# ① Cell Biology

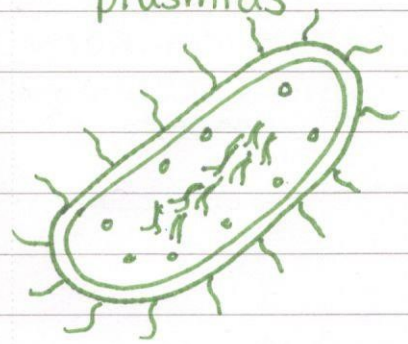
'eu' sounds like 'you' so think these are the kind of cells found in you!

- Cells can be **prokaryotic** or **eukaryotic**

**prokaryotic**

cells found in bacteria. They have no nucleus

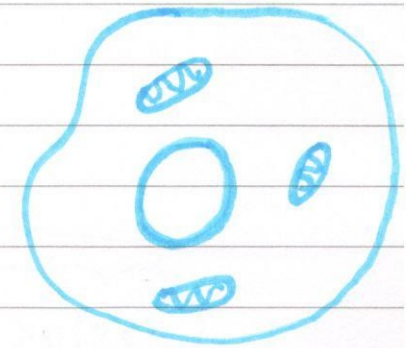
only contain:
- cell wall
- cell membrane
- cytoplasm
- circular DNA
- plasmids



**eukaryotic**

cells found in plants + animals. They have a nucleus

contain:
- cell membrane
- cytoplasm
- Nucleus with DNA



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## Determining the size of a cell:

3 times biger so 3 zeros

- $10^{1}$ bigger than another cell = The cell is **10** times **bigger**
- $10^{3}$ bigger than another cell = The cell is **1000** times **bigger**
- $10^{-1}$ smaller than another cell = The cell is **10** times **smaller**

| | |
|---|---|
| **Centi** | = multiply by 0·01 |
| **Milli** | = multiply by 0·001 |
| **Micro** | = multiply by 0·000,001 |
| **Nano** | = multiply by 0·000,000,001 |

# Active Transport

The movement of particles from an area of **low** concentration to an area of **high** concentration **against their concentration gradient**.

↳ It requires energy, which comes from RESPIRATION.

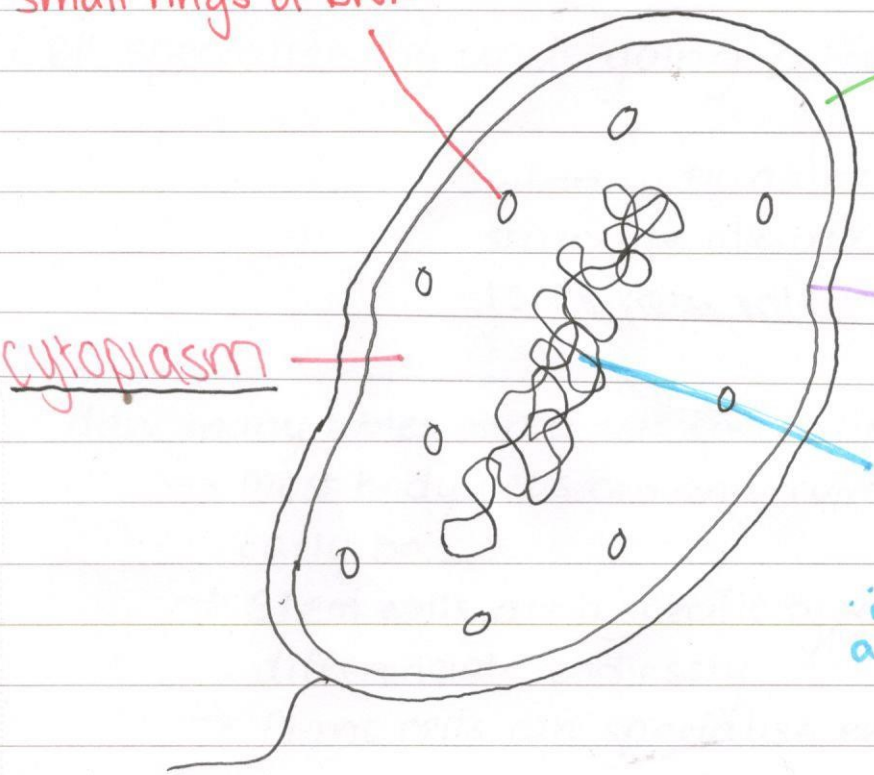
## In root hairs:

- mineral ions are higher in root hairs than in the soil so they cannot move diffusion. They therefore need to use active transport to go against the concentration gradient.

## In the gut:

Often theres more sugar molecules in the blood than in the gut so diffusion cannot occur. Active transport is used to move sugar to the blood against its gradient.

# Bacterial cell




## How to calculate the size of structures:

1. Find the structure on the diagram
2. If it is rectangular → length × width = size/area

# Cell Specialisation

* Cell specialise by undergoing differentiation.

when a cell gains a new sub-cellular structure in order for it to be suited to its new role.

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How many times can a cell specialise?

→ Most body cells can only differentiate **once** early on.

→ **Stem cells** are a specific type of cells which can differenciate endlessly.

→ Plant cells can specialise endlessly

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## examples of specialisation:

- Sperm cells – They have changed to have a tail for swimming, many mitocondria to provide energy to swim
- Nerve cells – These cells differenciate to have a long axon and lots of extentions to form connections with other nerve cells.
- Muscle cells – They develop lots of mitochondria for energy for contraction
- Root hair cells – They've developed a large surface area to reach more water

# calculations:

① magnification = magnification of eyepiece * magnification of objective lens

② size of object = size of image ÷ magnification

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## Cell division

Chromosomes = contains coils of DNA
Gene = short section of DNA that codes for a protein and therefore controls characteristics

☆ Humans have **23 pairs** of chromosomes in each body cell.
↳ This makes a total of 46 chromosomes.

☆ 23 chromosomes come from the mother + 23 from father

except sex cells! (aka gametes)
→ They have half the number of chromosomes (i.e. half of 46)
WHY?
Because sex cells eventually join up.
i.e. 23 cell join up with another 23 cell to make the usual 46.

# Mitosis

→ Cell **division**

→ Mitosis is important to replace damaged cells

## Stages:

① interphase

DNA is replicated.

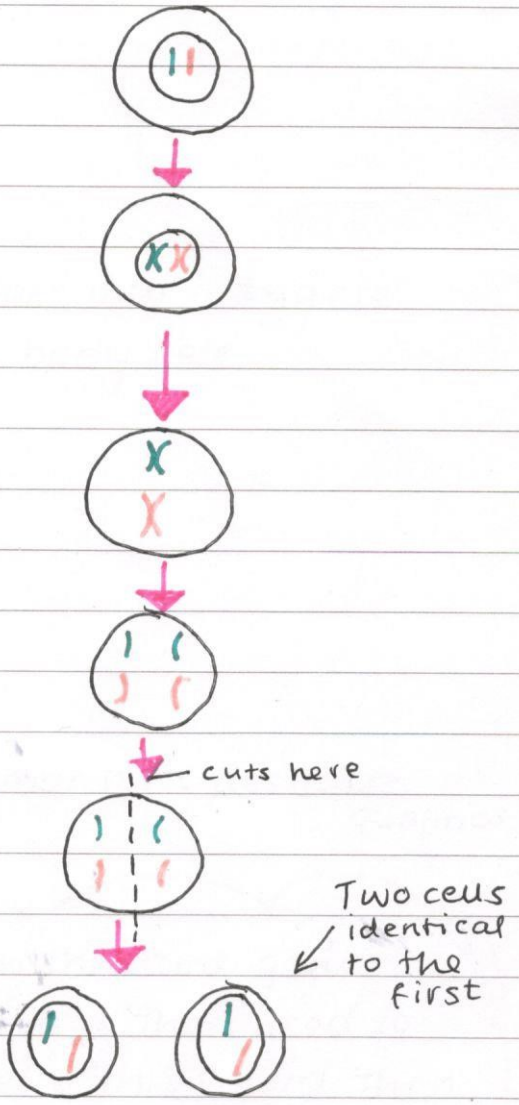
so that when it splits there is the same amount in each

② mitosis

chromosomes line up at the equator and are pulled to either side of the cell.

③ cytokinesis

cell divides. forming 2 identical 'daughter' cells.



# Stem cells

An undiferentiated cell which can undergo division to produce many more cells, some will then differentiate to have different functions.

**Types:**

① EMBRYONIC STEM CELLS
- They form when an egg + sperm fuse into a zygote
- They can differentiate into any body cell

② ADULT STEM CELLS
- found in bone marrow

③ MERISTEMS (in plants)
- found in root + shoot tips
- This means you can clone plants that have desirable qualities

Theraputic cloning = producing an embryo with the same genes as the patient. The embryo is then used to get its embryonic stem cells. This could then be grown into any cells the patient needs.

# Using stem cells in research

| BENEFITS | PROBLEMS |
| --- | --- |
| • can be used to replace diseased body parts | • It may be hard to control stem cells to form the cells we want |
| • We could use unwanted embryos from fertility clinics so they're not destroyed | • Removing stem cells destructs the embryo |
| | • People might have ethical or religious objections as it is intefering with the normal reproduction process |
| | • Growing them could result in contamination with a virus which is then transferred into the person |

# TRANSport in cells.

## ① DIFFUSION → The spreading out of particles resulting in net movement from an area of high concentration to an area of low concentration.

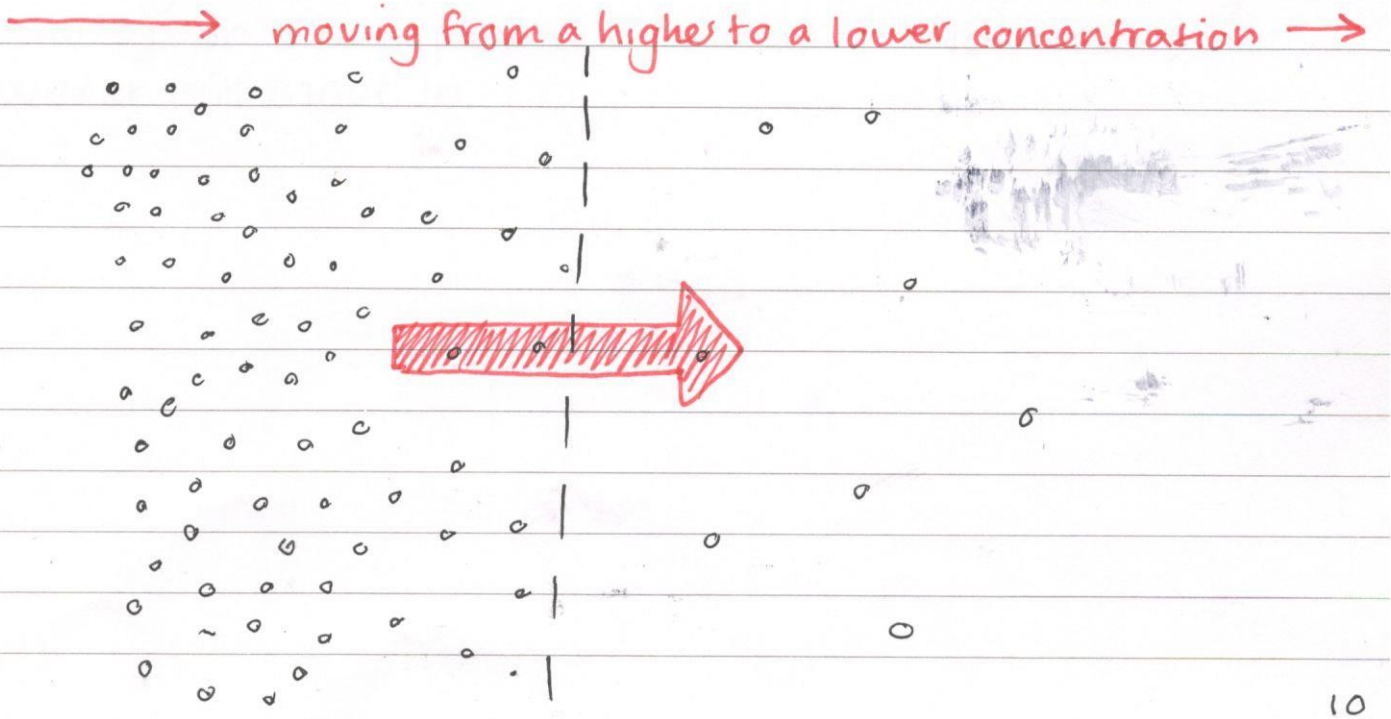
☆ Substances can move across cell membranes by diffusion However, the particles have to be small e.g glucose + oxygen but starch and proteins are too big

# examples of diffusion:

- Breathing - oxygen moves through membranes in the lungs and into red blood cells by diffusion
- Urea - This is a waste product which moves from liver cells and into the blood by diffusion.

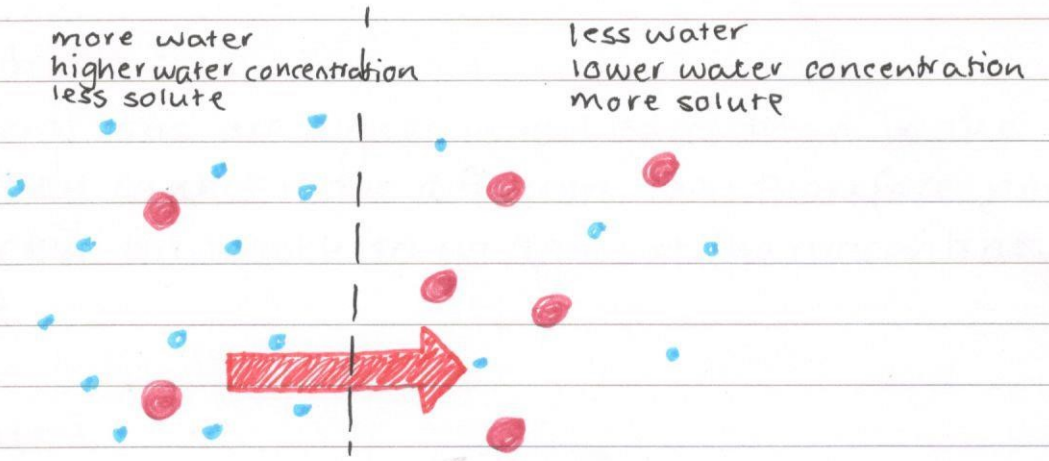
## what affects the rate of diffusion?

1. concentration gradient → greater the concentration, faster diffusion.
2. temperature → higher temperature = particles move more = more collisions = faster diffusion.
3. surface area → Greater surface area = more space for particles to move through = faster diffusion.



# OSMOSIS

The movement of water from a high concentration (i.e. low solute concentration) to a low water concentration (i.e. higher solute concentration) through a partially permeable membrane.




☆ In simple, water always moves from the area with less solute to the area with more solute.

## examples of osmosis:

- The cytoplasm in plants contains salt + sugars (i.e. high solute). So when placed in water (i.e. low solute) water will move in.

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# ANIMAL TISSUES, ORGANS, + ORGAN SYSTEMS

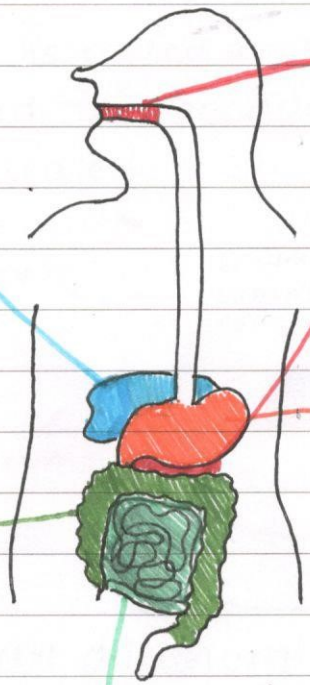
**TISSUE** = A group of specialised cells with a similar structure + function.

**ORGAN** = A number of different tissues, working together for a specific function.

**ORGAN SYSTEM** = A group of organs working together to perform a certain function.

## The human digestive system

– It is an ORGAN SYSTEM



**Glands** (salivary glands, pancreas)

They produce digestive juices containing enzymes which break down food.

**liver**

produces bile which is stored in the gall bladder. this helps to digest lipids (fats)

**stomach**

produces hydrochloric acid to kill bacteria and provide the right pH for the protease enzyme to work

**large intestine**

absorbs water from undigested food to produce faeces.

**small intestine**

This is where soluble molecules are absorbed into the blood.

Bile from liver is released into small intestine. so it can neutralise the hydrochloric acid from the stomach, and to break down large drops of fat into smaller ones.

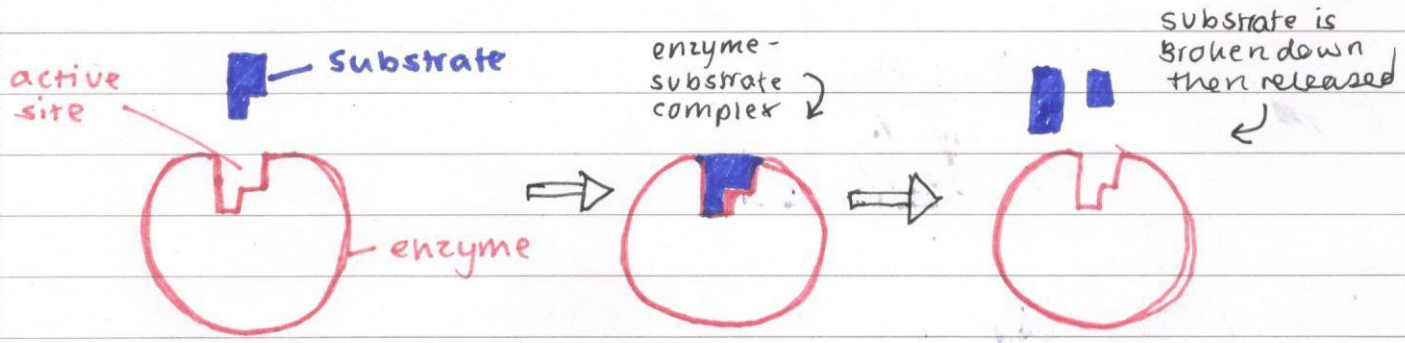
# enzymes

- enzymes are biological catalysts, this means they increase the rate of reactions without being used up.
  - ↳ Enzymes can break up large molecules
  - ↳ Enzymes can join together small molecules
  - ↳ Each enzyme has a uniquely shaped active site where the substrate binds.

## The lock + key hypothesis

★ Enzymes have an active site with a shape that is made specifically to fit the substrate. (when they are bonded together its called an ENZYME-SUBSTRATE COMPLEX)

★ when they bind, the reaction occurs, and the products are released.




## enzymes need an optimum **temperature**

- Usually around 37°c - this makes the molecules collide faster
- Really high temperatures will **denature** (ie. change the shape of the active site so the substrate will no longer FIT)

enzymes also need an optimum **pH**;

- Optimum is pH 7 for most enzymes
- If pH is too high or too low, the amino acids that make up the enzyme will be affected so substrate will no longer fit.

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## ENZYMES IN DIGESTIVE SYSTEM:

Enzymes are used in the digestive system to break down large molecules.

- CARBOHYDRASE - converts **carbohydrate** into **sugar**
- PROTEASE - converts **proteins** into **amino acids**.
- LIPASE - converts **lipids** into **fatty acids and glycerol**

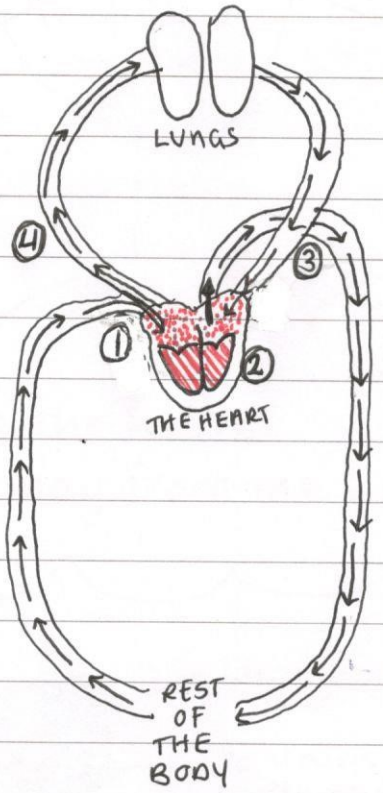
# THE HEART AND BLOOD VESSELS

The heart pumps blood around the body in a **double circulatory system**

i.e. there are 2 circuits;

① Deoxygenated blood going away from heart + into lungs

② Oxygenated blood going from lungs into the heart




① Blood flows into the heart via the vena cava and the pulmonary vein.
② Atria contracts forcing blood into the ventricles
③ Ventricles contract pushing blood through the ventricles. On the left side blood goes out the pulmonary artery to the lungs
④ On the right side blood goes out the aorta to the rest of the body
⑤ Valves close so blood doesn't flow backwards.