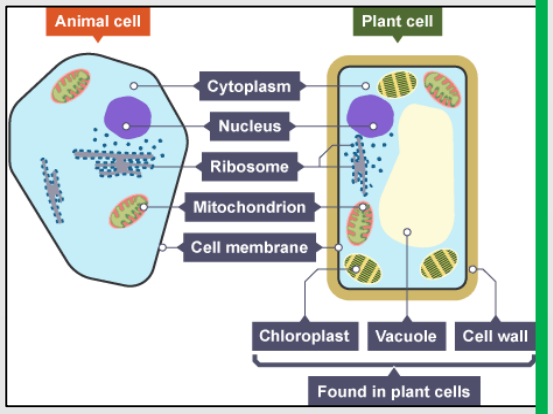
science biology

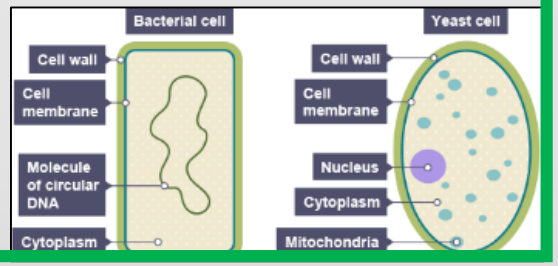
GCSE B1 – Cell Biology

Cell Structure:

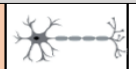
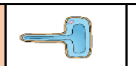
- **Nucleus** Contains DNA and controls cell
- **Ribosomes** Protein synthesis
- **Cell Membrane** Controls what goes in and out the cell
- **Mitochondria** Respiration
- **Cytoplasm** Where chemical reactions occur
- **Chloroplast** Absorb light for photosynthesis
- **Vacuole** Stores cell sap
- **Cell Wall** Made of cellulose to strengthen the cell

Eukaryotic cells – larger, more complex cells, with nucleus eg. animal/plant/fungus
Prokaryotic cells – very small simple cells, no nucleus (loose DNA and plasmids) eg. bacteria





Specialised Cells: cells which have **differentiated** so they have a modified structure to enable them to carry out a specific function.

specialised animal cells	nerve		*carry electrical signals*	long branched connections and insulating sheath
	sperm		*fertilise an egg*	streamlined with a long tail acrosome containing enzymes large number of mitochondria
	muscle		*contract to allow movement*	contains a large number of mitochondria long
specialised plant cells	root hair		*absorb water and minerals from soil*	hair like projections to increase the surface area
	xylem		*carry water and minerals*	TRANSPIRATION - dead cells cell walls toughened by lignin flows in one direction
	phloem		*carry glucose*	TRANSLOCATION - living cells cells have end plates with holes flows in both directions

Microscopes and Magnification:

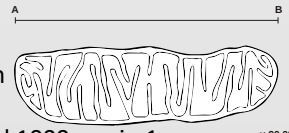
Microscopes allow us to see greater detail in small samples:

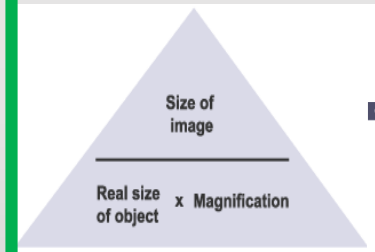
- Adjust the focus (turn the focus wheel) - to make the image more clear (less blurry)
- Increase the magnification (change the objective lens) – to make the image larger

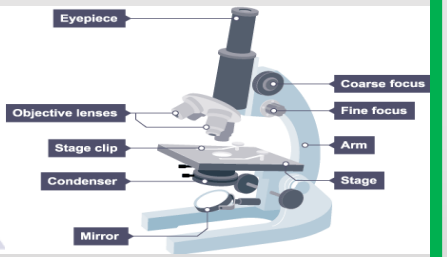
Magnification is the number of times larger an image is compared with the real size of the object.
Resolution is the ability to distinguish between 2 separate points.
PRACTICAL – USING A LIGHT MICROSCOPE

1. Use a stain to make organelles visible (eg. cell wall, nucleus).
2. Get the specimen as flat and thin as possible.
3. Start on the smallest lens, focus, then move up a lens.

CALCULATING ACTUAL SIZE:
Use a RULER to measure the image in mm
Multiply by 1000 to CONVERT mm into µm
Divide image size by the magnification
REMEMBER there are 1000µm in 1mm and 1000mm in 1m







Electron microscopes can magnify the sample up to 1,000,000x and have a much greater resolution than light microscopes

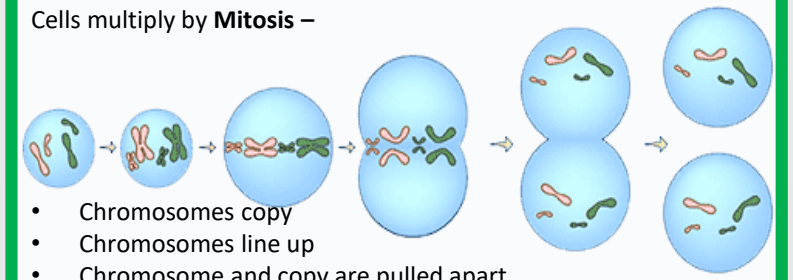
Chromosomes and Genes:

Human body cells contain **46** (23 pairs of) chromosomes. **Chromosomes** are long, rolled-up strands of **DNA** which carry the genes. **Genes** are the codes that instruct how to build an organism. Males = 22pairs + XY Females = 22 pairs + XX

Stem cells are undifferentiated cells that can **clone** to make more stem cells or specialise into any type of body cell by **differentiation**.
+ replace/repair tissue, grow organs, cure disease
- destroys embryo, ethical issues, moral/religious objections
Therapeutic cloning - an embryo is cloned from the patient. Stem cells are taken from the embryo to treat the patient's disease. No rejection issues as genes are the same.

Cell Division:

Cells multiply by **Mitosis –**

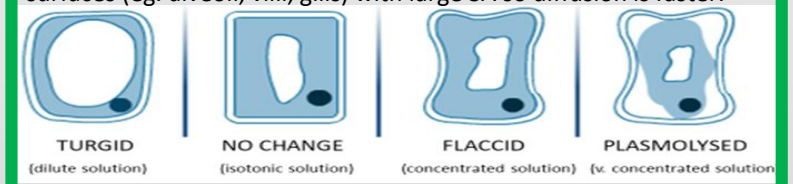


- Chromosomes copy
- Chromosomes line up
- Chromosome and copy are pulled apart
- Cell membrane pinches the cytoplasm in half to divide the cell

Result = 2 daughter cells, identical to each other and the parent cell

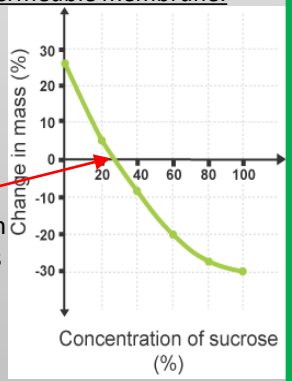
Cell Transport:

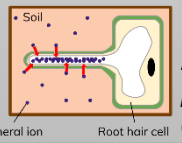
Diffusion – *the movement of particles from a high concentration to a low concentration.* Rate is increased by: ▲ temperature ▲ surface area ▲ concentration gradient ▼ diffusion distance
Large organisms have a small SA:vol so need specialised exchange surfaces (eg. alveoli, villi, gills) with large SA so diffusion is faster.



Osmosis – *the movement of water from a high concentration of water (dilute solution) to a low concentration of water (concentrated solution) across a partially permeable membrane.*

PRACTICAL – OSMOSIS
Cut sections of plant (potato) tissue, put into a range of solutions, leave for 1 hr, remove from solutions, blot dry, re-weigh and calculate the %change in mass.
x intercept = zero change in mass = solution must = concentration of cytoplasm
IV= conc of solution. DV = %change in mass
CVs = time, same potato, solution vol, amount of blotting





Active transport – *energy is used to move particles against a concentration gradient*
eg. soil minerals absorbed by a root hair cell

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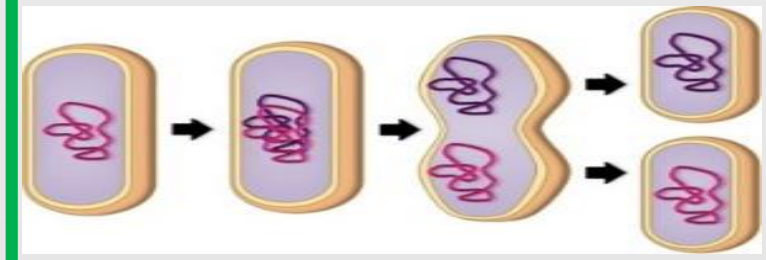
GCSE B1 – Cell Biology (+triple)

Culturing microorganisms

Bacteria multiply by simple cell division (**Binary Fission**) as often as once every 20 minutes if they have enough nutrients and a suitable temperature.



The DNA loop is copied and the cytoplasm separates as the cell wall begins to pinch the cell in half.

Result = 2 genetically identical daughter cells and population growth is **exponential** (1>2>4>8>16>32>64>128….)

Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate.

Sterile cultures of microorganisms are required for investigating the action of disinfectants and antibiotics.

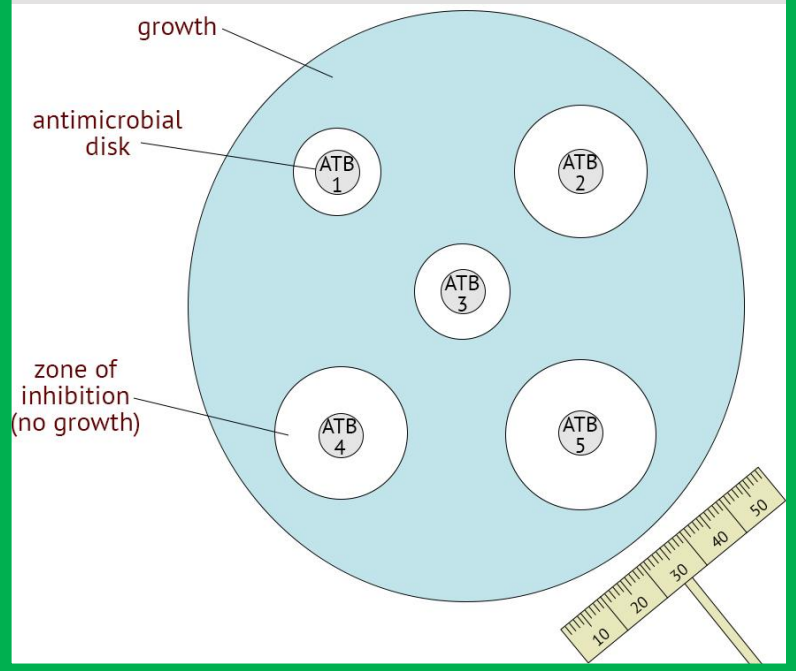
Aseptic technique – a process used to prepare an uncontaminated culture:

- petri dishes and **culture media** must be sterilised before use = no unwanted bacterial growth
- Lift lid only slightly and away from you = prevents contamination from airborne bacteria
- inoculating loops used to transfer bacteria to the dish must be sterilised by passing them through a flame = no unwanted bacterial growth
- the lid of the Petri dish should be secured with 2 pieces of tape and stored upside down = air can get in but lid won't come off and no condensation will form on the lid
- in school laboratories, cultures should generally be incubated at 25°C = no growth of pathogenic bacteria

PRACTICAL - INVESTIGATING THE EFFECT OF ANTISEPTICS ON BACTERIAL GROWTH

1. Using aseptic technique **inoculate** a petri dish with a **lawn** of *E.coli* bacteria.
2. Place discs of filter paper, soaked in a variety of antiseptics (eg mouthwash, hand-gel, disinfectant, water (control)), onto the prepared petri dish.
3. **Incubate** at 25°C for 48h
4. Using a mm scale ruler, measure the diameter of the **zone of inhibition** around each filter paper disc.
5. Calculate area of each clear areas using πr^2.
6. Compare the effectiveness of each antiseptic.

More clear area = more bacteria killed = more effective antiseptic



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