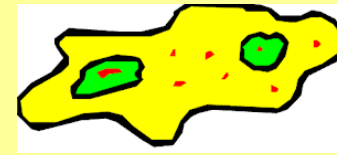
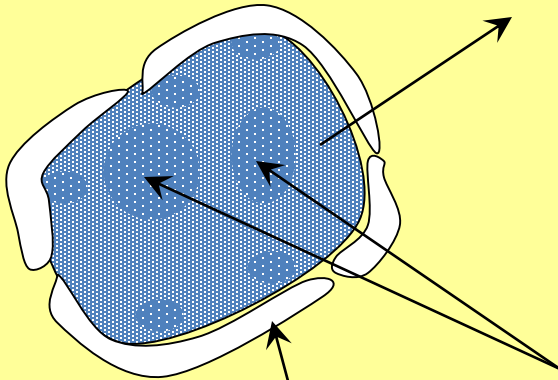


The nucleus



The nucleus contains the cell's genetic material in the form of chromosomes together with a cytoplasm like substance called **nucleoplasm**.

DNA is bound to proteins and is called **chromatin** – this condenses to form the chromosomes during cell division.



Within the nucleus are 1 or 2 bodies – each called a **nucleolus** these make rRNA and assemble **ribosomes**.

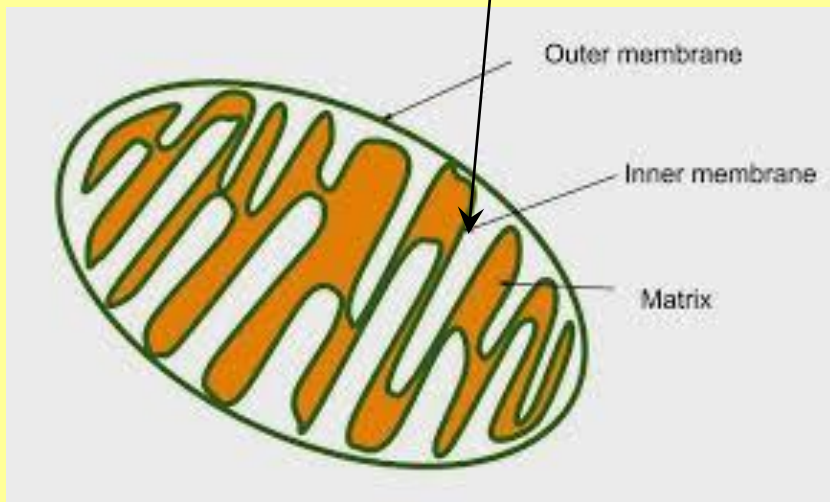
The **nuclear envelope** is a double membrane structure containing pores that allow the transport of mRNA and nucleotides.

## Mitochondria

Mitochondria are formed from 2 membranes separated by a narrow **inter-membrane space**.

The inner membrane is folded to increase its surface area into extensions called **cristae**.

The biochemical reactions of **aerobic respiration** take place in the mitochondria and they release chemical energy in the form of **ATP**.



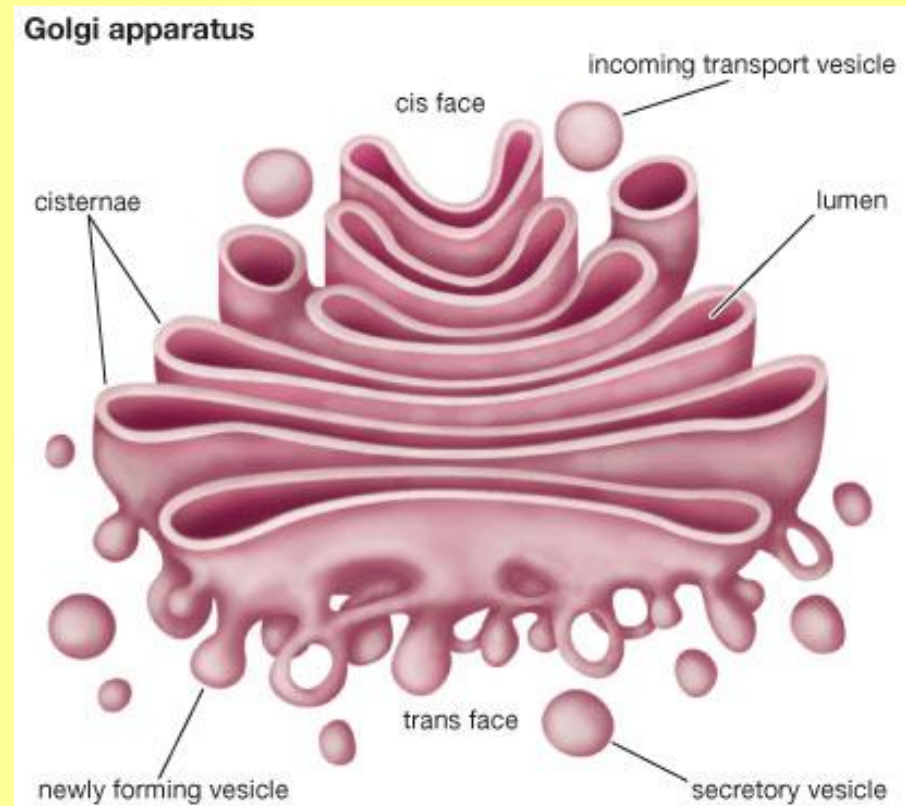
## Golgi body

The Golgi body is similar in structure to smooth ER but has a more compact form.

It is a collection of flattened membrane sacs that are constantly forming on one side and budding off as vesicles on the other

Its functions are:

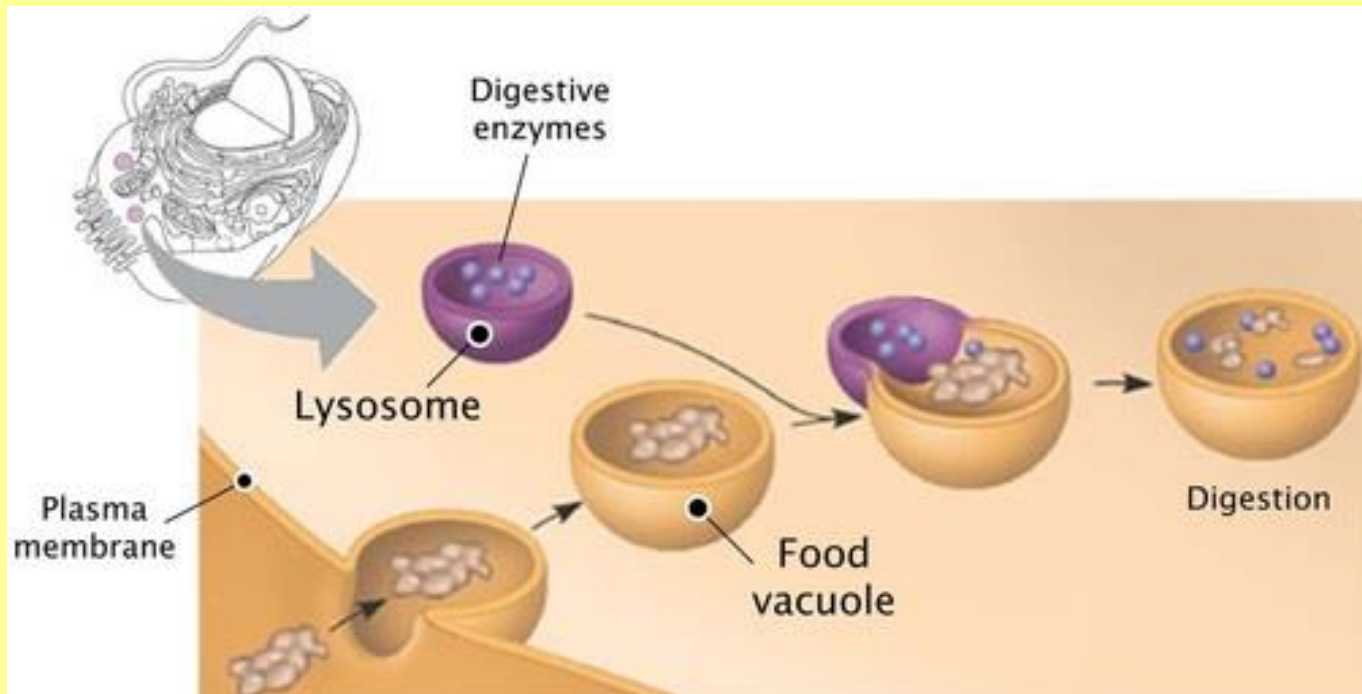
- to modify and package proteins for secretion.
- to form lysosomes.



# Lysosomes

Lysosomes contain and isolate **digestive enzymes** – they are needed to prevent the rest of the cell being digested by these enzymes.

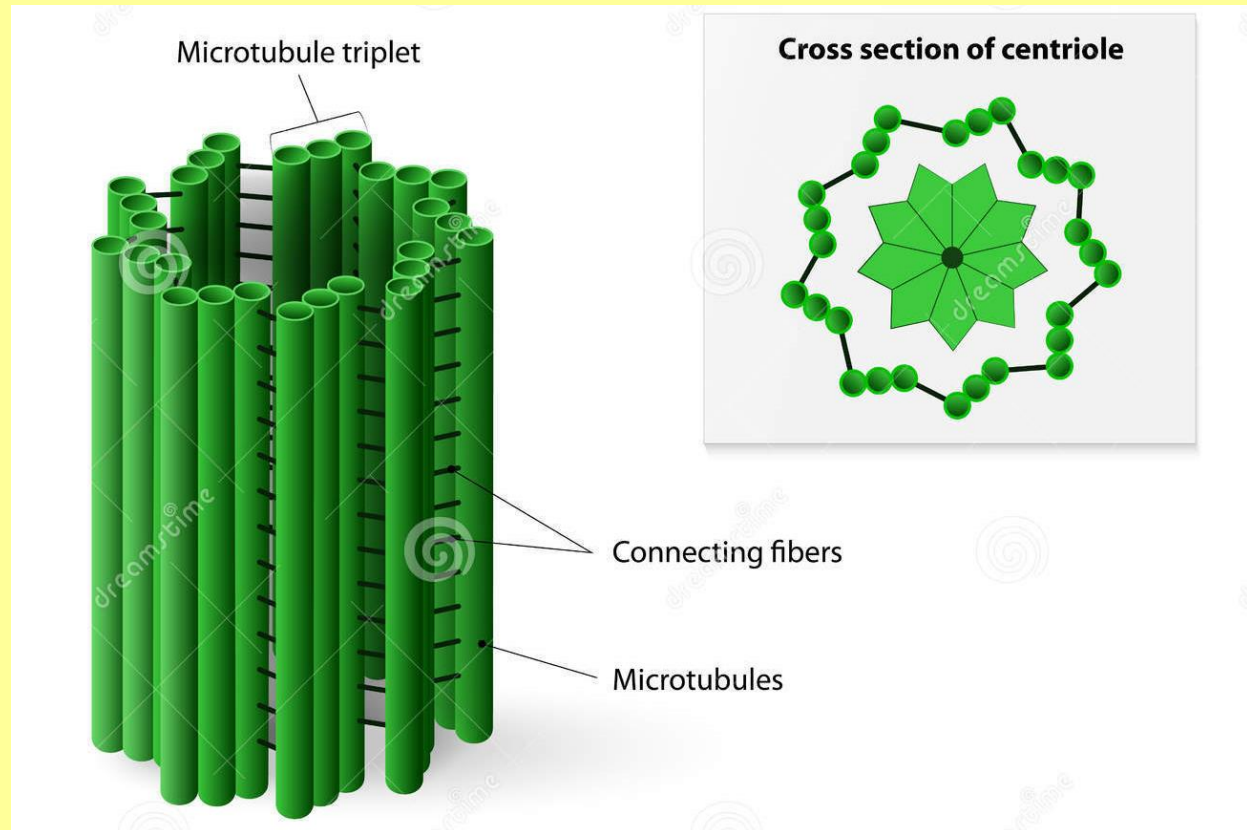
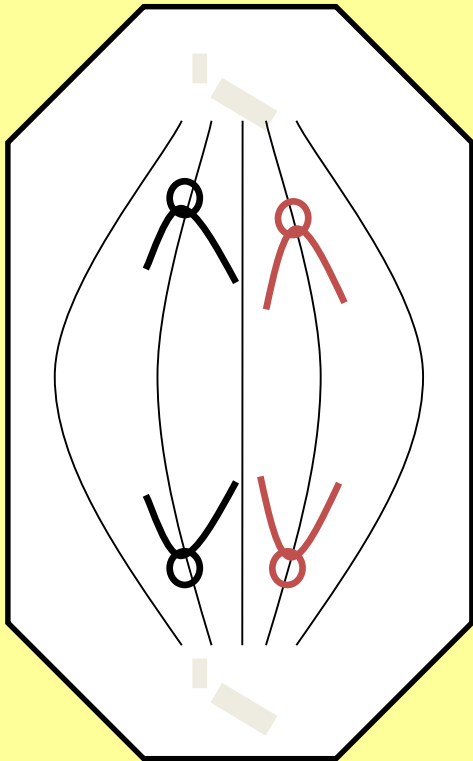
Several lysosomes may empty their contents into one membrane lined vacuole containing a worn out organelle in order to break it down.



# Centrioles

Centrioles arise from a region of the cytoplasm called the **centrosome** and consist of 2 hollow cylinders made of microtubules.

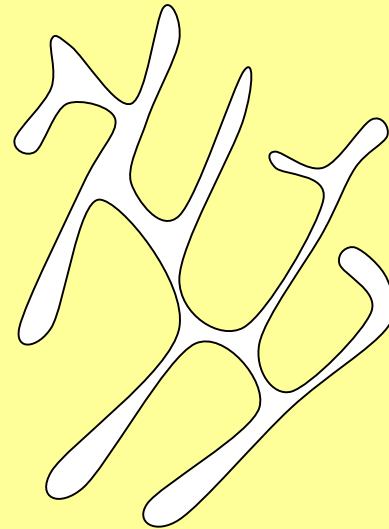
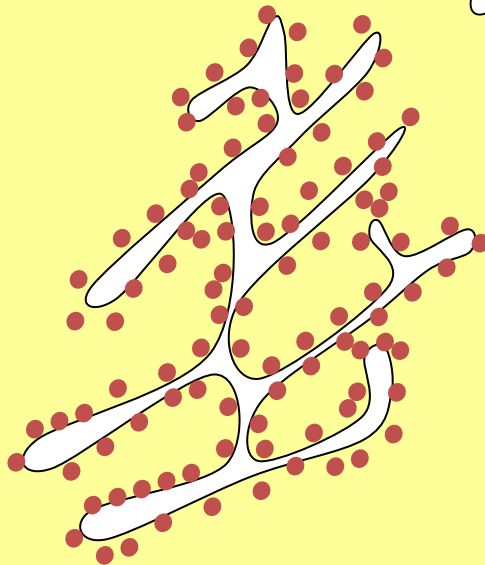
At cell division they migrate to opposite poles of the cell and produce the microtubules of the spindles that pull chromosomes apart.



## Endoplasmic Reticulum

The endoplasmic reticulum (ER) is an elaborate system of membrane bound sacs (cisternae) – these are often continuous with the nuclear envelope and the Golgi body.

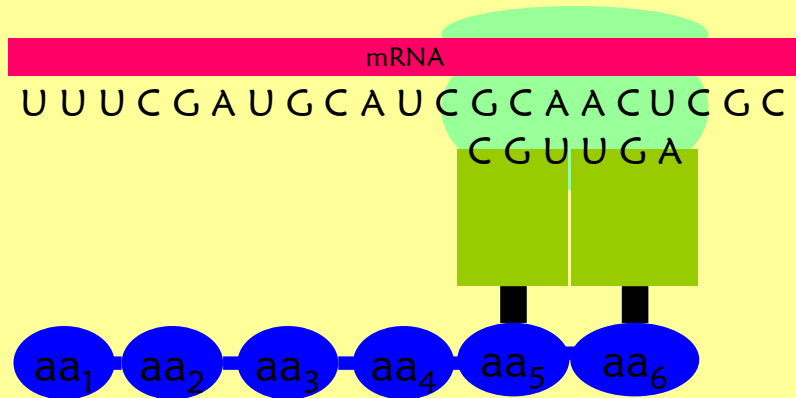
Rough Endoplasmic Reticulum (RER) has [ribosomes](#) lining it and is involved with protein synthesis.



Smooth Endoplasmic Reticulum (SER) lacks ribosomes – it is involved with the synthesis and transport of lipids

# Ribosomes

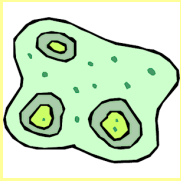
Ribosomes are involved in protein synthesis – they move along molecules of mRNA and read the nucleotide code to produce proteins



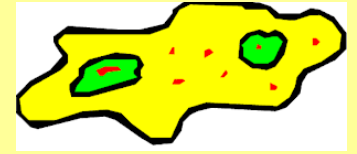
Ribosomes are made of rRNA (produced by the [nucleolus](#)) and protein – they consist of one large and one small sub-unit

small sub-unit

large sub-unit

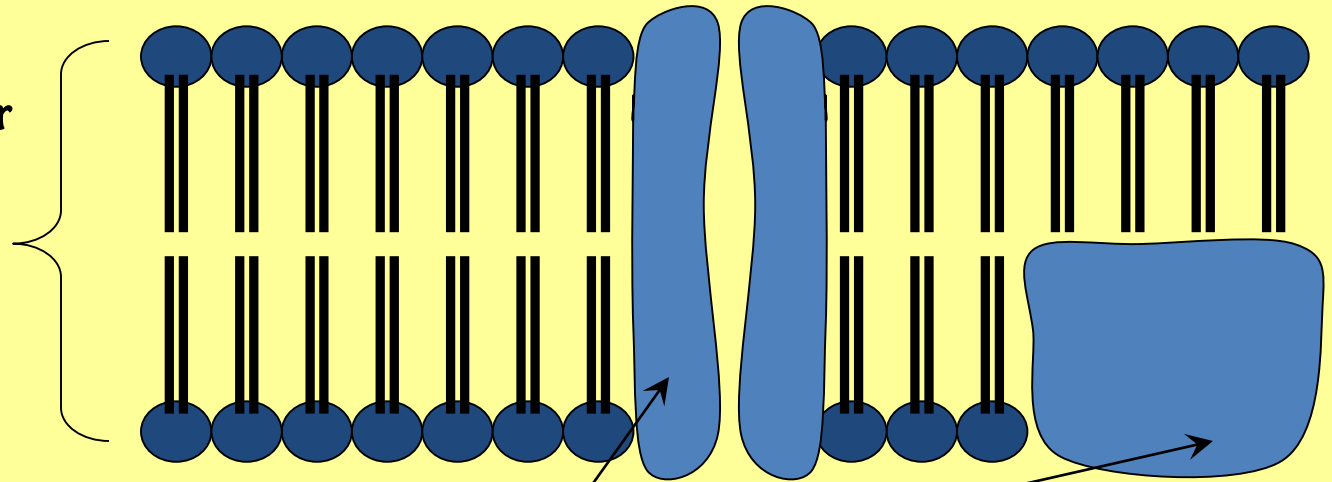


## Cell Surface (Plasma) Membrane



The main function of a cell membrane is to function as a boundary between the cell and its environment – it controls entry and exit into and from the cell.

A phospholipid bilayer forms the majority of the membrane



Proteins also totally penetrate and appear on the inner and outer surfaces of the membrane



# Chloroplasts

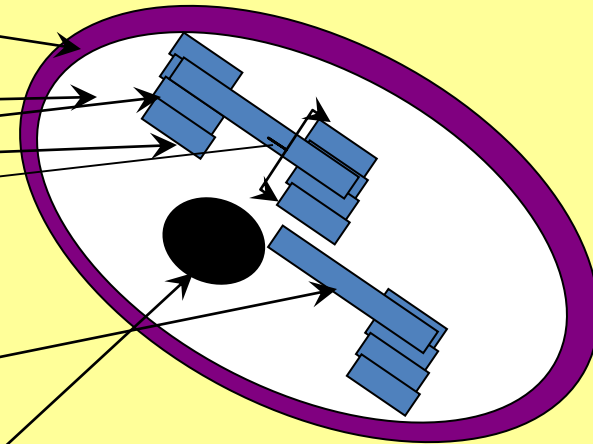
Found only in plant cells – chloroplasts are bound by a double membrane known as the **chloroplast envelope**.

Inside is a colourless matrix – the **stroma**

Floating in the stroma are **thylakoids**  
these stack together to form a **granum**  
(like stacking pitta breads)

The grana can be interconnected by  
tubular extensions called **intergranal lamellae**

**Starch grains** are also  
present.

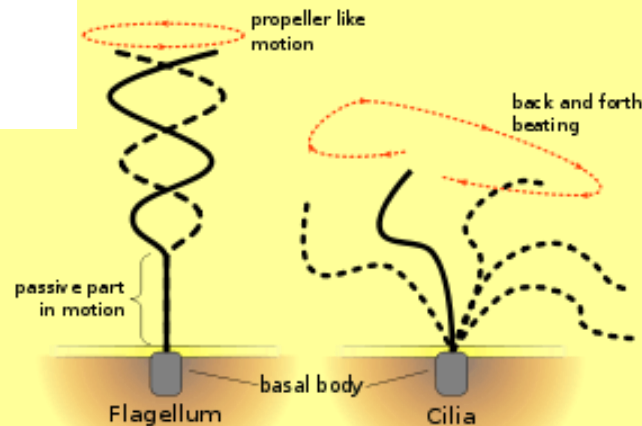
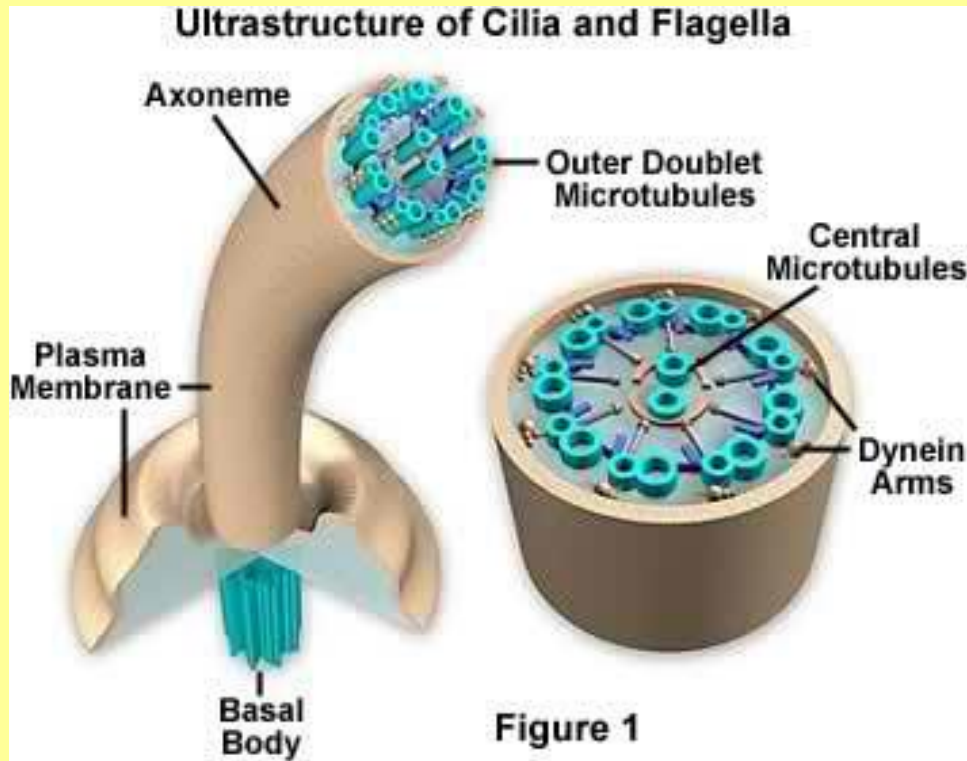


# Flagella and Cilia

Flagella (undulipodia) and cilia have essentially the same structure.

They are made up of nine microtubules arranged in a circle with a further two microtubules in the centre.

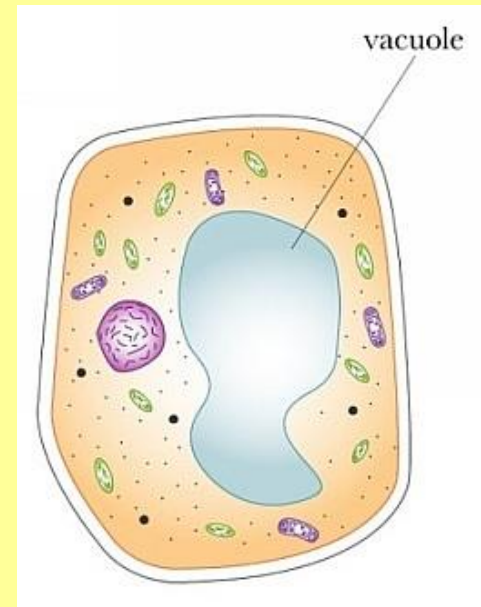
Flagella are normally longer and occur in ones and twos whereas cilia are much shorter but are present in larger numbers/.



## Vacuole

These are **large** and **permanent** in plant cells.

They are fluid-filled-sacs found in the cytoplasm and are surrounded by plasma membrane called the **tonoplast**, which is selectively permeable.



## Cell Wall

In plant cells, these surround the cell surface membrane.

In plants they are made of the complex carbohydrate **cellulose**.

The cell wall is freely permeable and gives the cell support.

