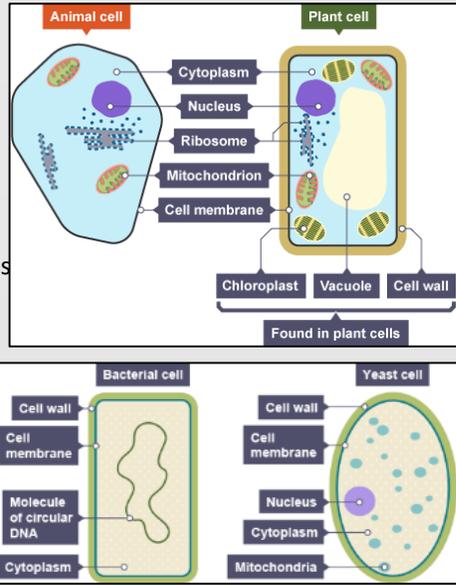


**1. Cell Structure**

- **Nucleus**  
Contains DNA and controls the 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
- **Plasmid**  
Contains additional genes

**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



**2. Specialised Cells:** They are **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

**3. Microscopes and Magnification:**

Microscopes allow us to see greater detail in small samples:

- Adjust the focus (turn the fine focus) - to make the image clearer
- 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.

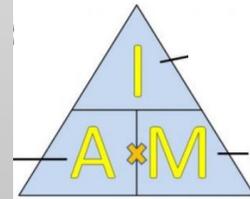
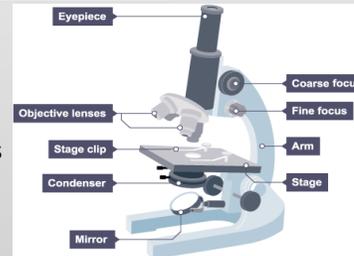
**Resolution** is the ability to distinguish between 2 separate points.

**Types of microscopes**

Feature	Light microscope	Electron microscope
Radiation used	Light rays	Electron beams
Max magnification	1500x	2 000 000x
Resolution	200nm	0.2nm
Size of microscope	Small and portable	Very large and not portable
Cost	Low	High

**Required Practical 1 – 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. Select the lowest objective lens to give the largest field of view.
4. Use the coarse focus to move the stage.
5. Use the fine focus to make the image clearer.
6. Calculate the total magnification = eye piece lens x objective lens



**Calculating magnification:**

Magnification (M) = Image size (I) / actual size (A)

**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 1000nm in 1μm

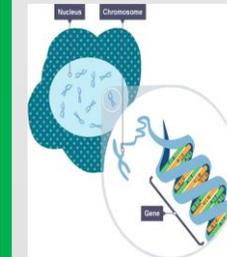
**4. Stem Cells**

**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.

**5. 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 sections of DNA that code for characteristics.

Males = 22pairs + XY  
 Females = 22 pairs + XX

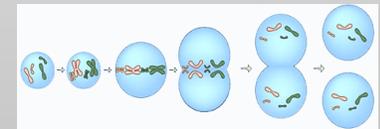
**6. Cell Division:**

Cells multiply by **Mitosis** to produce genetically identical cells.

**Stages of the cell cycle**

**Stage 1: Growth** increase the number of sub-cellular structures e.g. ribosomes and mitochondria.

**Stage 2: DNA synthesis** DNA replicates to form two copies of each chromosome



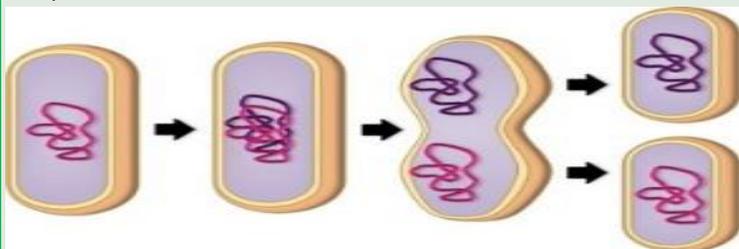
**Stage 3: Mitosis**

Chromosomes line up in the centre of the cell and are pulled apart  
 The cell membrane pinches the cytoplasm in half to divide the cell

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

### 7. 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** ( $1 > 2 > 4 > 8 > 16 > 32 > 64 > 128 \dots$ )

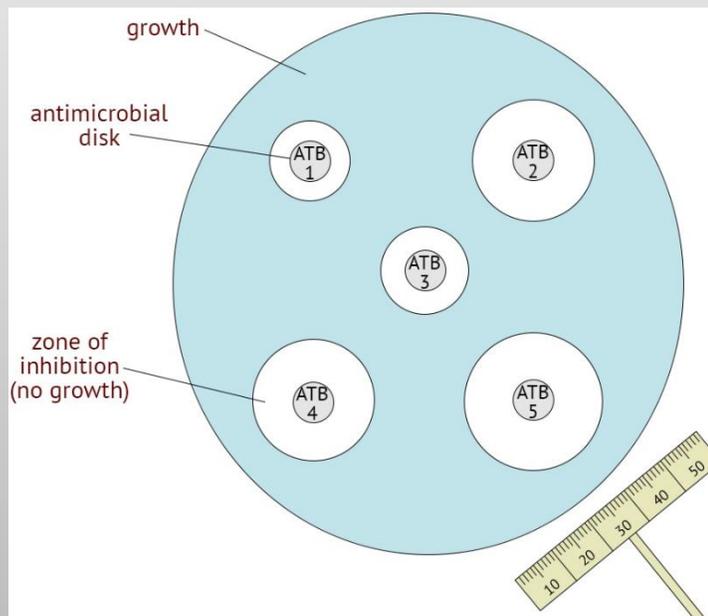
Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate.

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

### 8. PRACTICAL - INVESTIGATING THE EFFECT OF ANTISEPTICS ON BACTERIAL GROWTH

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

More clear area = more bacteria killed = more effective antiseptic



### 9. Aseptic Technique

Preparing an uncontaminated culture.

Process	Why is it important?
Petri dishes and <b>culture media</b> 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

