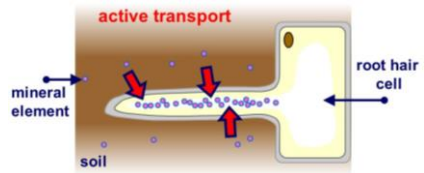
Substances move from an area of low concentration to high concentration, **against the concentration gradient**.

It requires **ATP** (energy) - this means it need **mitochondria**. The ATP is used to change the shape of **protein channels** in the cell membrane.



This happens at the end of small intestine where there are less nutrients than in the blood but we don't want to waste them.

Root hair cells have more minerals than the soil but still needs them. Active transport is used for uptake of these minerals.



Root hair cells therefore have lots of mitochondria.

### REQUIRED PRACTICAL: Growing Bacteria

- Flame the loop - sterilises it
- Lift lid slightly - prevent airborne bacteria getting into it
- Seal with 2 bits of tape - allows air to get in but keeps lid on for safety
- Incubate at 25°C - prevents pathogens growing

Antibiotics on bacteria on the jelly.

Big space around disk = most bacteria killed

