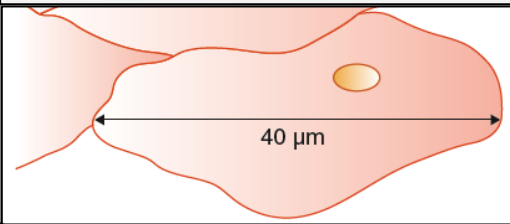


Animal cell

Plant cell

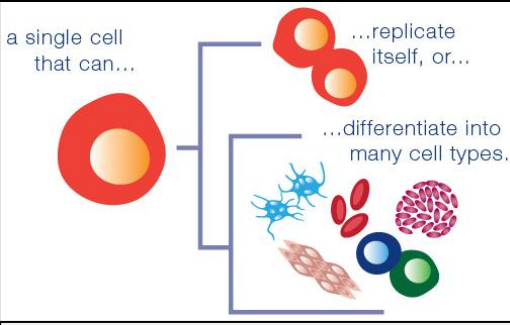
In order to look at cells and their organelles we need to use a **microscope** in order to magnify the image. Following this we need to be able to calculate the actual size of the cell and the **magnification**.



Total magnification = magnification of eyepiece × magnification of objective lens

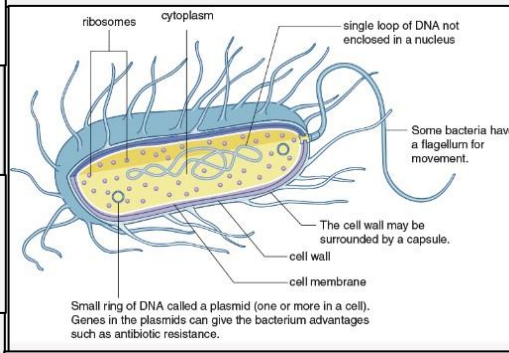
$$\text{magnification of the image} = \frac{\text{size of the image}}{\text{size of real object}}$$

**Stem Cells** are **unspecialised** cells that can produce many different types of cells. They are found in the developing **embryo** and some remain (in certain locations) in our bodies as adults.



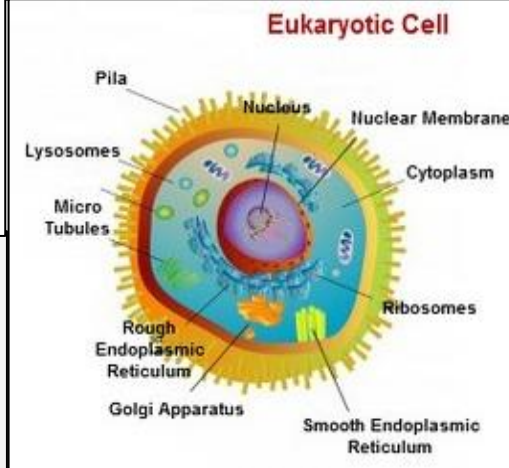
The use of **embryonic** stem cells, which are removed from living embryos, is **controversial**. Due to it raising several **ethical** and **moral** questions. Despite this it can potentially **help** with several complex **genetic diseases**.

**Bacteria** are among the simplest of organisms. Along with bacteria-like organisms called **Archaeans**, they belong to a group of organisms called the **Prokaryota**. The cells of most types of organism (e.g. animals and plants) are **Eukaryotic**. **Prokaryotic** cells are much smaller than Eukaryotic cells. Their DNA is **not** enclosed in a **Nucleus**, it is found as a **single molecule in a loop**.



Small ring of DNA called a plasmid (one or more in a cell). Genes in the plasmids can give the bacterium advantages such as antibiotic resistance.

The small called **Archaeans** were originally grouped in a **kingdom** with bacteria. But in 1977, **Carl Woese** suggested that living things should be divided into three groups called **domains: Bacteria, Archaea and Eukaryota**.

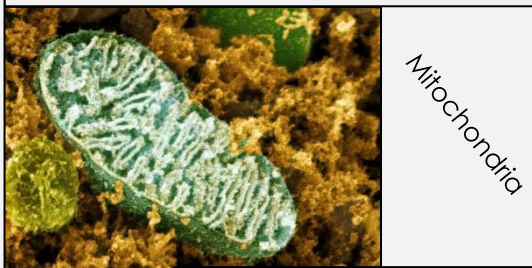


In both animal and plant cells you have;  
**Nucleus** – Containing the **DNA** of the cell and controls the chemical reactions that take place inside the cell. The only type of cell not  
**Cell membrane**; controls substances coming in and out of the cell.  
**Cytoplasm**; This is where most of the chemical reactions take place.

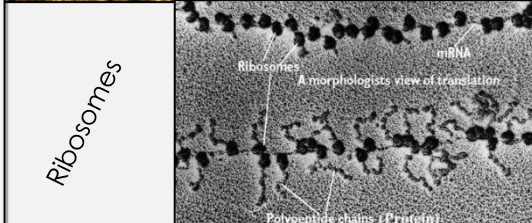
In just plant cells you have;  
**Vacuole**; This is a **sac** containing fluid called **cell sap**. This has its own membrane.  
**Chloroplasts**; These are found in plant cells above ground (not in roots). They contain the **chlorophyll** needed for **photosynthesis**.  
**Cell Wall**; This is an additional layer of structure and support for the cell, it is made from cellulose fibres. It does **not** regulate what comes in and out.

We can see the above **organelles** using a regular **light microscope**. When cells are placed under a **Scanning electron microscope (SEM)**, we can see more detail such as;

**Mitochondria**–**Aerobic Respiration** takes place in the mitochondria. Here, you can see the internal structure of a **double membrane**.  
**Ribosomes**; These are tiny structures where protein synthesis takes place. They can be seen as tiny dots that are either free-floating in the cytoplasm or attached to an internal network of channels.

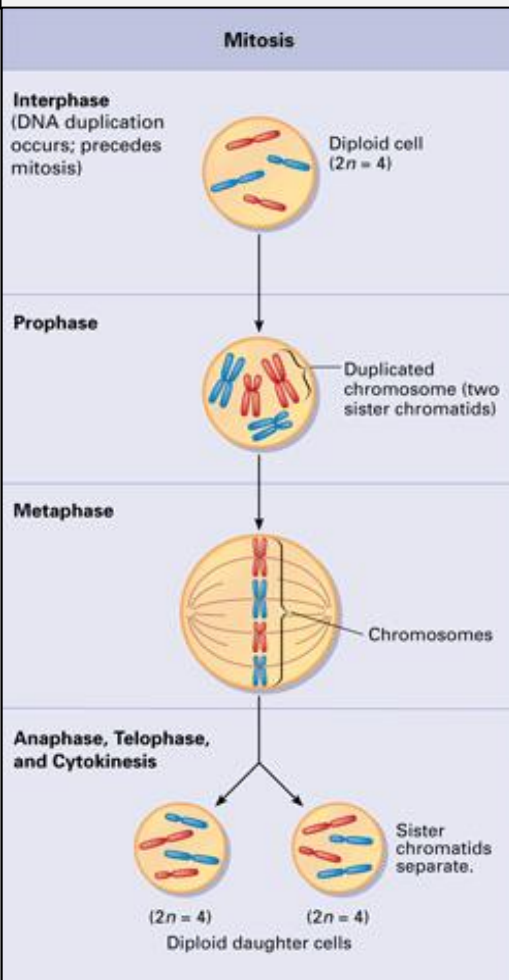


Mitochondria



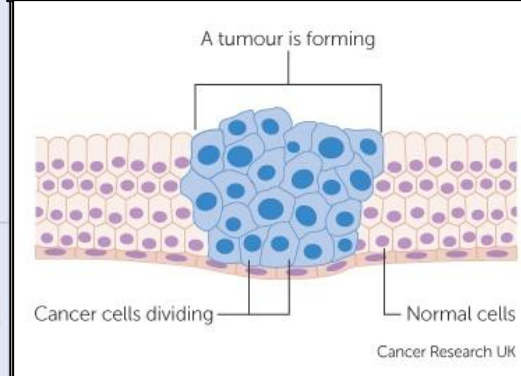
Ribosomes

As we grow, the cells produced by **cell division** must all contain the same **genetic information**. This DNA is contained in chromosomes. **Human body cells** have **46** (or **23 pairs**) of chromosomes, each containing the same type of genes. During growth, cells divide to produce **two daughter cells**, this is called **Mitosis**.

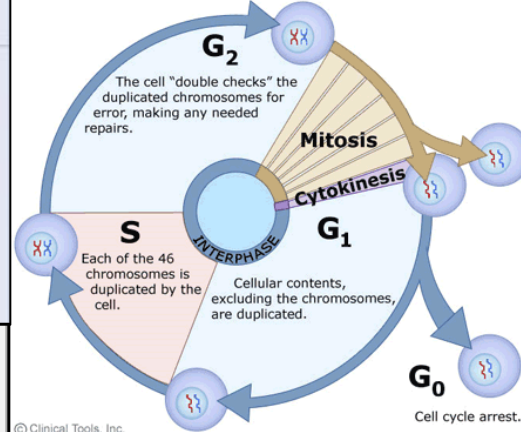


A cell that actively divides goes through a series of stages; this is called the **cell cycle** →

Normally cells grow and divide by **Mitosis** so the body can replace old or damaged cells. When it becomes **cancerous**, it begins to divide **uncontrollably**. These extra cells form growths called **tumours**, which are usually **solid**. However leukaemia, which is a cancer of the blood, is an exception. Cancer is caused by **Carcinogens**, these are chemicals or other agents that cause **mutations** in the cell's DNA.



<b>Benign</b>	<ul style="list-style-type: none"> <li>• slow growing</li> <li>• often have a capsule around them, so can be removed easily</li> <li>• not cancerous and rarely spread to other parts of the body</li> <li>• they can press on other body organs and look unsightly.</li> </ul>
<b>Malignant</b>	<ul style="list-style-type: none"> <li>• grow faster</li> <li>• can spread throughout other body tissues</li> <li>• as the tumour grows, cancer cells detach and can form <b>secondary tumours</b> in other parts of the body.</li> </ul>



Organisms need energy;

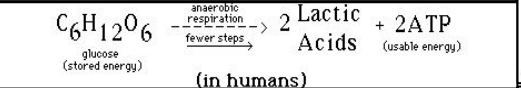
- For movement,
- To drive the chemical changes needed to keep them alive.

**Respiration** is the process used by **all** organisms to **release** the energy they need from **food**.

There are two main types of **respiration**. When respiration is using **Oxygen** then cells will carry out **Aerobic respiration** to release energy from **glucose**. The below equation shows the **overall change**, however respiration actually takes place over a series of steps.



Respiration can also occur without oxygen; this is called **anaerobic respiration**. This process can occur in **Yeast cells**, where it is called **fermentation**. It is much less efficient than aerobic respiration, but when our muscles are contracting they can run out of oxygen, and so respire anaerobically.



In order to study **bacteria** and other microorganisms, its easier to grow them in a **culture**, such as a nutrient broth or agar jelly. When supplied with nutrients and a suitable temperature, **bacteria will multiply**. This process is called **binary fission**. This is not the same as mitosis, it involves **prokaryotes** with a single **chromosome**. In optimal conditions bacteria can multiply as often as every 20 minutes, this can be plotted as a growth curve on a graph.

In a **multicellular organism**, many different types of cell take on **different roles** to ensure that the organism functions as a whole. As they divide, cells can take on new **features** required for their specific **function**. A cells size, shape and internal structure are **adapted** for its role.

