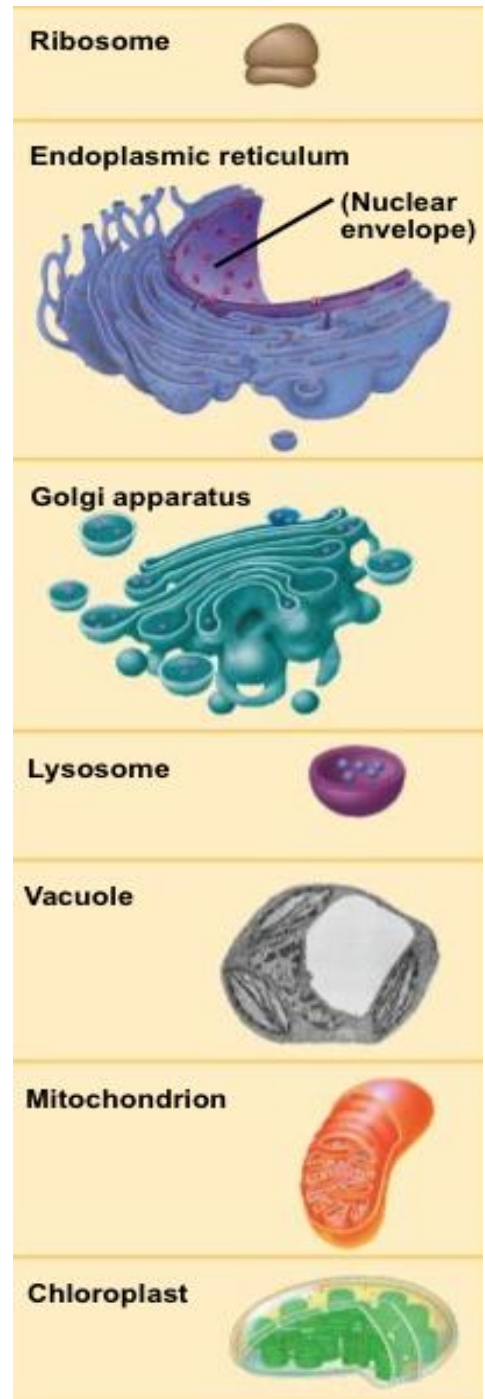


Organelles

Organelles are **enclosed by their own lipid membranes** similar to the outermost cell membrane.

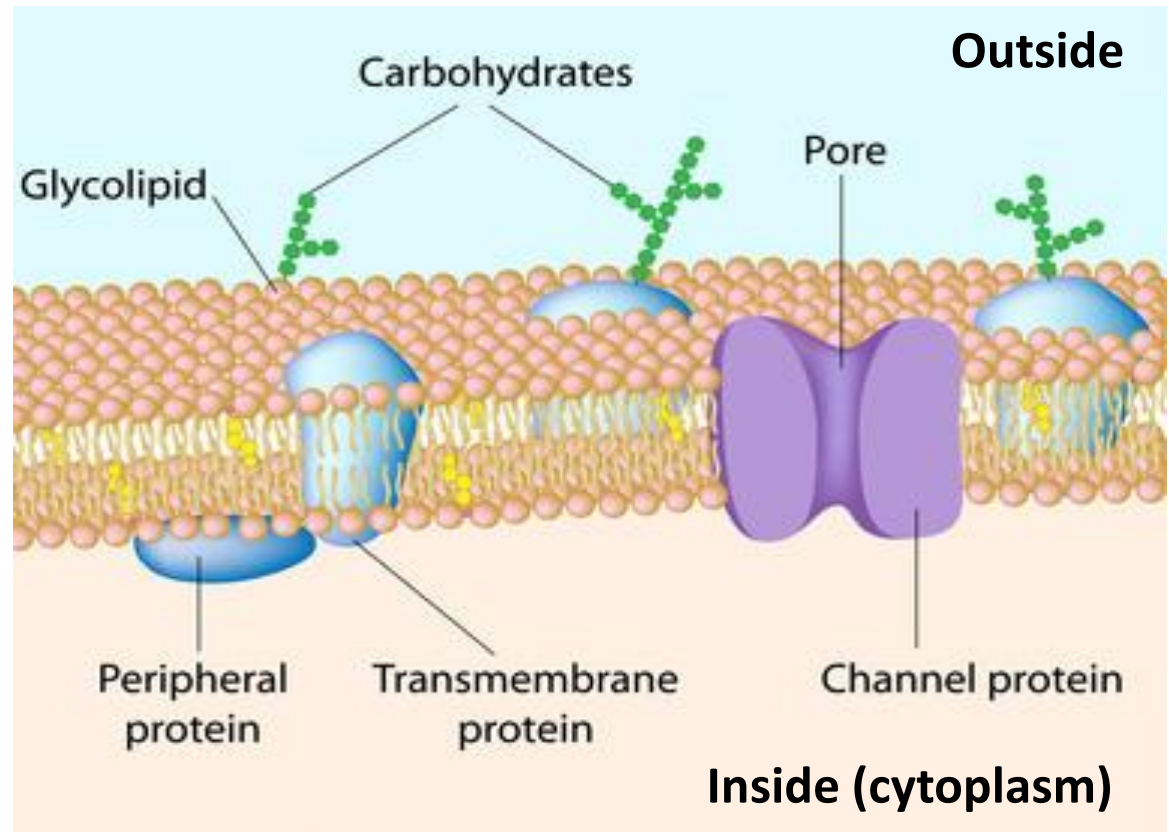
- All organelles in a cell perform different functions (*see details on each next slide*).
- The number of individual organelles of each type found in a given cell varies depending upon the function of that cell.
- The **larger organelles**, such as the *nucleus* and *vacuoles*, are **easily visible with the light microscope**. They were among the first biological discoveries made after the invention of the microscope.
- Both plant and animal cells have many, but not all, of the same organelles.



Cell Membrane

The cell membrane (aka the *plasma membrane*) separates the interior of all cells from the outside environment.

- All membranes are **lipid (fat) double layer**.
- Basic function is to **protect the cell** from its surroundings.
- **Selectively permeable** to ions and organic molecules.
- Control the **movement of substances in and out** of cells.

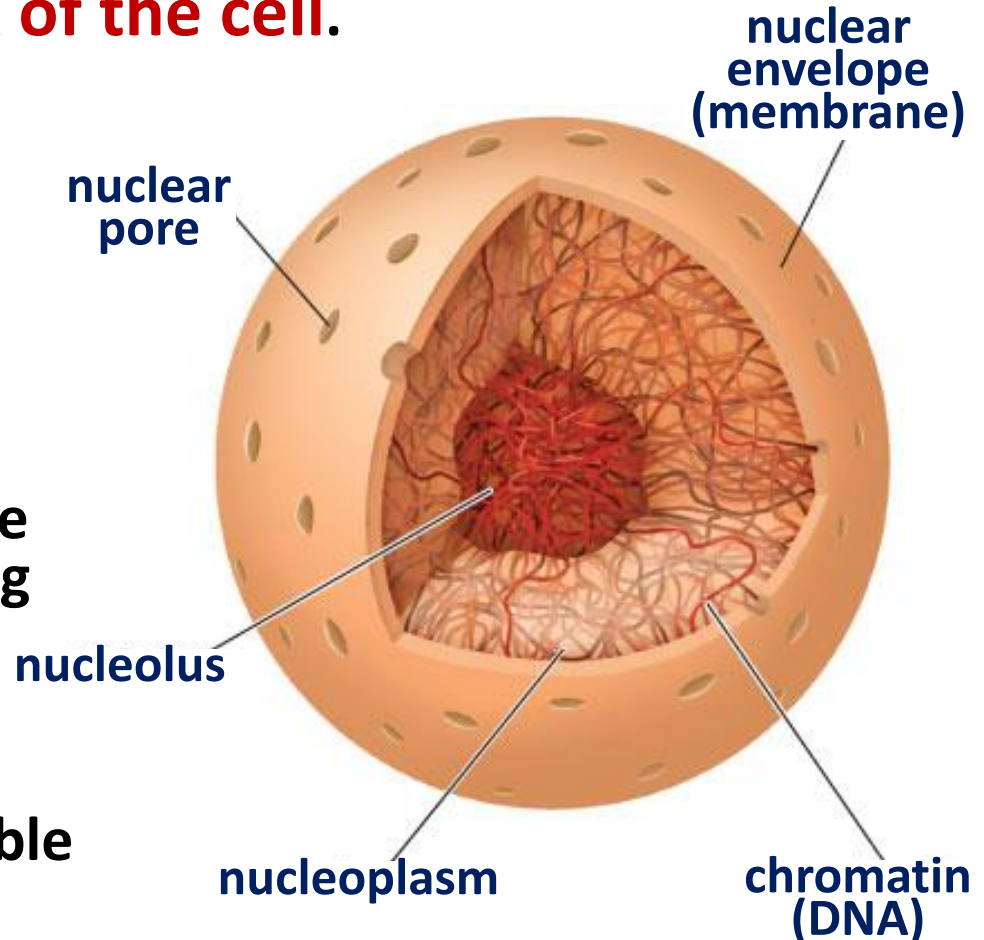


Nucleus

The nucleus is the **control center** of the cell.

- The **largest organelle** in the cell.
- Contains (most of) the **DNA of the cell**.

- The nucleus was **the first organelle to be discovered**:
Antonie van Leeuwenhoek observed a "Lumen", the nucleus, in the red blood cells of salmon.
- Main function - to control gene expression and mediate the replication of DNA during the cell cycle.
- Inside the nucleus is a *suborganelle* called the **nucleolus**, which is responsible for making **ribosomes**.

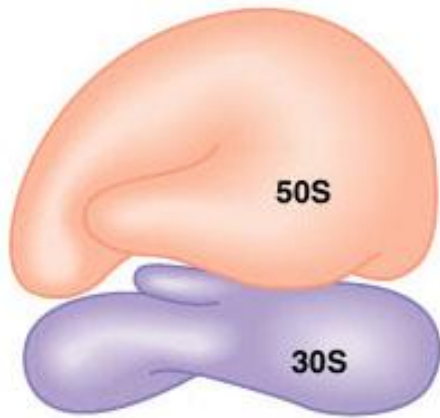


Ribosomes

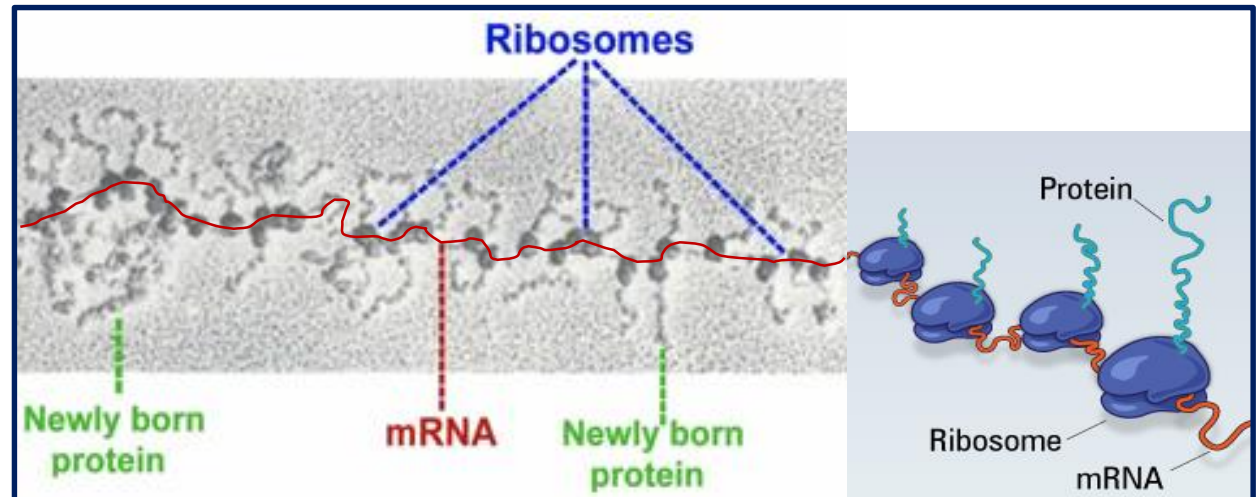
The ribosome is a complex molecular machine responsible for the **synthesis of proteins** in cells.

Two major components:

- the **small subunit** which reads the RNA
- the **large subunit** which joins amino acids to form a polypeptide chain.



The process
of protein
synthesis
(translation) →



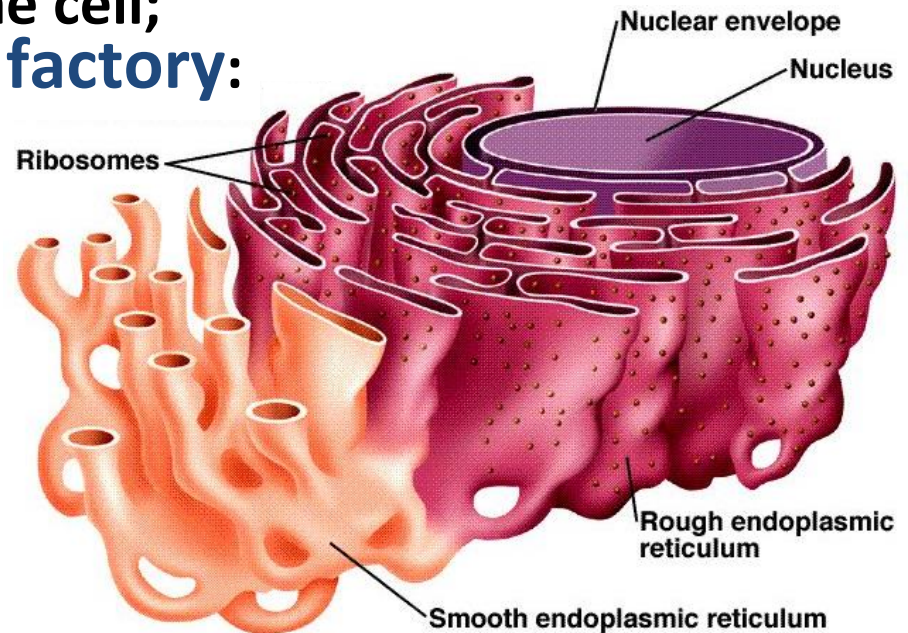
The **ribosomes** are found within all living cells: some are free floating in the cytoplasm, but most are attached to the **endoplasmic reticulum**.

Endoplasmic Reticulum

The endoplasmic reticulum serves many general functions: **folding of protein molecules**, **synthesizing lipids** and **steroids**, and **transport of synthesized molecules** within the cell.

Consists of a network of “lacy” membranes throughout the cytoplasm of the cell; function is similar to that of a **factory**:

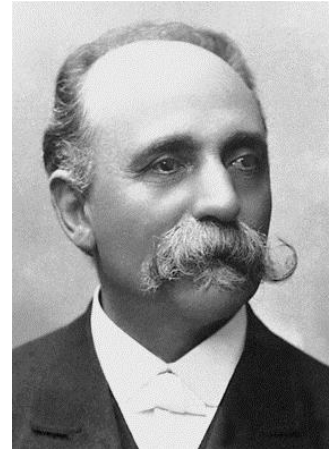
- **Rough ER** - **houses ribosomes** on its surface; helps make and transports proteins.
- **Smooth ER** - makes and transports lipids and other materials within the cell (no ribosomes found on its surface).



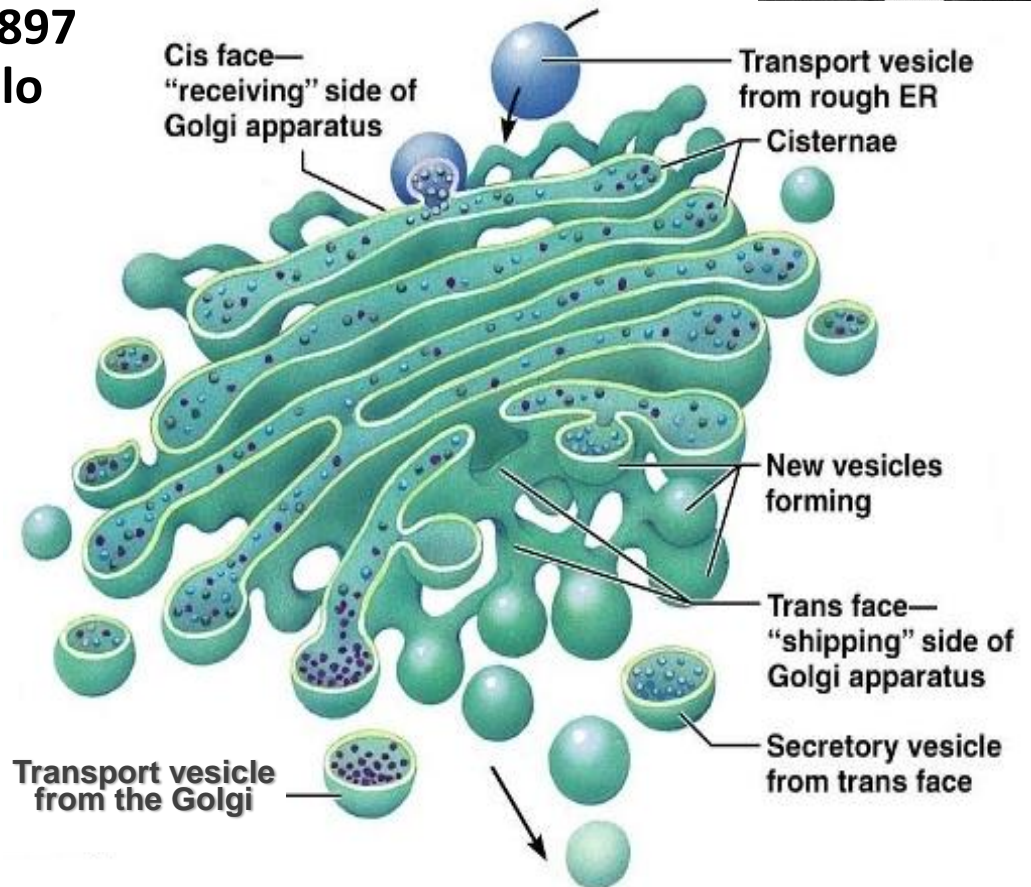
The rough endoplasmic reticulum works together with the **Golgi Apparatus** to target new proteins to their proper destinations.

Golgi Apparatus

The Golgi apparatus (aka Golgi complex or Golgi body) **processes proteins and other molecules** produced in the endoplasmic reticulum.

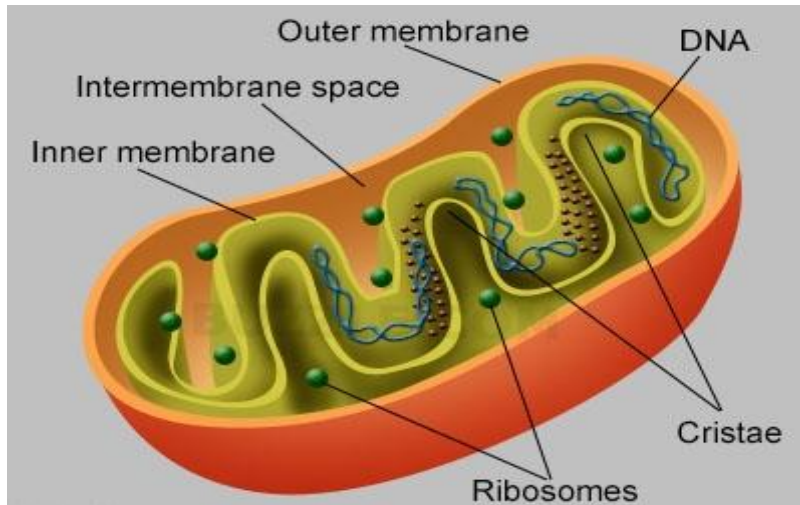


- One of the first organelles discovered: identified in 1897 by the Italian physician Camillo Golgi.
- Present inside most eukaryotic cells.
- Golgi body function is similar to that of a **post office**: **packages** (into *vesicles*), **sorts** and **labels** items which it then **sends** to different parts of the cell or to the extracellular space.



Mitochondria

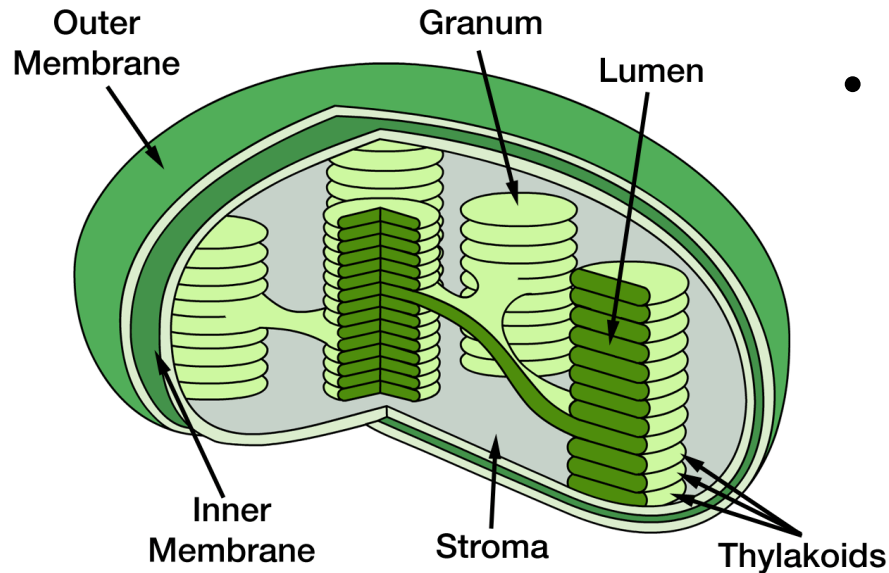
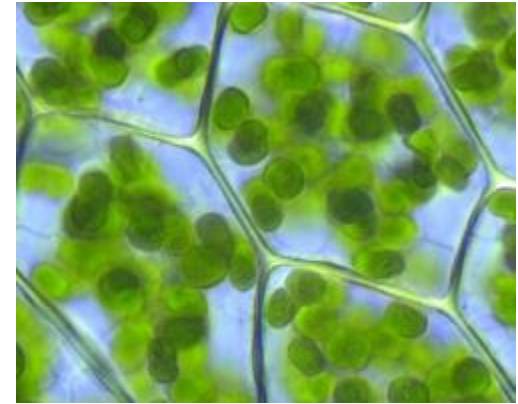
Mitochondrion is the **powerhouse** of the cell: generates *adenosine triphosphate* (ATP) which is used as a source of chemical energy within cells.



- Mitochondria have their **own small independent genome** (DNA is circular and similar to bacterial) and **ribosomes**.
- They can replicate on their own (by fission) and make their own proteins.
- The number of mitochondria in a cell is based on energy demand and can **vary widely** by organism, tissue, and cell type (red blood cells have no mitochondria; liver cells can have more than 2000).
- Cells with **high energy needs** can meet their demands by **increasing the number of mitochondria** they contain (for example, muscle cells in people who exercise regularly possess more mitochondria than muscle cells in sedentary people).

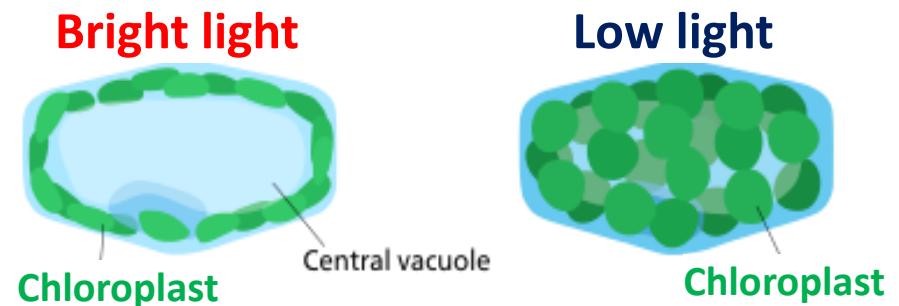
Chloroplast

Chloroplasts are organelles found in plant cells and eukaryotic algae that conduct **photosynthesis**.



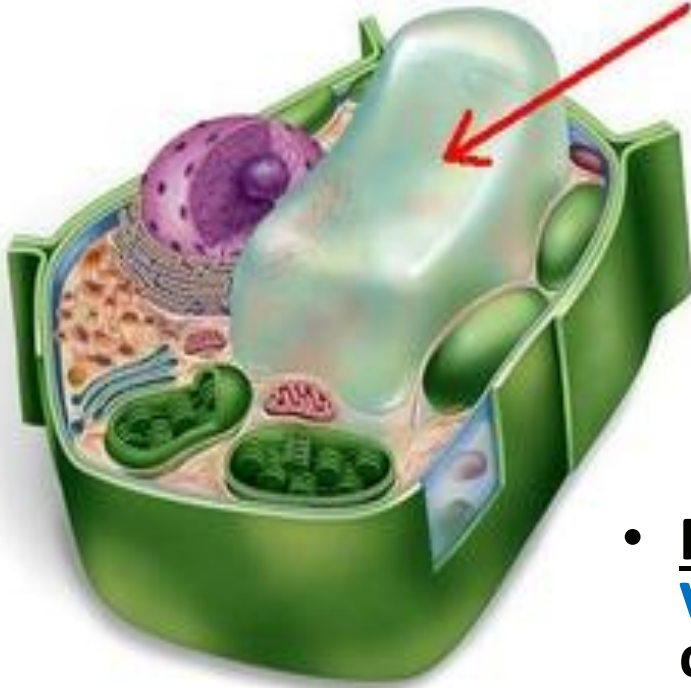
- All green parts (but not all cells!) of a plant contain chloroplasts - the **chlorophyll** in them makes plants appear green; in most plants, chloroplasts are concentrated in the leaves.

- Participate in the plant immune response.
- Contain their own DNA and ribosomes (similar to mitochondria).



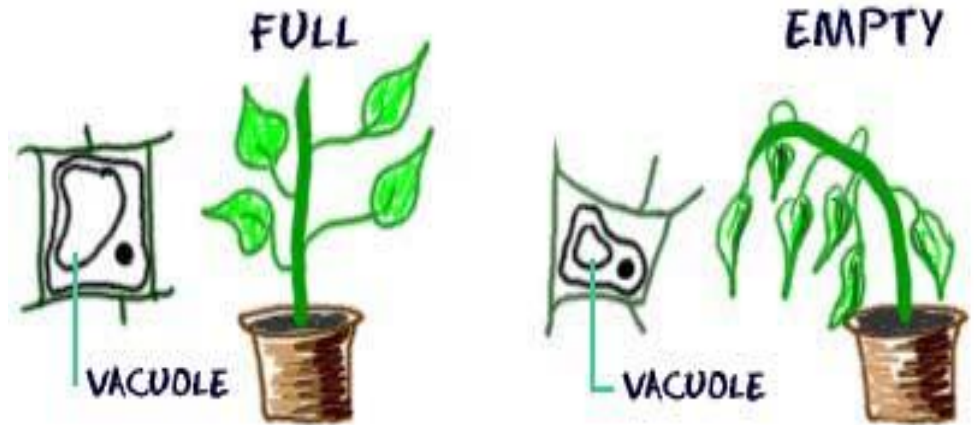
The chloroplasts can orient themselves to best suit the available light.

Vacuole



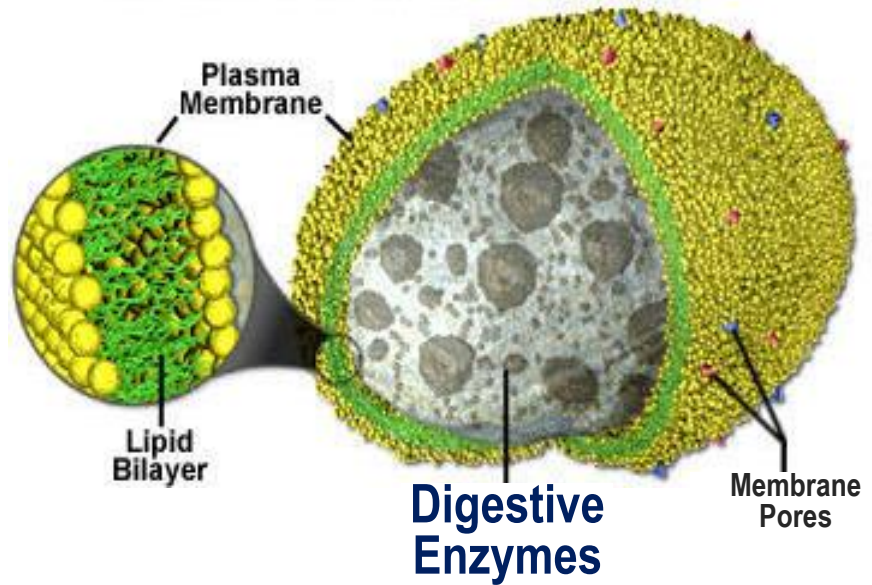
A sac-like structure for storage usually filled with water containing inorganic and organic molecules.

- Has no basic shape or size; its structure varies according to the needs of the cell.
- Plant cells usually contain **one large vacuole** that fills more than 30% of the cell volume - pressure from this large vacuole helps plants support themselves.
- Vacuoles play a less important role within animal cells, mainly isolating materials that might be harmful and containing waste products.

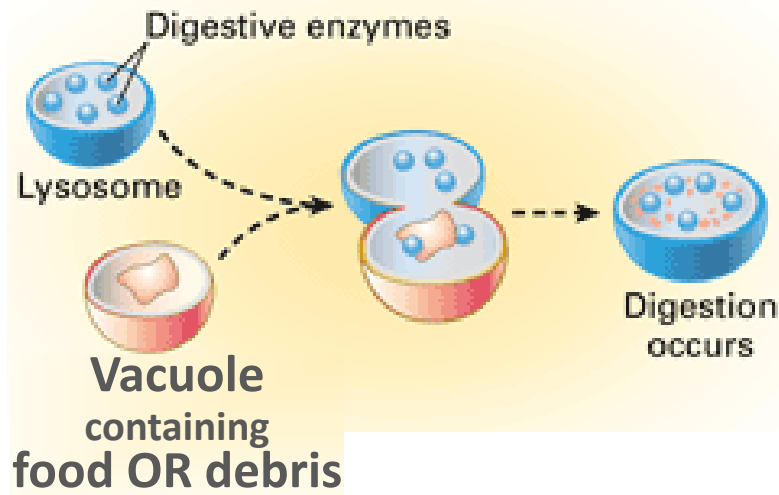


Lysosome

Lysosomes are membrane-enclosed organelles that **contain special enzymes** capable of breaking down all types of biological polymers - proteins, nucleic acids, carbohydrates, and lipids.



- Can be described as the **stomach of the cell**: digest food particles, waste materials, cellular debris, and engulfed viruses or bacteria.
- Lysosomes also play the role of **recycling units**: break down excess or worn-out organelles to their basic molecules.

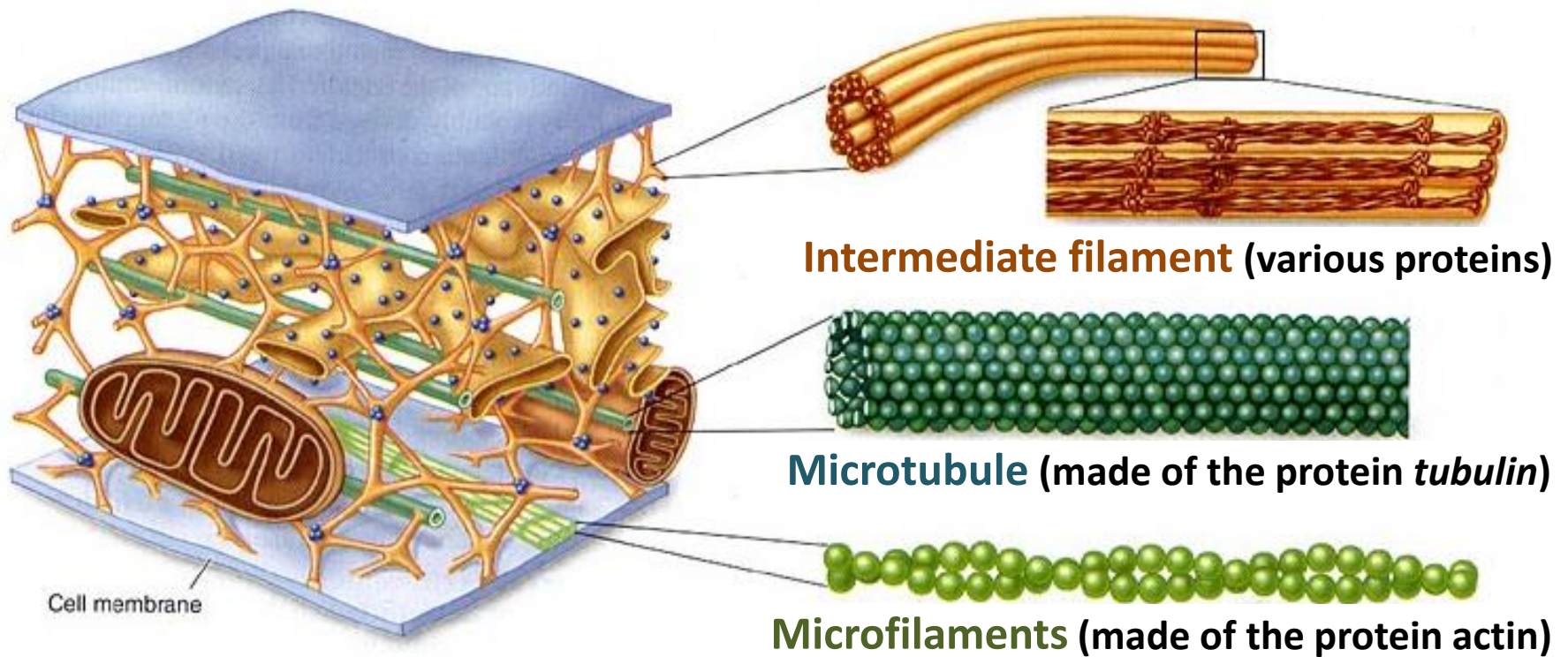


Found in most animal cells (they are absent in red blood cells).

Cytoskeleton

Cytoskeleton is a **network of protein fibers** that gives the cell shape and mechanical resistance to deformation.

- Composed of three main filaments, which are capable of **rapid assembly or disassembly** dependent on the cell's requirements.



Large-scale example of a cytoskeleton action: muscle contraction.