

Anatomy and physiology

Structure and function of cells

Cell Structure

Learning outcome

Understand the key structure and functions of cells

Topics

In this presentation we are going to look at:

Structure of cells

Functions of cells

Structure of a typical human cell

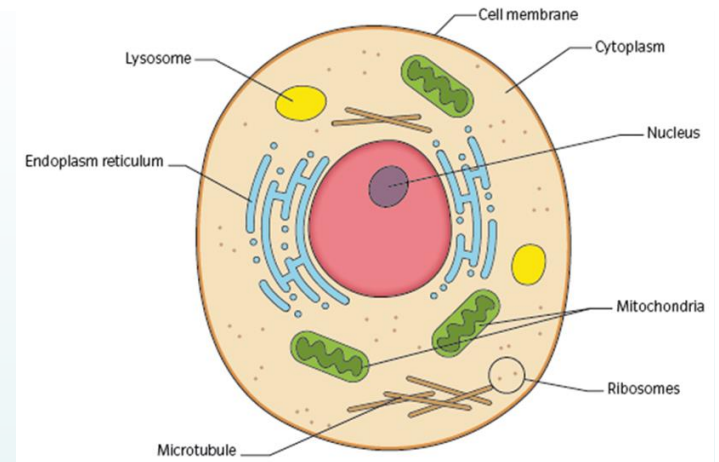
Cells are the building blocks of tissues and organs. They are the smallest functional unit found in our bodies.



Each human cell consists of a **plasma membrane**.

Inside the plasma membrane, is the **cytoplasm**.

Suspended within the cytoplasm are tiny organs called **organelles**. There are several different organelles, including the nucleus, mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes and centrioles. Each organelle has a specialised and individual function.



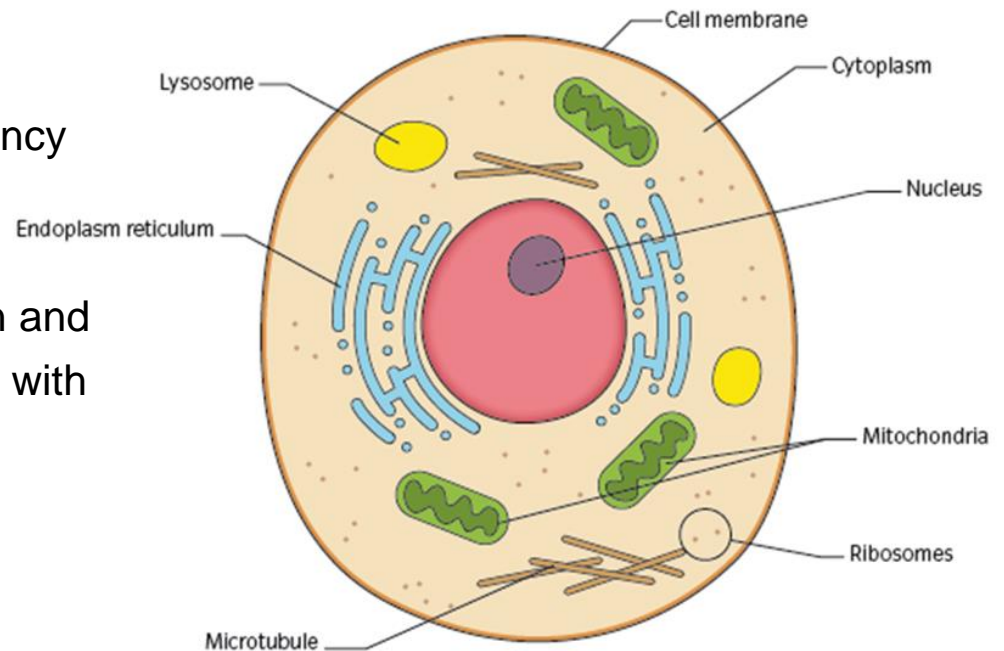
The cell (plasma) membrane

Consists of two flexible layers which surround the cell and enclose the contents of the cell.

The membrane has a similar consistency to olive oil.

The layers are embedded with protein and sugar molecules, which communicate with the contents on either side of the cell membrane.

Everything inside the cell is known as **intracellular fluid**, everything outside the cell is **extracellular fluid**.

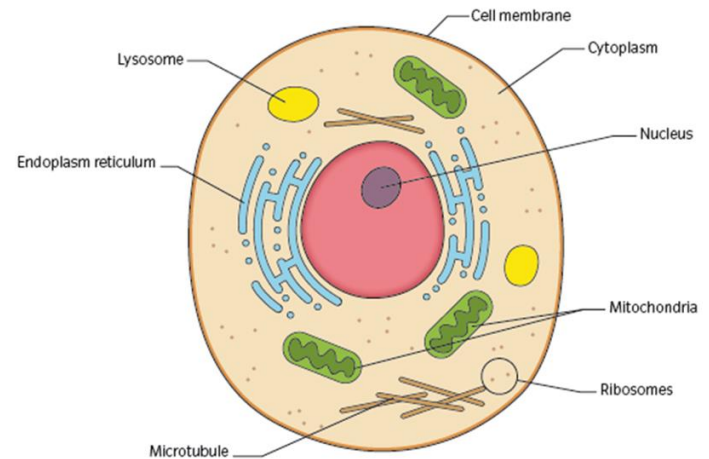


The cytoplasm

This is the region in the cell between the nucleus and the plasma membrane. Most of the cellular activity occurs in the cytoplasm. The cytoplasm contents are contained by the cell membrane.

The cytoplasm consists of:

- **cytosol**, a semi-transparent viscous liquid. It is made up of mainly water, but also proteins, sugars, salts and other solutes
- organelles suspended in the cytosol
- other chemical substances, depending on the function of the cell.



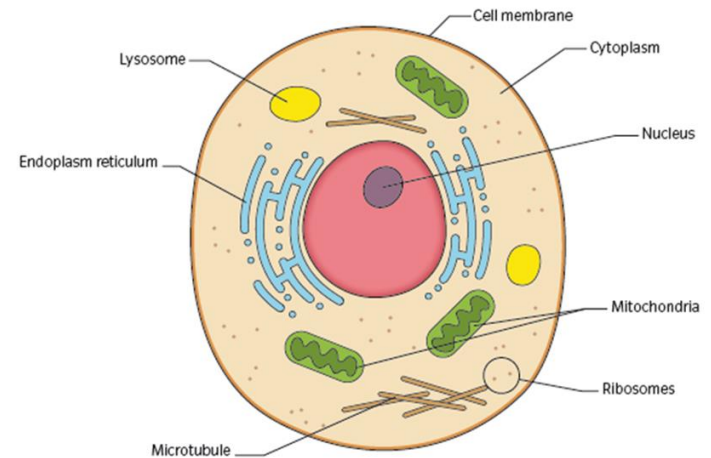
The nucleus

Control centre

The nucleus is the largest organelle.

It contains DNA (deoxyribonucleic acid) which is our genetic material.

Its function can be described as the board of directors, control centre, design departments and construction boss! Responsible for directing metabolic activities in the cells and for providing instructions for the synthesis of proteins in the cells.



Nuclei = pit / kernel

The majority of cells have one nucleus, however, some including bone, skeletal and some liver cells have many.

Red blood cells are an exception, as their nuclei is ejected before the cells begin to circulate in the blood.

Mitochondria

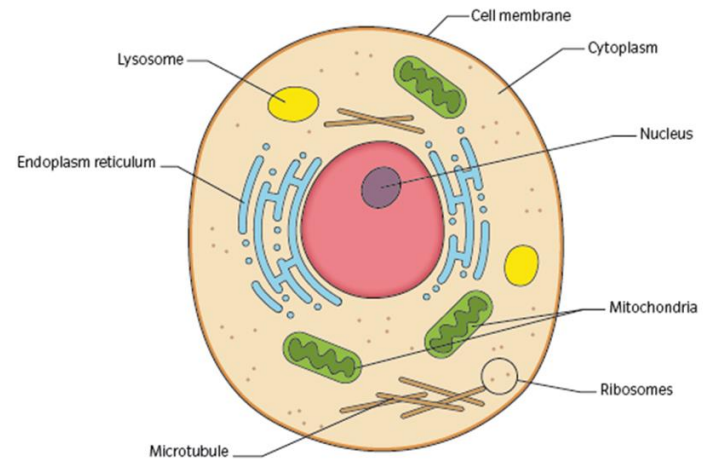
Power house

These are organelles found in the cytoplasm.

They are recognisable by their distinct sausage shaped structures.

They are involved in aerobic respiration - a process whereby energy is made available in the cell. It is often as a result referred to as the power house of the cell.

The more active a cell needs to be, the more mitochondria it has, eg muscle and liver cells.



Centrioles

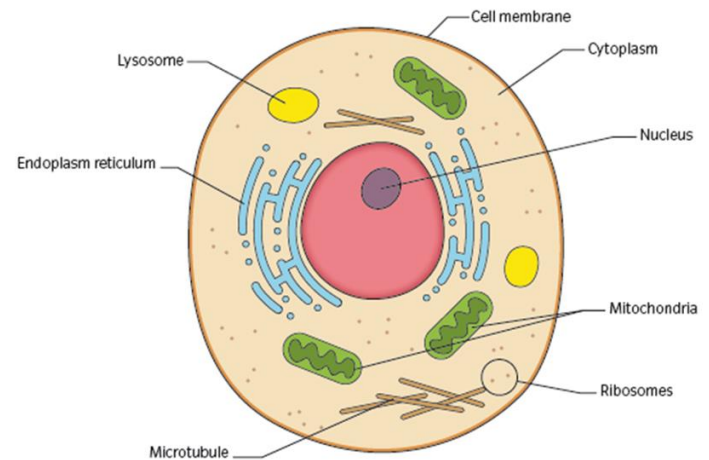
These are small cylindrical organelles, found in pairs and positioned at right angles to each other.

They're usually located in close proximity to the nucleus.

Each centriole is composed of short lengths of microtubules.

They move to opposite ends of the cell (the poles) when it is time for cell division.

They are involved in the development of spindles during cell division.



Cell growth and reproduction

The cell cycle is a series of changes from formation to the time it reproduces. There are two major periods within the cell cycle:

- **Interphase:** Cell growth and cellular routine activity. In addition to routine activities the cell prepares for the next cell division. There are three sub phases where the cell grows by producing proteins and organelles:
 1. G1: the cell grows in size and volume. It may vary in length but it's usually the longest phase
 2. S phase: the synthesis of DNA 46 chromosomes become 92. Chromatin is reproduced which is an essential component for the mitotic phase
 3. G2: further growth and preparation
- **Cell division/mitotic (M) phase**

Cell division

Cell division is essential for the growth and repair of tissues during normal use.

When fully mature, some cells lose their ability to divide such as muscle and nervous cells, resulting in scar tissue.

In most cells the mitotic phase of the cell cycle involves two events:

- **Mitosis (M phase):** division of the cell
- **Cytokinesis:** division of the cytoplasm

Another type of cell division, **meiosis**, occurs when the sex cells (ova and sperm) divide with only half the number of genes found in other cells.

Cell transportation

The cell membrane has selective permeability.

This means that only certain substances can come in and go out of the cell.

Transportation across the cell membrane can occur in many different ways, depending on the size and characteristics of the substance.

Two methods of transportation are diffusion and osmosis

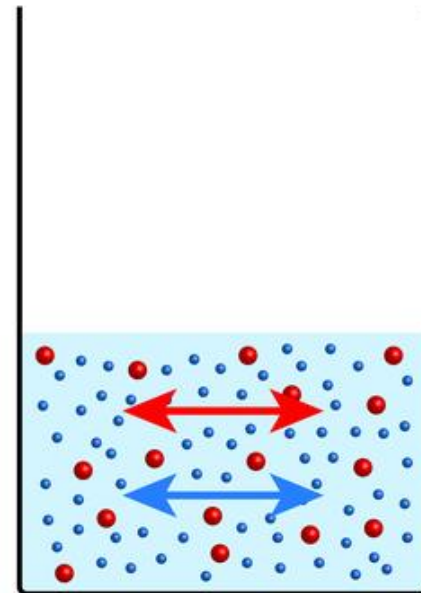
Diffusion

This is the movement of a chemical substance from an area of high concentration to an area of low concentration so that the solution is of equal concentration. It can occur in gases, liquids and solutions.

Can you think of some examples?

- Coffee granules in a cup when water is added, squash in a glass when water is added, the smell of aroma from perfume or a diffuser.

diffusion



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Diffusion (cont.)



Diffusion can also occur across a semipermeable membrane.

Only molecules able to cross the membrane will be able to diffuse through.

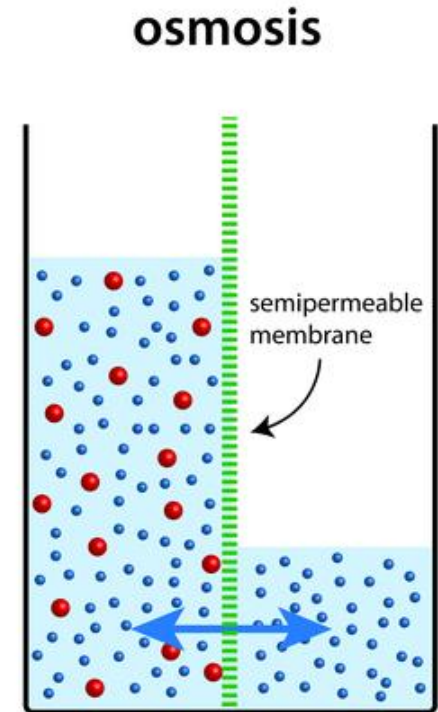
Can you think of some examples where this occurs in the body?

- Through the plasma membrane, in the walls of alveoli in the lungs, capillary walls.

Osmosis

This is the movement of a water down its concentration gradient. This is often because the solute molecules are too large to pass through the pores of a membrane. The force with which this occurs is referred to as osmotic pressure - water is pulled from the dilute solution to the stronger solution across a membrane.

<http://www.bbc.co.uk/education/guides/zc9tyrd/video>



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