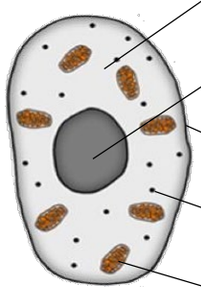
**AQA B1a Cell Structure**
**Combined Higher (page 1 of 2)**

**Required practical for this topic:**
**Microscopy**

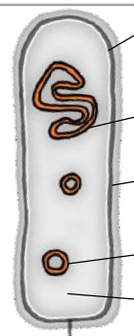
| | |
|---|---|
| **Prokaryotic cells** | These cells include bacterial cells and are much smaller in comparison. They have cytoplasm and a cell membrane surrounded by a cell wall. The genetic material is not enclosed in a nucleus. It is a single DNA loop and there may be one or more small rings of DNA called plasmids. |
| **Eukaryotic cells** | These cells include plant and animal cells. These cells have a cell membrane, cytoplasm and genetic material enclosed in a nucleus. |

**animal cell**



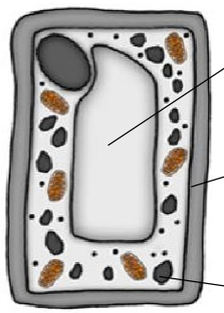
| | | |
|---|---|---|
| **cytoplasm** | Site of chemical reactions in the cell | Gel like substance containing enzymes to catalyse the reactions |
| **nucleus** | Contains genetic material | Controls the activities of the cell and codes for proteins |
| **cell membrane** | Semi permeable | Controls the movement of Substances in and out of the cell |
| **ribosome** | Site of protein Synthesis | MRNA is translated to an amino acid Chain |
| **mitochondrion** | Site of respiration | Where energy is released for the cell to function |

**Bacterial cell**



| | | |
|---|---|---|
| **cell membrane** | Semi permeable | Controls the movement of substances in and out of the cell |
| **bacterial DNA** | Not in nucleus. Floats in cytoplasm | Controls the function of the cell |
| **cell wall** | NOT made of cellulose | Supports and strengthens the cell |
| **Plasmid** | Small rings of DNA | Contain additional genes |
| **cytoplasm** | Site of chemical reactions in the cell | Gel like substance containing enzymes to catalyse the reactions |

**plant cell** *(contain all the parts of an animal cell plus these extras)*



| | | |
|---|---|---|
| **permanent vacuole** | Contains cell sap | Keeps cell turgid, contains sugars and salts in solution |
| **cell wall** | Made of cellulose | Supports and strengthens the Cell (algal cells have a cell wall too) |
| **chloroplast** | Site of photosynthesis | Contains chlorophyll, absorbs light energy |

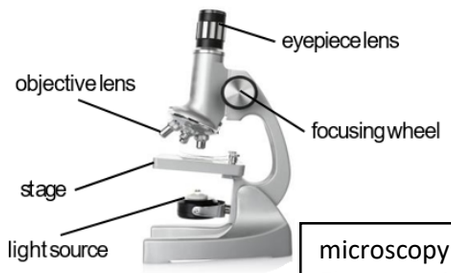
| | |
|---|---|
| **Cell differentiation** | Cells change to form different types of cells. Many types of plant cells can differentiate throughout life. Animal cells differentiate at an early stage of development. |
| **Why is cell differentiation important?** | turn into different types so they can make up different tissues and organs. Without this ability our bodies wouldn't develop or function properly. |
| **Specialised cells** | As a cell differentiates it acquires different sub-cellular structures to enable it to carry out a certain function. It has become a specialised cell. |
| **Stem cells** | Undifferentiated cells. They can divide to form more cells of the same type or can differentiate to form other types of cells. |

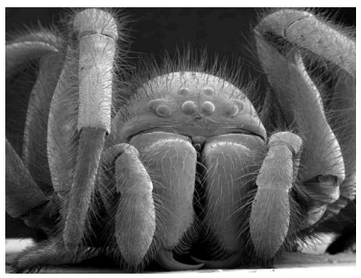
| **PREFIXES** | | |
|---|---|---|
| Prefix | Multiple | Standard form |
| **centi (cm)** | 1 cm = 0.01 m | x $10^{-2}$ |
| **milli (mm)** | 1 mm = 0.001 m | x $10^{-3}$ |
| **micro (µm)** | 1 µm = 0.000 001 m | x $10^{-6}$ |
| **nano (nm)** | 1nm = 0.000 000 001 m | x $10^{-9}$ |

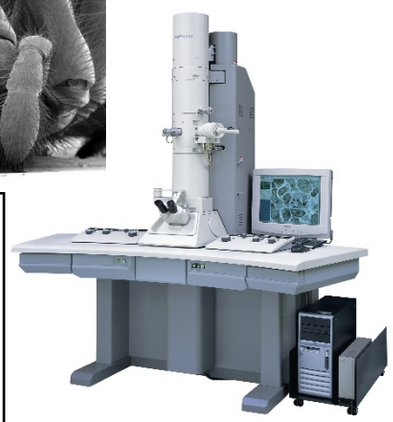
*Remember this equation:*

**magnification (M) = size of image (I) / real size of the object (A)**

I
A M

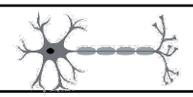
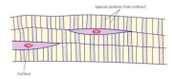


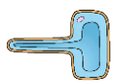
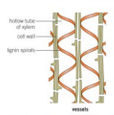
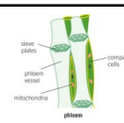


microscopy techniques have developed over time. Electron microscopy has increased our understanding of sub-cellular structures because they have a much **higher magnification and resolution** than a light microscope. This means that they can be used to study cells in much finer detail. This has enabled biologists to see and understand many more sub-cellular structures.

**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. They are also long |

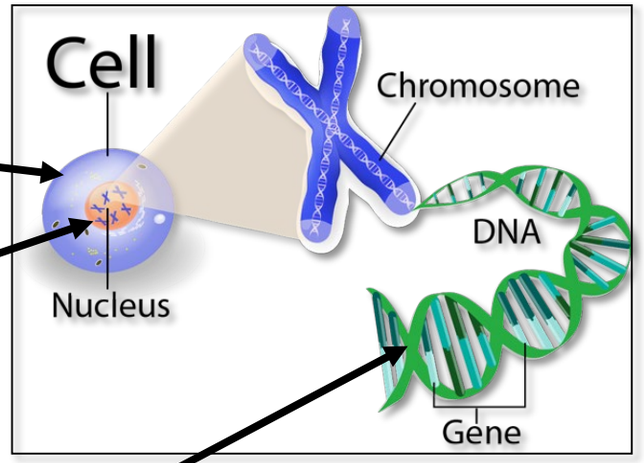
**Specialised plant cells**

| | | | |
|---|---|---|---|
| **Root hair** |  | Absorb water and minerals from the soil | hair like projections to increase the surface area |
| **xylem** |  | Transports water and minerals from the roots to the stem and leaves. This process is called TRANSPIRATION | The xylem is made of dead cells with cell walls toughened by lignin. The water and minerals flow in one direction only |
| **phloem** |  | Carry dissolved sugars from the leaves to the rest of the plant to use or store – this process is called TRANSLOCATION | The phloem is made of elongated living cells which have end plates with pores (holes). Cell sap can move through these pores in the end plates |

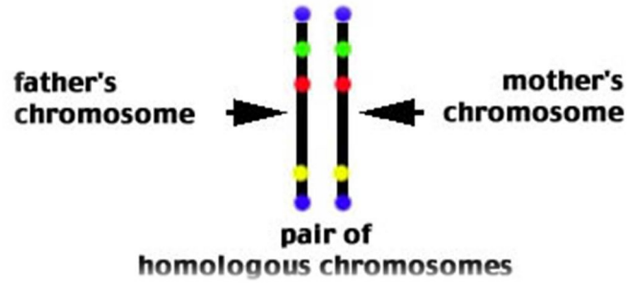
**AQA B1a Cell Structure**
**Combined Higher (page 2 of 2)**

largest ↑ smallest

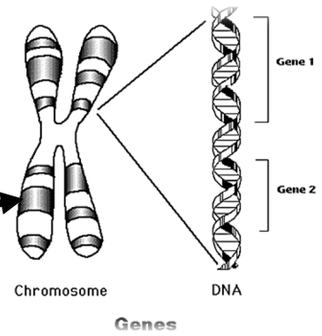
| | |
|---|---|
| cell | The smallest structural and functional unit of an organism. |
| nucleus | A structure that contains genetic material and controls the activities of the cell. |
| chromosome | A thread like structure of coiled DNA found in the nucleus of eukaryotic cells. |
| DNA | A polymer made up of two strands forming a double helix. |
| gene | A section of DNA that codes for a specific protein or characteristic. |

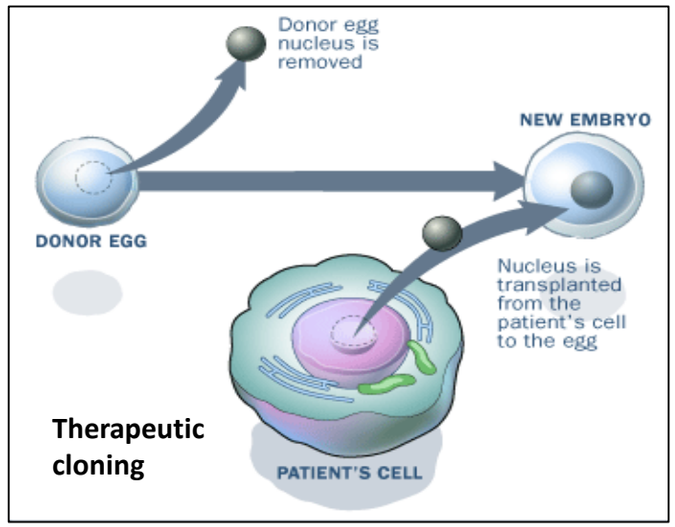



**In body cells the chromosomes are normally found in pairs**




**Each chromosome carries a lot of genes.**

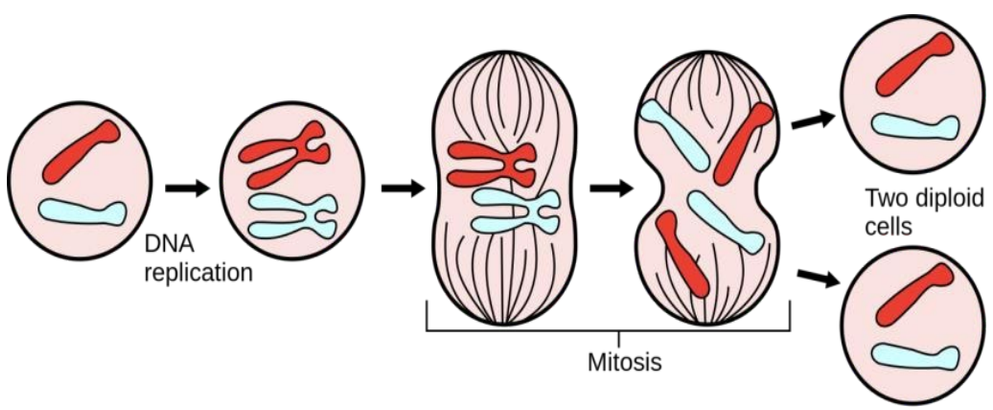



**Cells divide in a series of stages called the cell cycle.**
**During the cell cycle the genetic material is doubled and then divided into two identical cells. There are three stages:**

| | | |
|---|---|---|
| **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 | One set of chromosomes is pulled to each end of the cell and the nucleus divides.<br>Then the cytoplasm and cell membranes divide to form two identical cells. |

**Mitosis is important in the growth and development of multicellular organisms (organisms with many cells)**




| Stem cell type | function | Uses |
|---|---|---|
| Human Embryonic stem cells (from human embryos) | Can be cloned and made to differentiate into most cell types | Treatment with stem cells **(including therapeutic cloning)** may be able to help conditions such as diabetes and paralysis. |
| Adult bone marrow stem cells | Can form many types of human cells e.g. blood cells | |
| Meristems (plants – in the growing tips of shoots and roots) | Can differentiate into any plant cell type throughout the life of the pant. | Used to produce clones quickly and economically for:<br>• Rare species can be cloned to protect from extinction<br>• crop plants with pest or disease resistance can be cloned in large quantities for farmers to use. |

| Stem cell advantages | Stem cell disadvantages |
|---|---|
| • In therapeutic cloning, an embryo is made with the same genes as the patient so the body does not reject the tissue.<br>• With adult bone marrow tissue can be matched to avoid rejection. | • There is a risk of infection with therapeutic cloning e.g. transfer of viruses.<br>• With adult bone marrow only a few types of cells can be formed.<br>• Some people object on religious grounds<br>• Some people object on ethical grounds. |