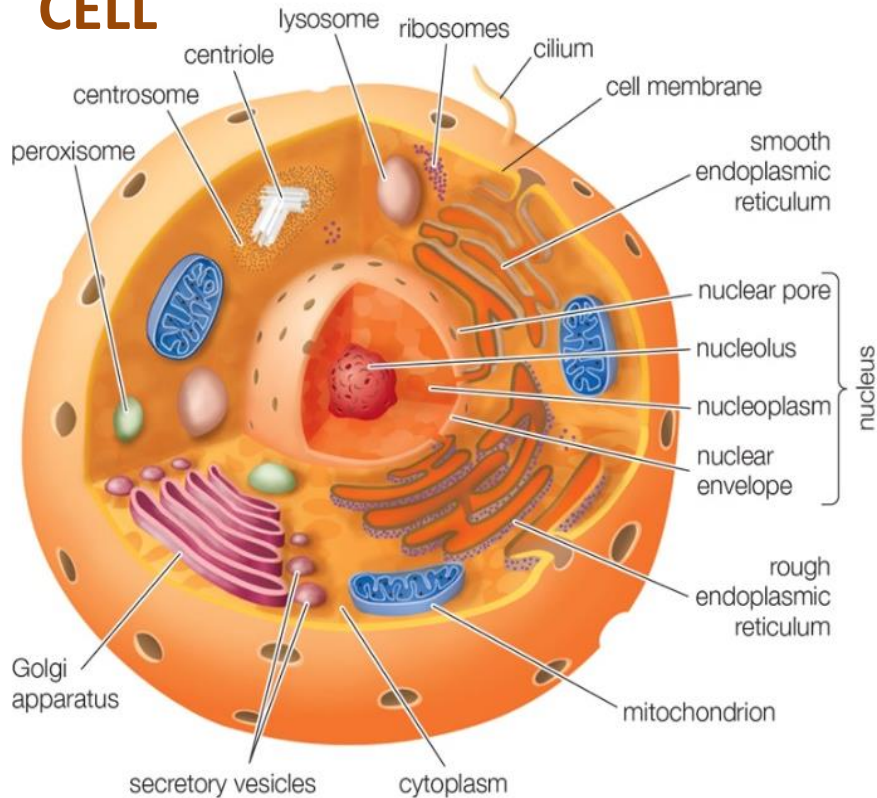


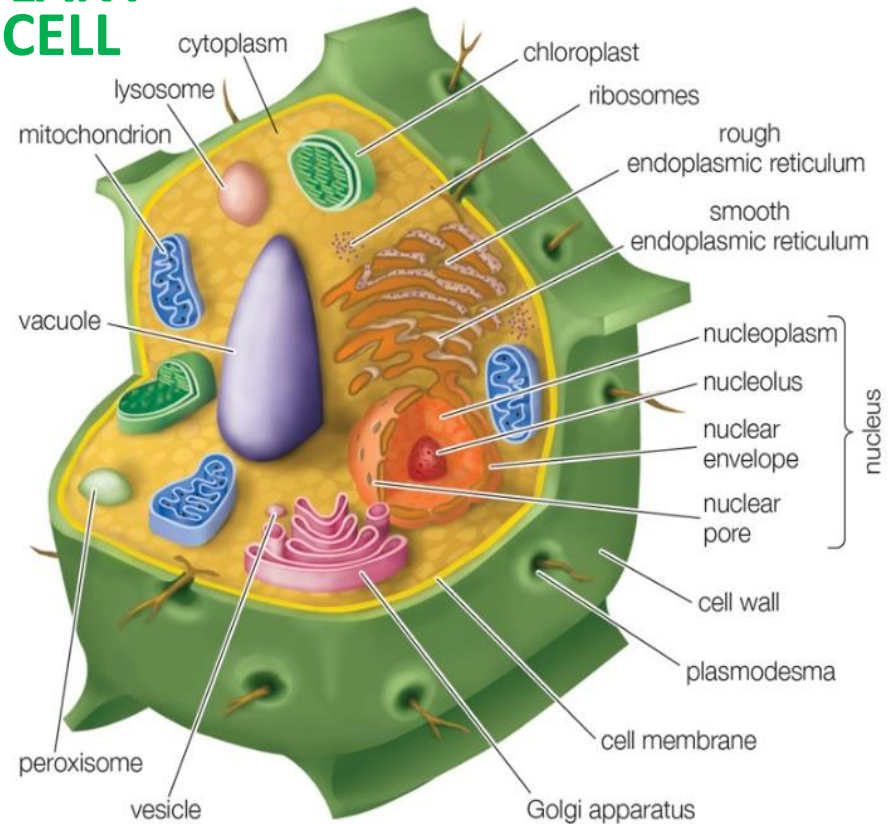
Organelles

Eukaryotic cells have **specialized interior compartments**, called **organelles** (“little organs”), that have specific functions.

ANIMAL CELL



PLANT CELL



Nucleus

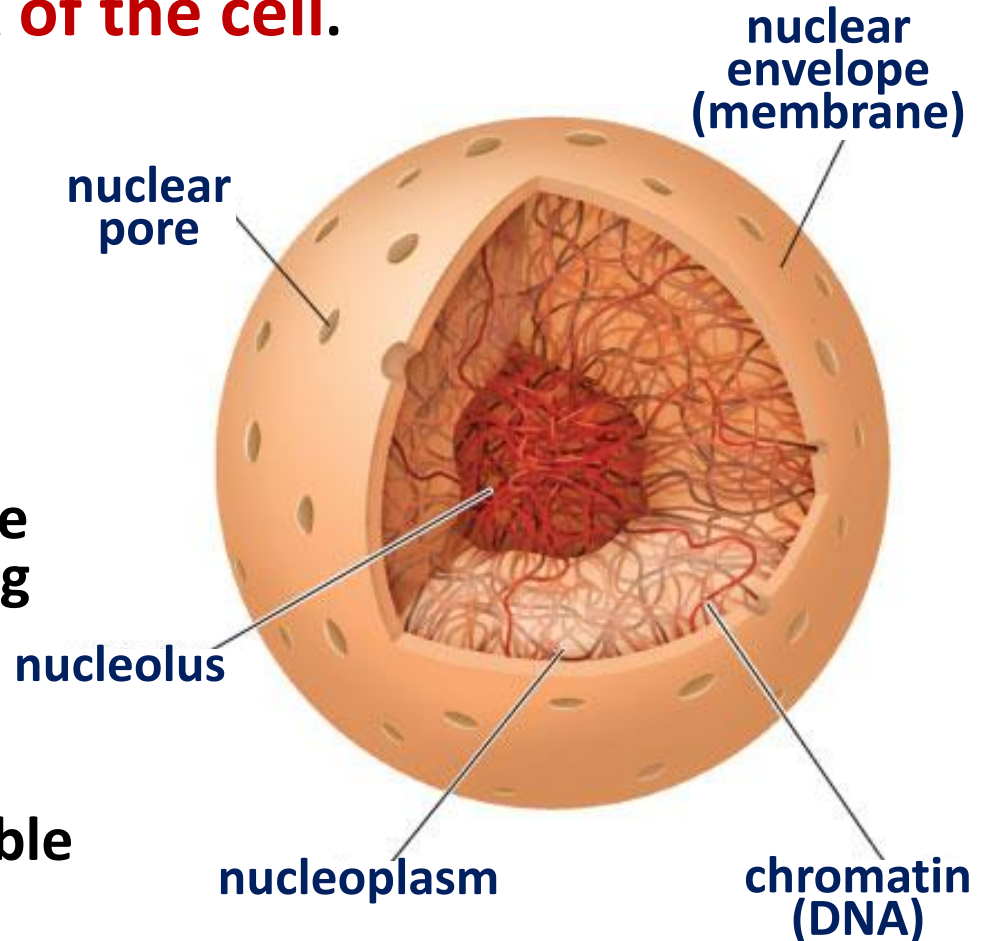
The nucleus is the **control center** of the cell.

- 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**.

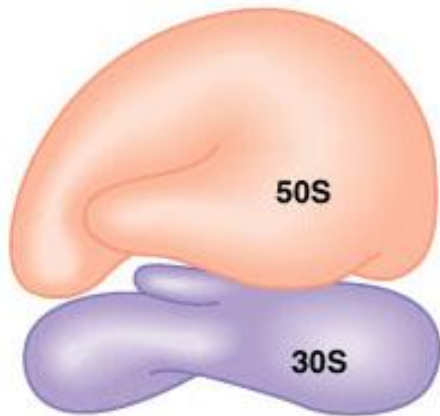


Ribosomes

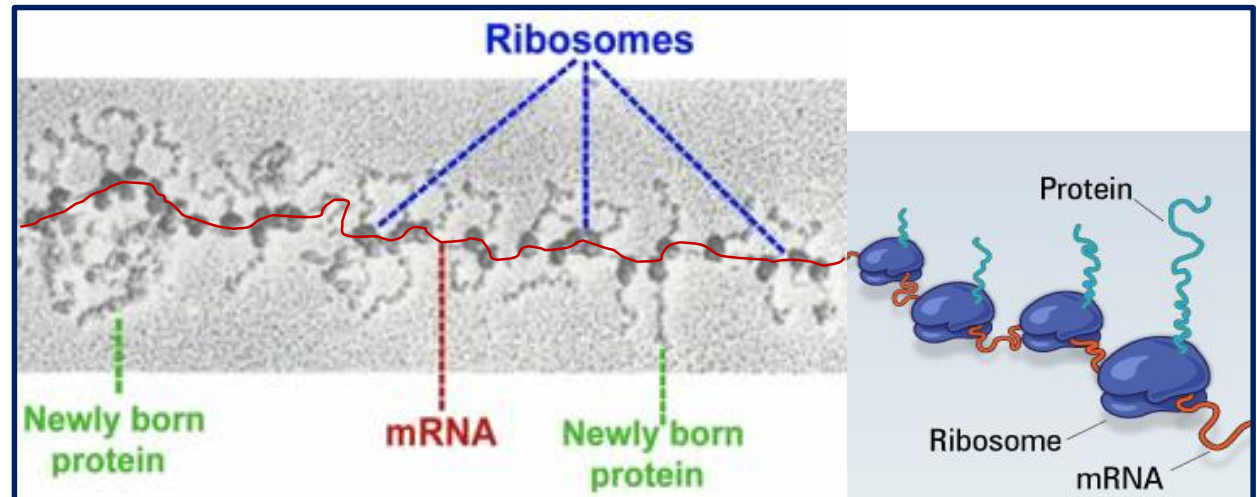
The ribosome is a complex molecular machine responsible for the **synthesis of proteins** in cells.

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) →



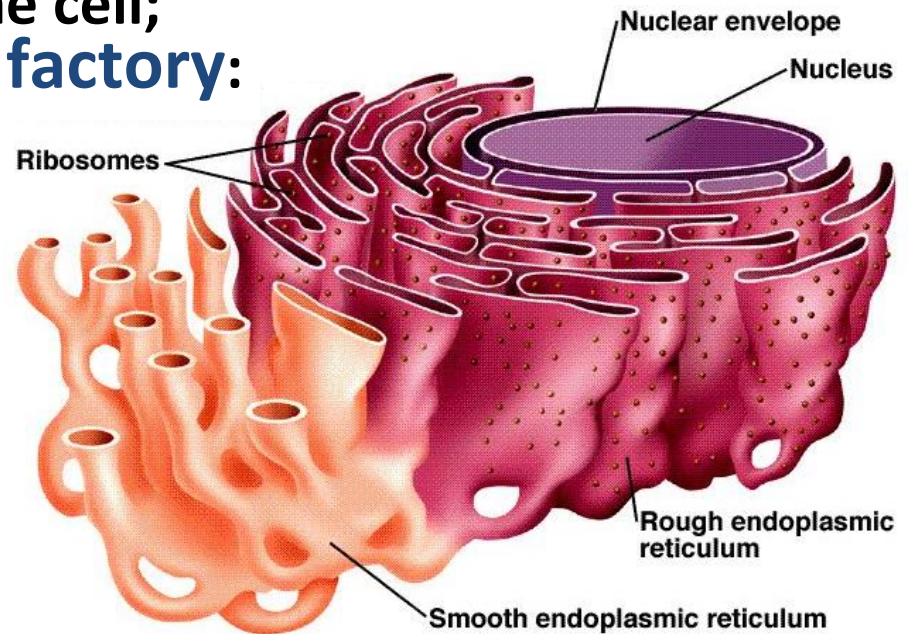
The **ribosomes** are found within all living cells: some are free floating in the cytoplasm, but most are attached to the **endoplasmic reticulum**.

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**:

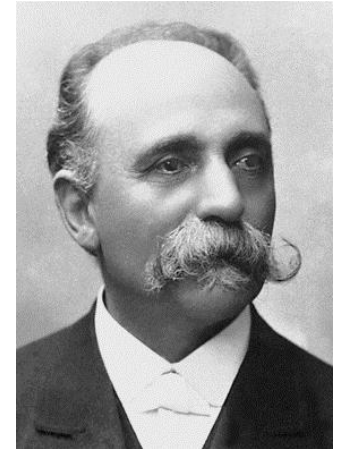
- **Rough ER** - houses **ribosomes** on its surface; helps make and transports proteins.
- **Smooth ER** - makes and transports lipids and other materials within the cell (no ribosomes found on its surface).



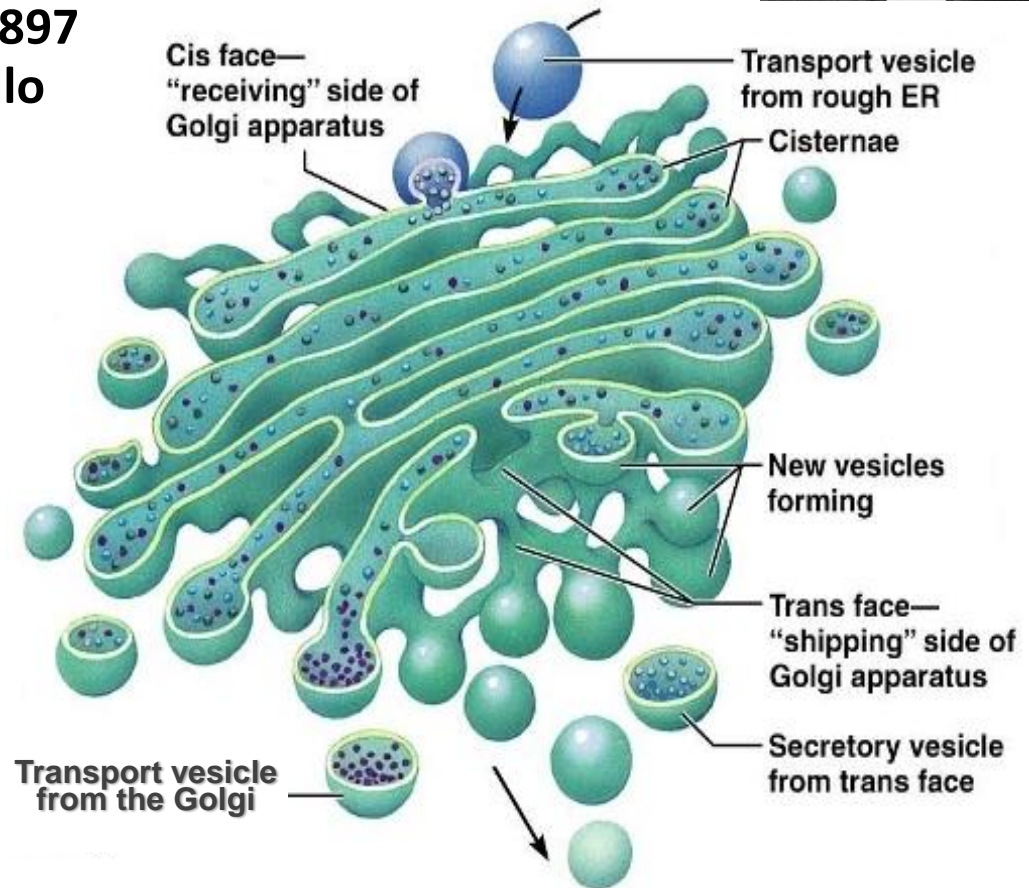
The rough endoplasmic reticulum works together with the **Golgi Apparatus** to target new proteins to their proper destinations.

Golgi Apparatus

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

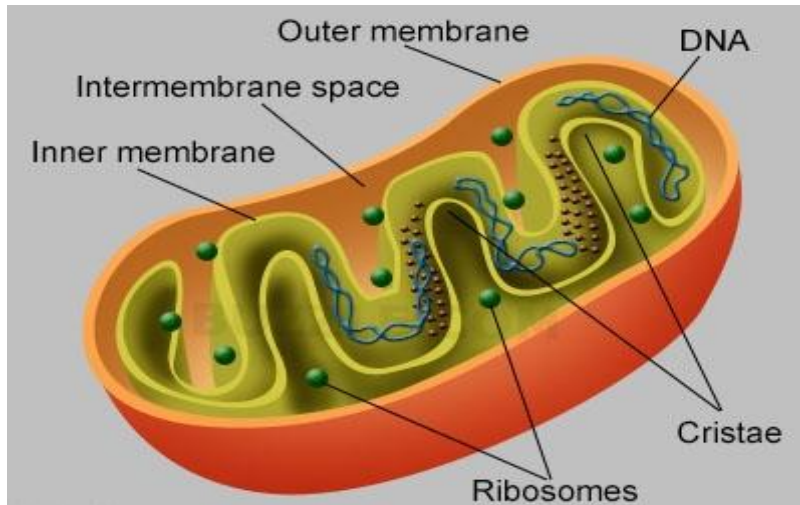


- One of the first organelles discovered: identified in 1897 by the Italian physician Camillo Golgi.
- Present inside most eukaryotic cells.
- Golgi body function is similar to that of a **post office**: **packages** (into *vesicles*), **sorts** and **labels** items which it then **sends** to different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



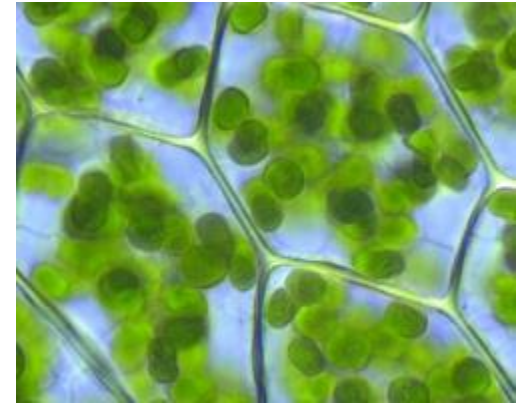
Mitochondria

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

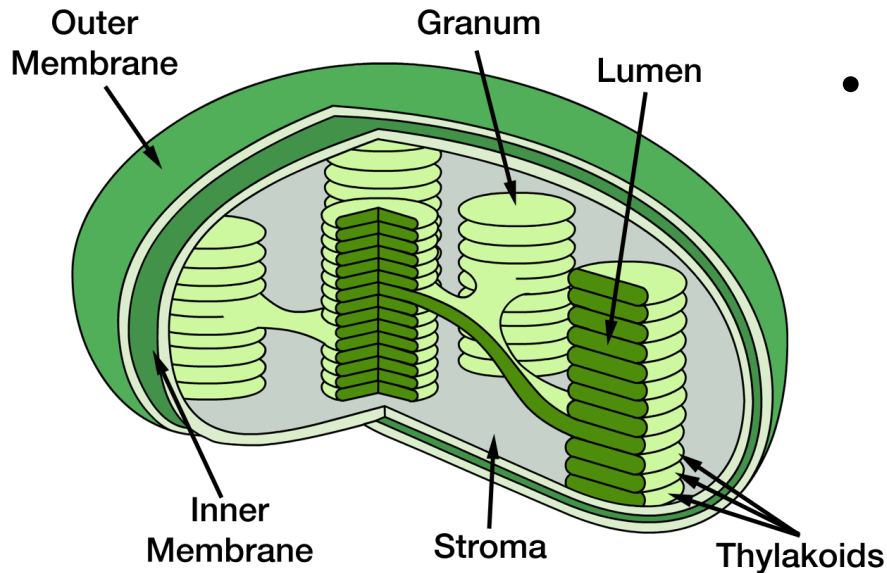


- Mitochondria have their **own small independent genome** (DNA is circular and similar to bacterial) and **ribosomes**.
- They can replicate on their own (by fission) and make their own proteins.
- The number of mitochondria in a cell is based on energy demand and can **vary widely** by organism, tissue, 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



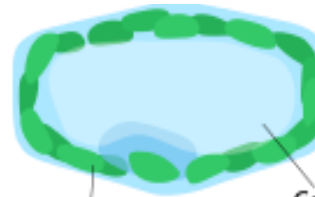
Chloroplasts are organelles found in plant cells and eukaryotic algae that conduct **photosynthesis**.



- 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).

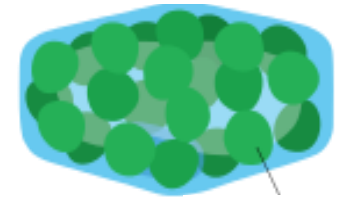
Bright light



Chloroplast

Central vacuole

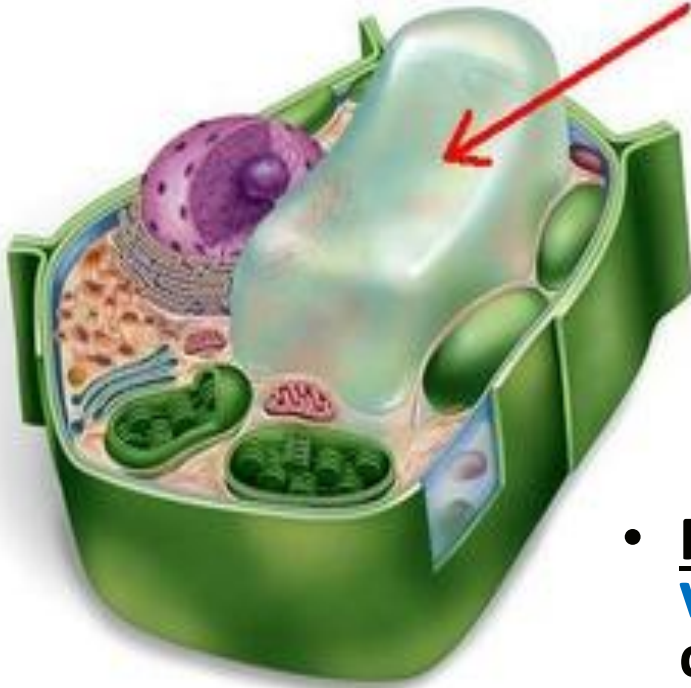
Low light



Chloroplast

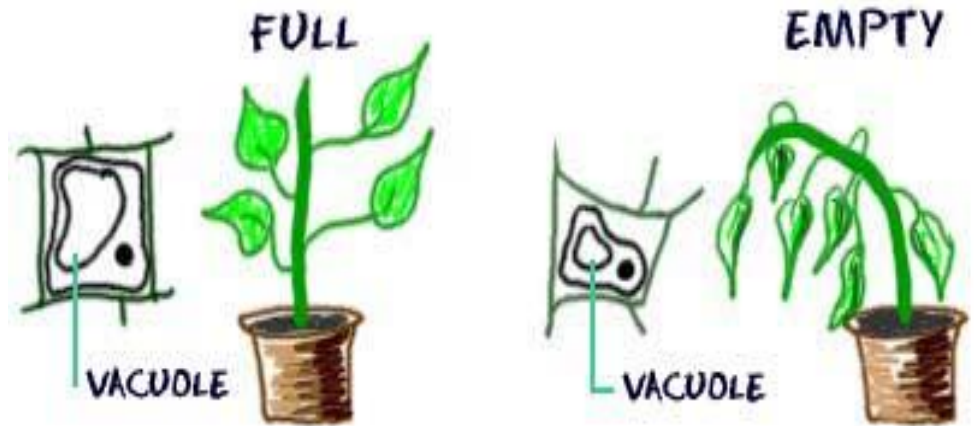
The chloroplasts can orient themselves to best suit the available light.

Vacuole



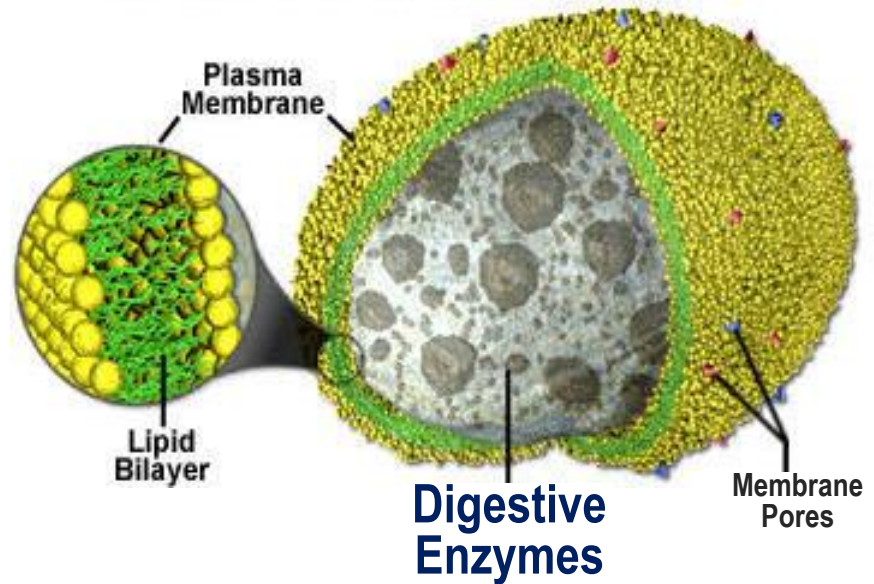
A sac-like structure for storage usually filled with water containing inorganic and organic molecules.

- 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.

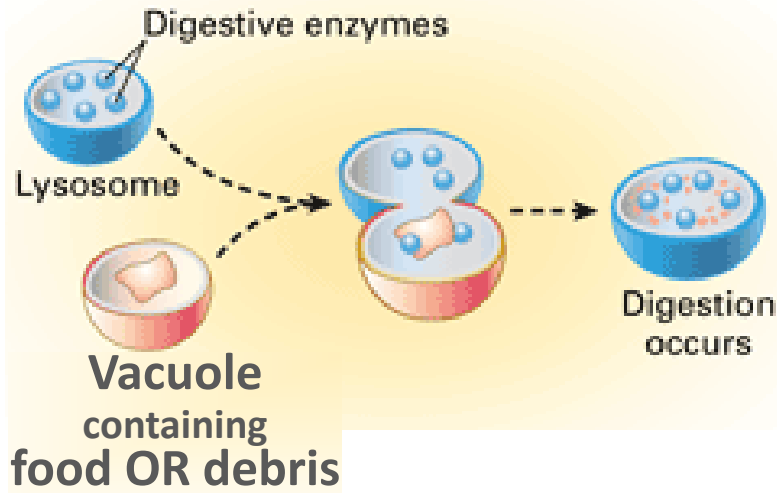


Lysosome

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.

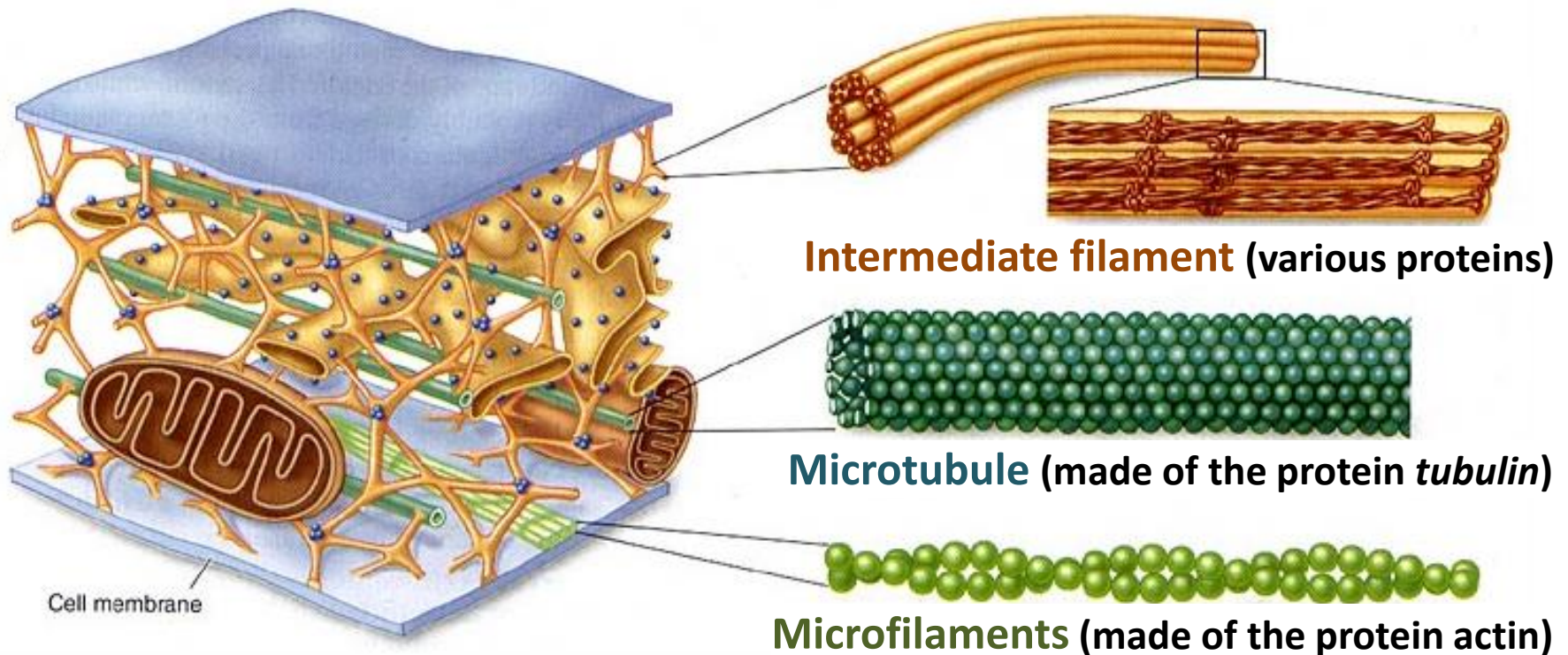


Found in most animal cells (they are absent in red blood cells).

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.