

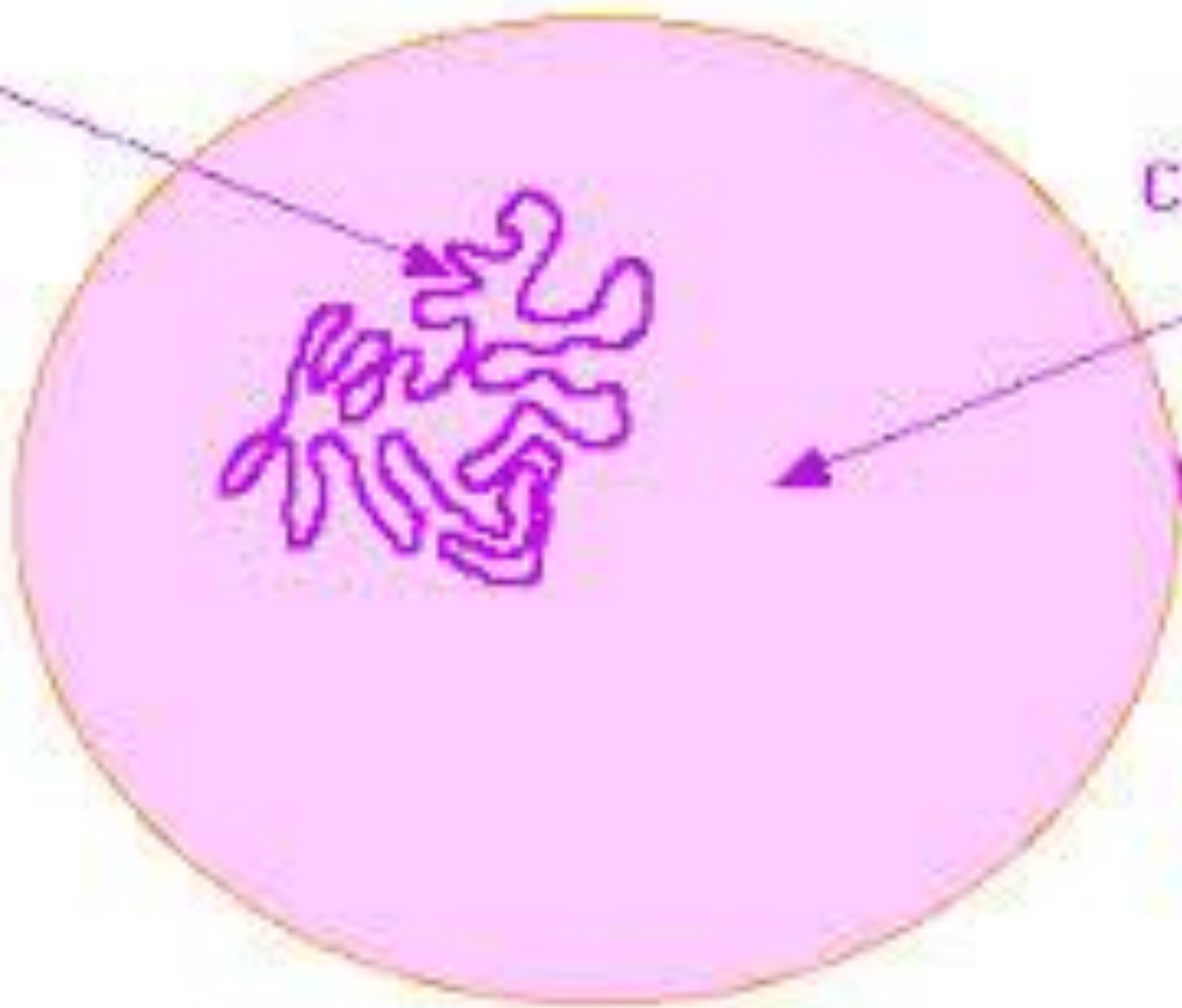
3. Cell structure

Cells are the basic unit of all living organisms that **carry out/perform** the three vital functions: nutrition, co-ordination and reproduction.

- There are many different types of cells, but they all have the same **BASIC STRUCTURE**. The main parts they have in common are:

- Cell membrane
- Cytoplasm
- Genetic material

DNA



Cytoplasm

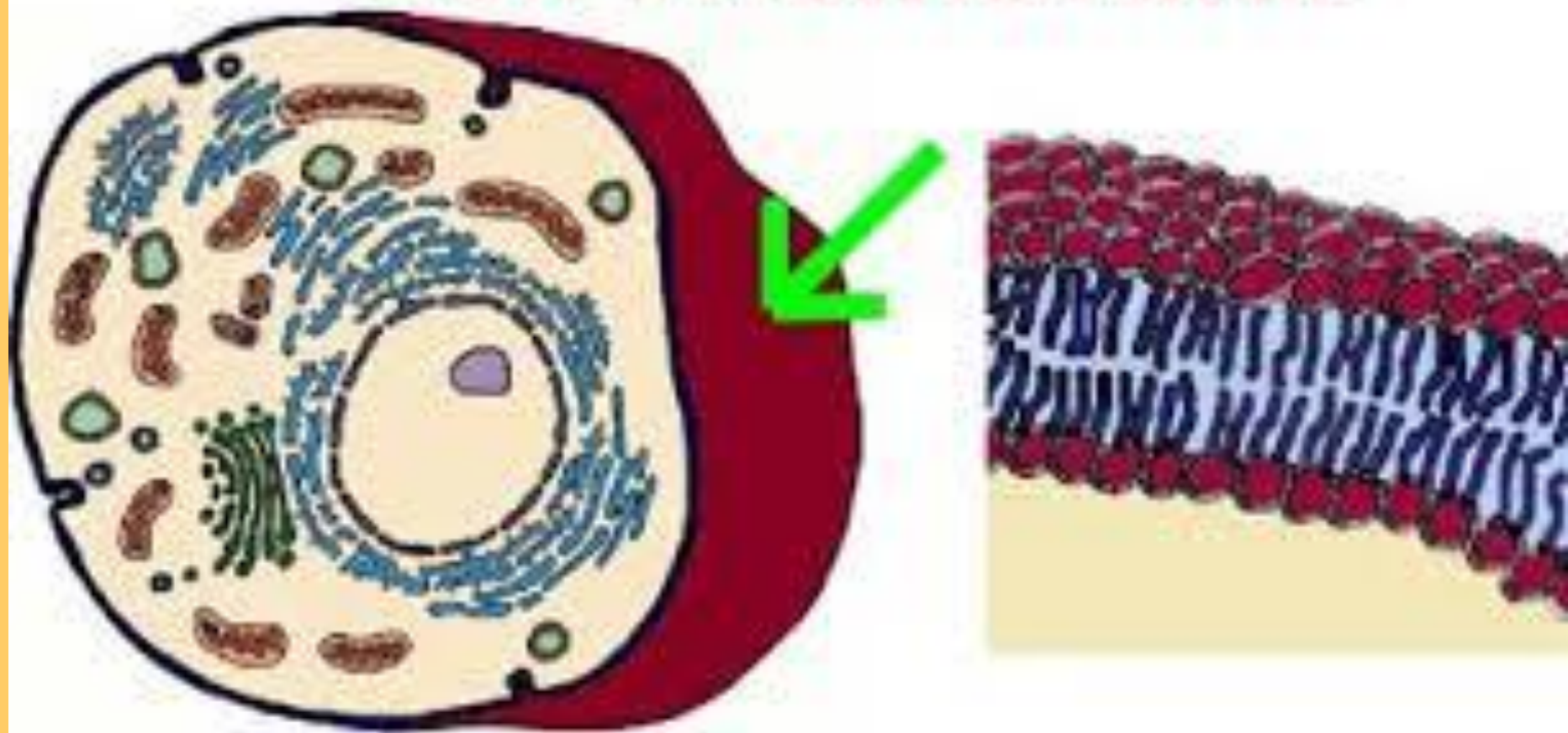
Cell Membrane

-The cell membrane: It is a thin layer that separates the cell from the external environment. The substances necessary for **nutrition** can pass through it into the cell and the **waste products** can pass out of the cell.

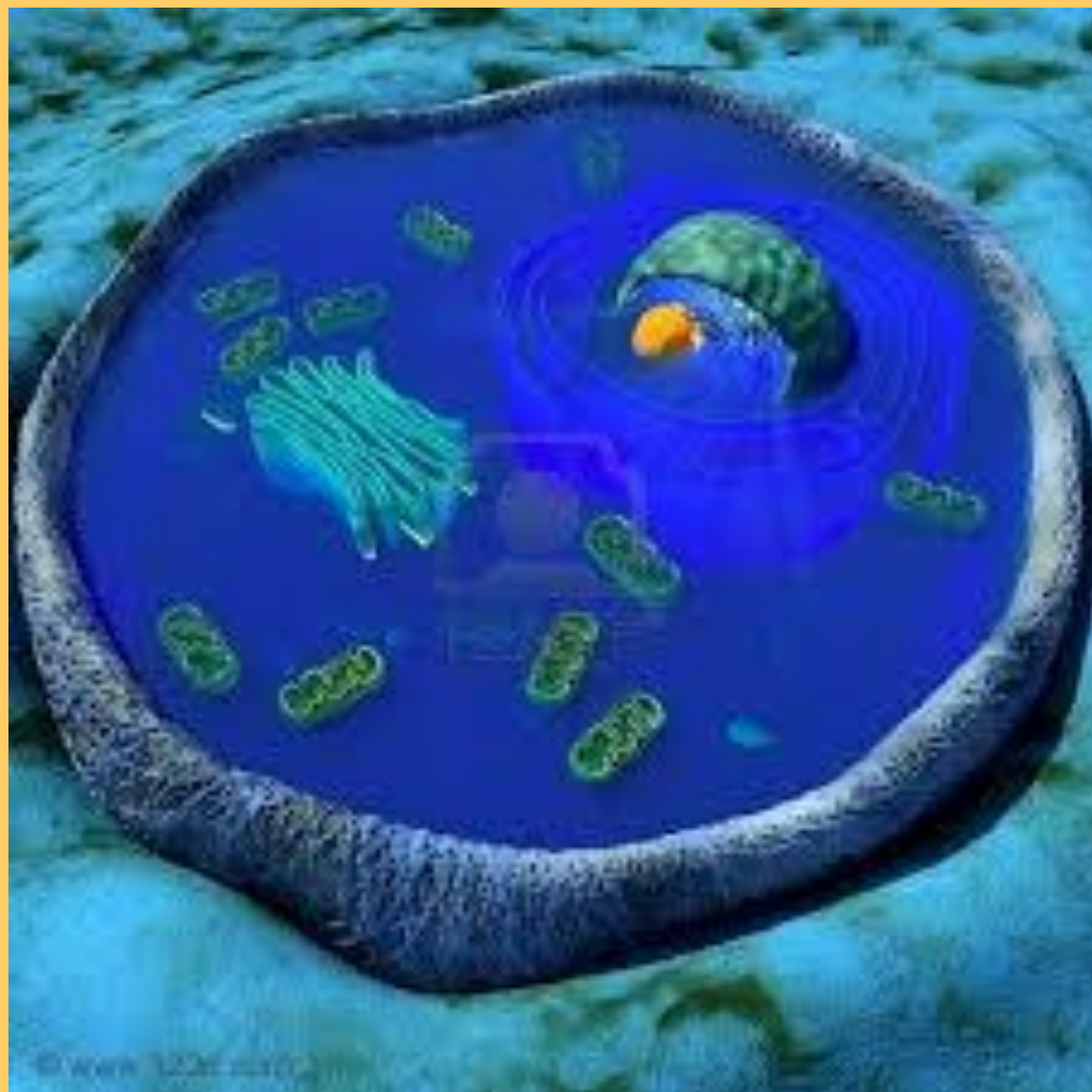
It is made up of a double layer of **lipids** associated to different types of **proteins**.

In **plant cells** this layer is surrounded by a thick layer called **CELL WALL**.

Cell Membrane



-The cytoplasm: It is the semi-liquid interior of the cell. It is made up of an **intracellular fluid (cytosol)**, biological molecules that are needed to **carry out/perform** the biochemical reactions that keep the cell alive (**cell organelles**) and a network of fibers composed of proteins (**cytoskeleton**).



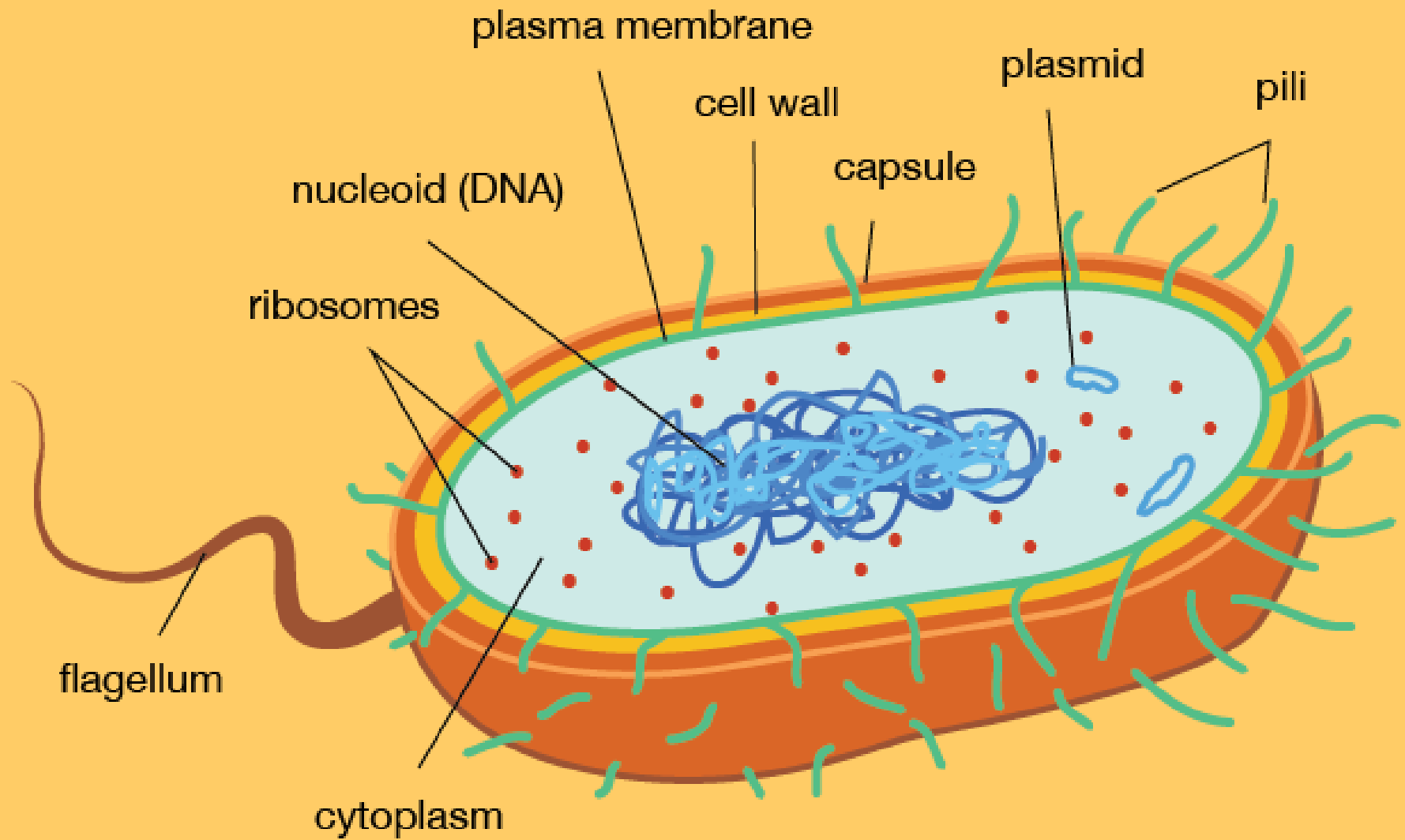
-The genetic material: It contains the information necessary to control cellular activity and to give the cell its specific characteristics.

It is made up of one or more molecules of **DNA** (deoxyribonucleic acid).

There are two types of cell according to their complexity: **PROKARYOTIC** and **EUKARYOTIC** cells.

* **PROKARYOTIC CELLS:** They are simpler than eukaryotic cells. The genetic material is **floating freely in the cytoplasm**. The DNA appears more or less condensed and located in a cell region called **nucleoid**. They have a very simple structure with **very few organelles: ribosomes and mesosomes** (cell membrane's invaginations, exclusive to the prokaryotic cells).

They also have an outer layer, the **cell wall** and one or more thin **flagella**.



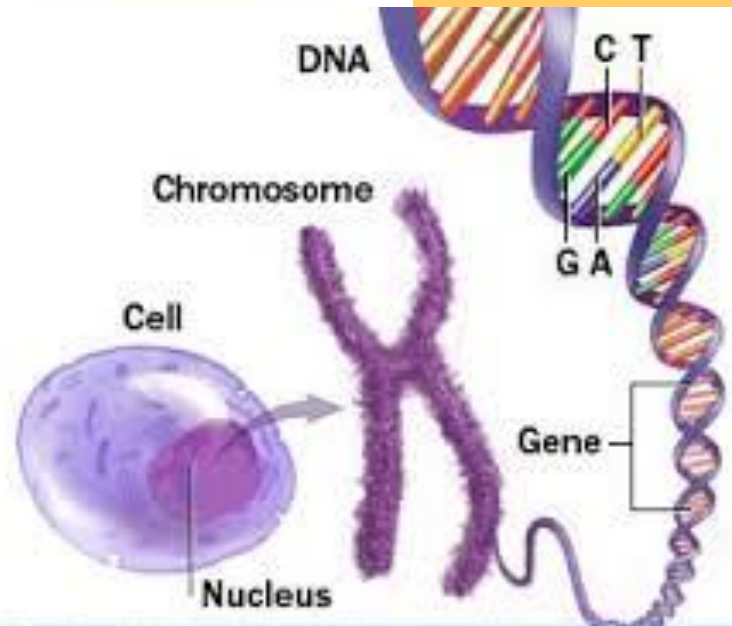
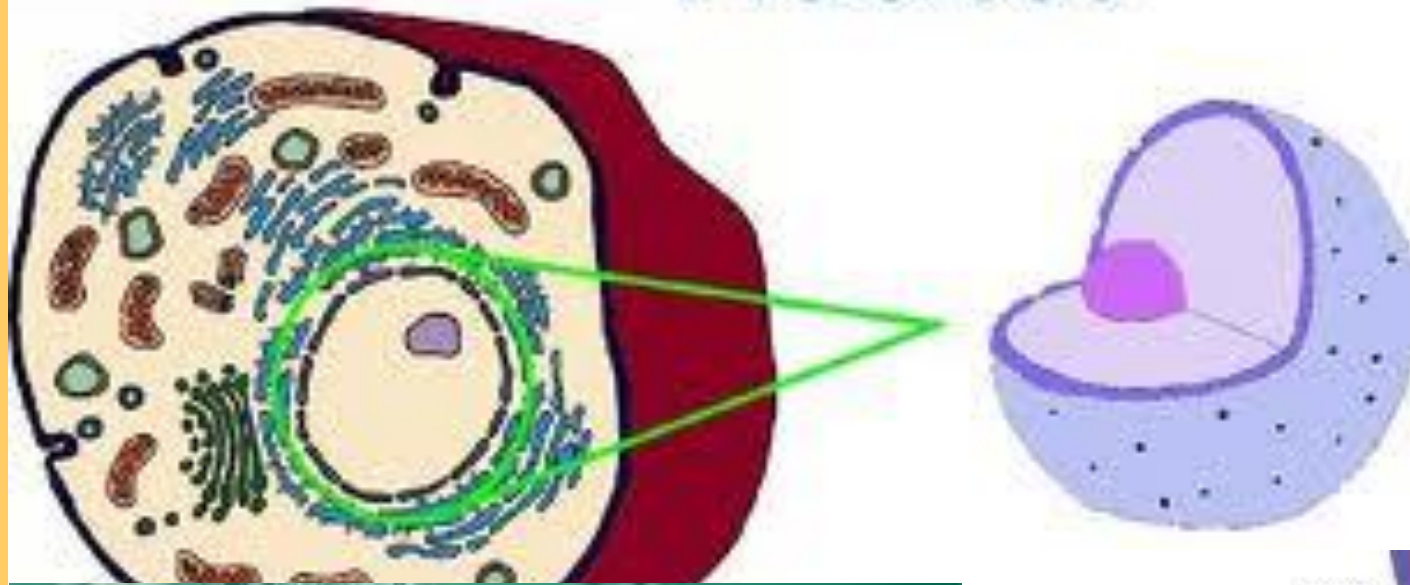
BACTERIA AND CYANOBACTERIA HAVE PROKARYOTIC CELLS

- **EUKARYOTIC CELLS:** Appeared later in the evolution process than prokaryotic cells. They are more **developed** and more **complex** than prokaryotic cells. **Protists, fungi, plants and animals** have eukaryotic cells.

All of them have **nucleus**, that is, the genetic material is protected by a nuclear layer. The DNA molecules in every cell make up the **chromatin**.

During **cell division**, every DNA molecule condenses giving rise to a microscopic structure called **chromosome**.

Nucleus



ANIMAL AND PLANT CELLS

The cytoplasm in eukaryotic cells contains various structures (**organelles**) which have different functions.

(1) Ribosomes: Tiny organelles composed of proteins and RNA, not enclosed in a membrane. Some are free in the cytoplasm and some are attached to the endoplasmatic reticulum. Function: **synthesis of proteins.**

(2) Endoplasmatic reticulum: Is made up of a complicated network of tubes and vesicles. It can be **smooth** or **rough (RER)**, the latter has ribosomes attached to its membrane.

RER: synthesis, storage and transport of proteins.

SER: synthesis of lipids and storage and transport of proteins.

(3) The Golgi Apparatus: is made up of vesicles and flattened sacs. It **takes substances from the ER and transport them through vesicles called lysosomes** to be delivered to other places within the cell.

(4) Lysosomes: Spherical and tiny vesicles enclosed in a membrane that contain **digestive enzymes** for breaking down old cellular components or ingested food (smaller cells, big macromolecules).

(5) Vacuoles: Are structures that **store** various substances (water, nutrients, waste products). They are enclosed by a membrane. They are **bigger in plant cells** and can occupy up to 80 % of a plant cell's total volume.

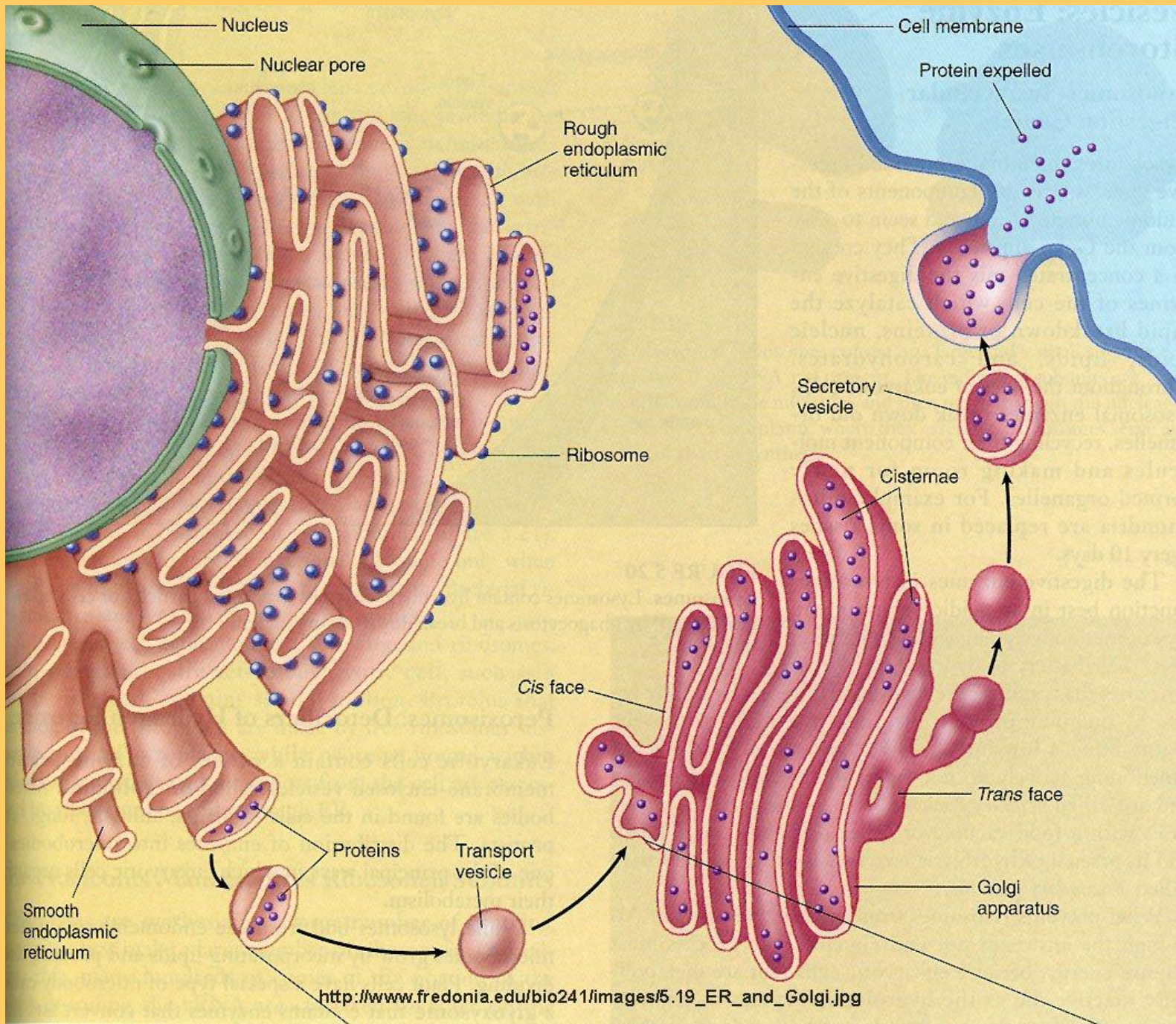
(6) Mitochondria: Are tube-shaped with a double membrane: the outer one is smooth and the inner membrane has folds called **cristae**. The **mitochondrial matrix** contains genetic material, ribosomes and enzymes. They carry out **cell respiration**, which converts sugars and fats into energy through oxidation.

Smooth Endoplasmic Reticulum



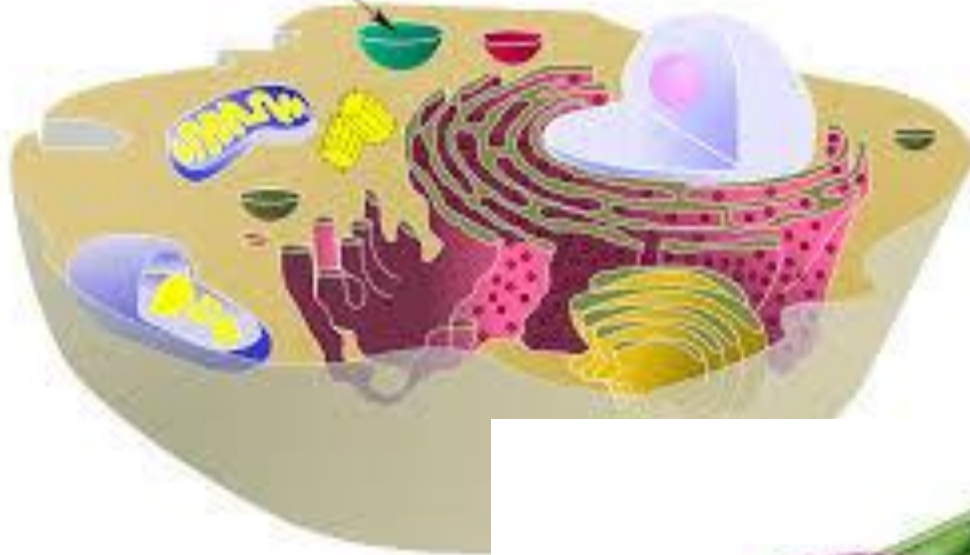
Rough Endoplasmic Reticulum

Animal Cell



http://www.fredonia.edu/bio241/images/5.19_ER_and_Golgi.jpg

Vacuole

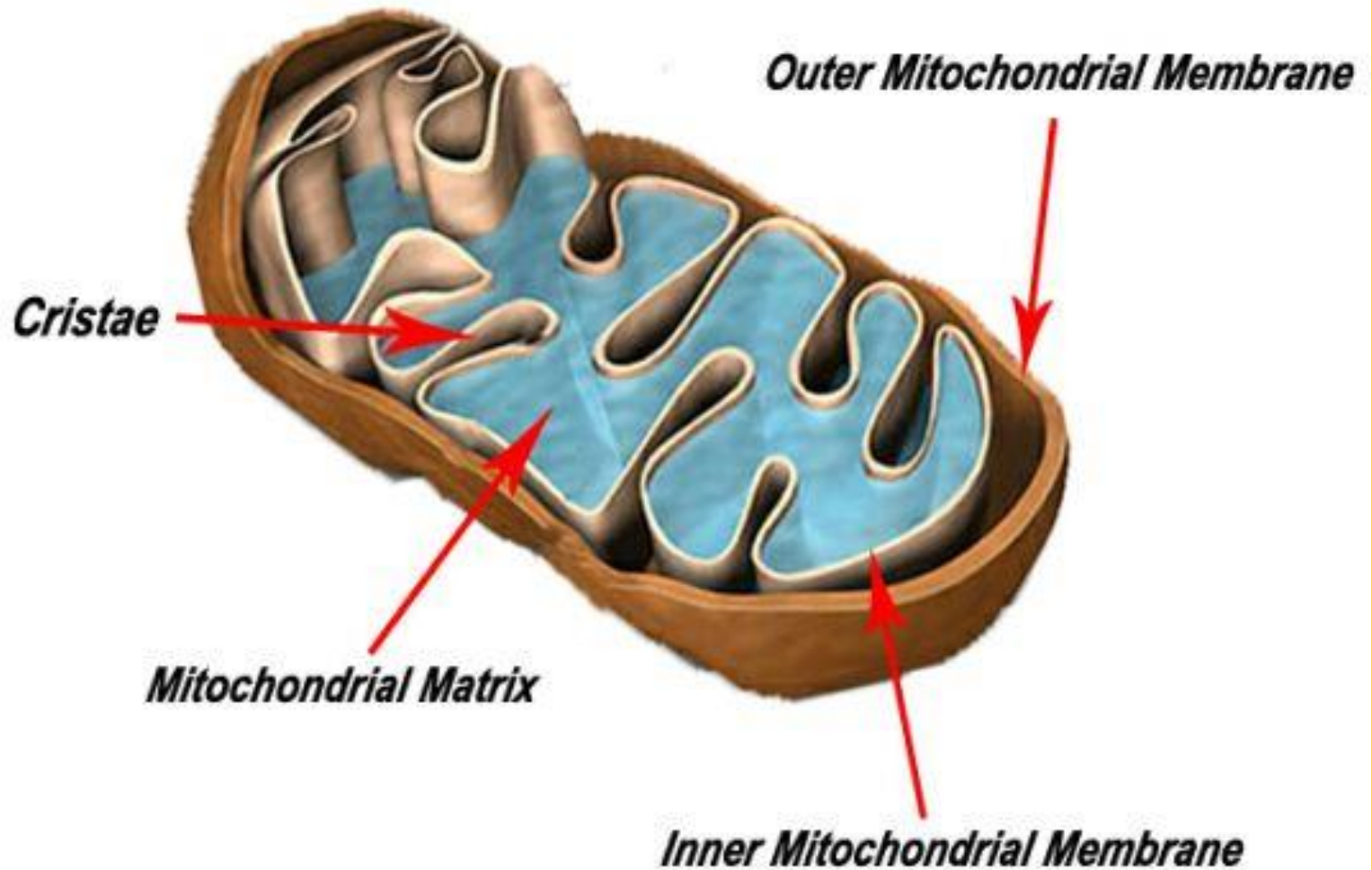


ANIMAL CELL

PLANT CELL

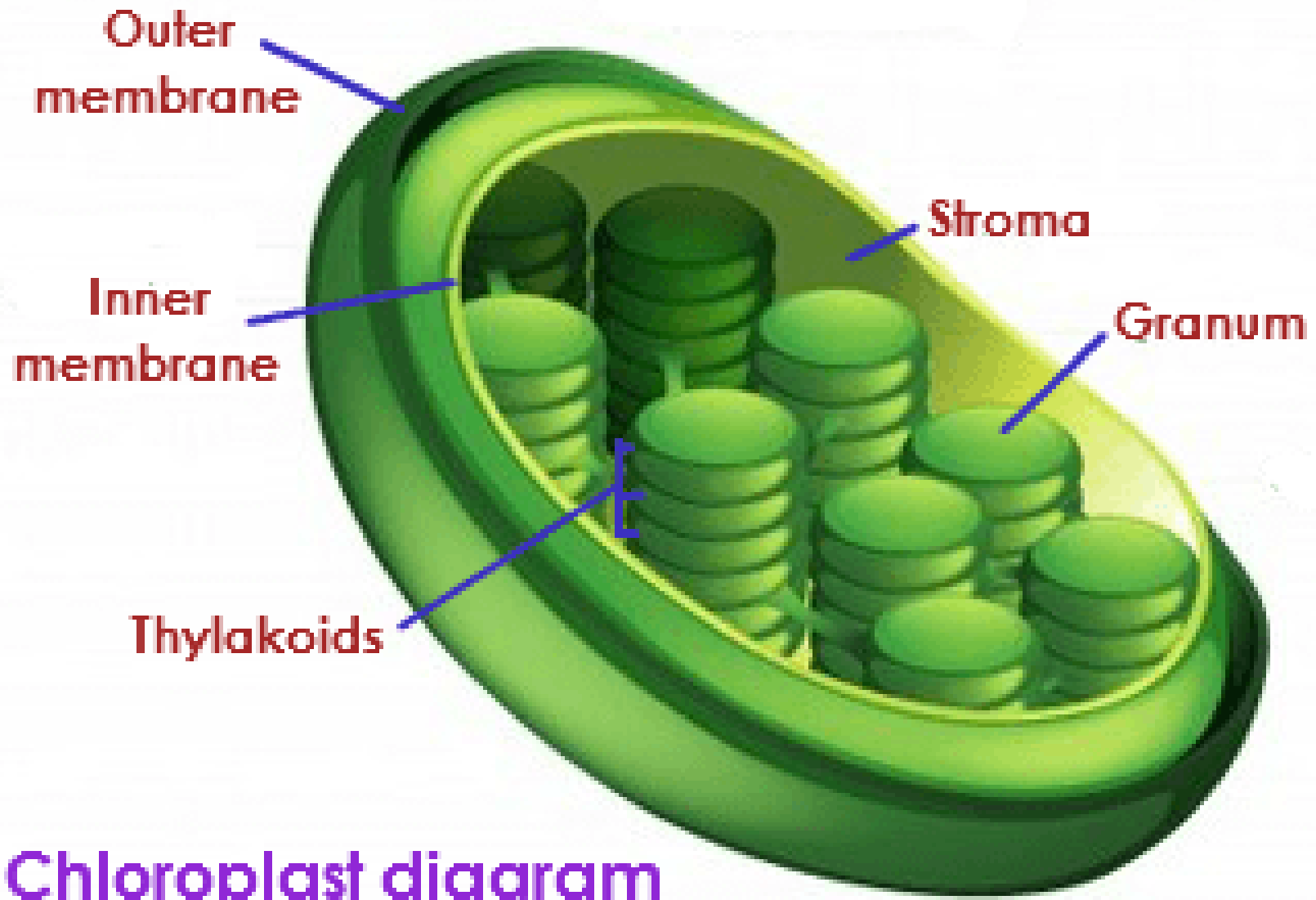


The Mitochondrion



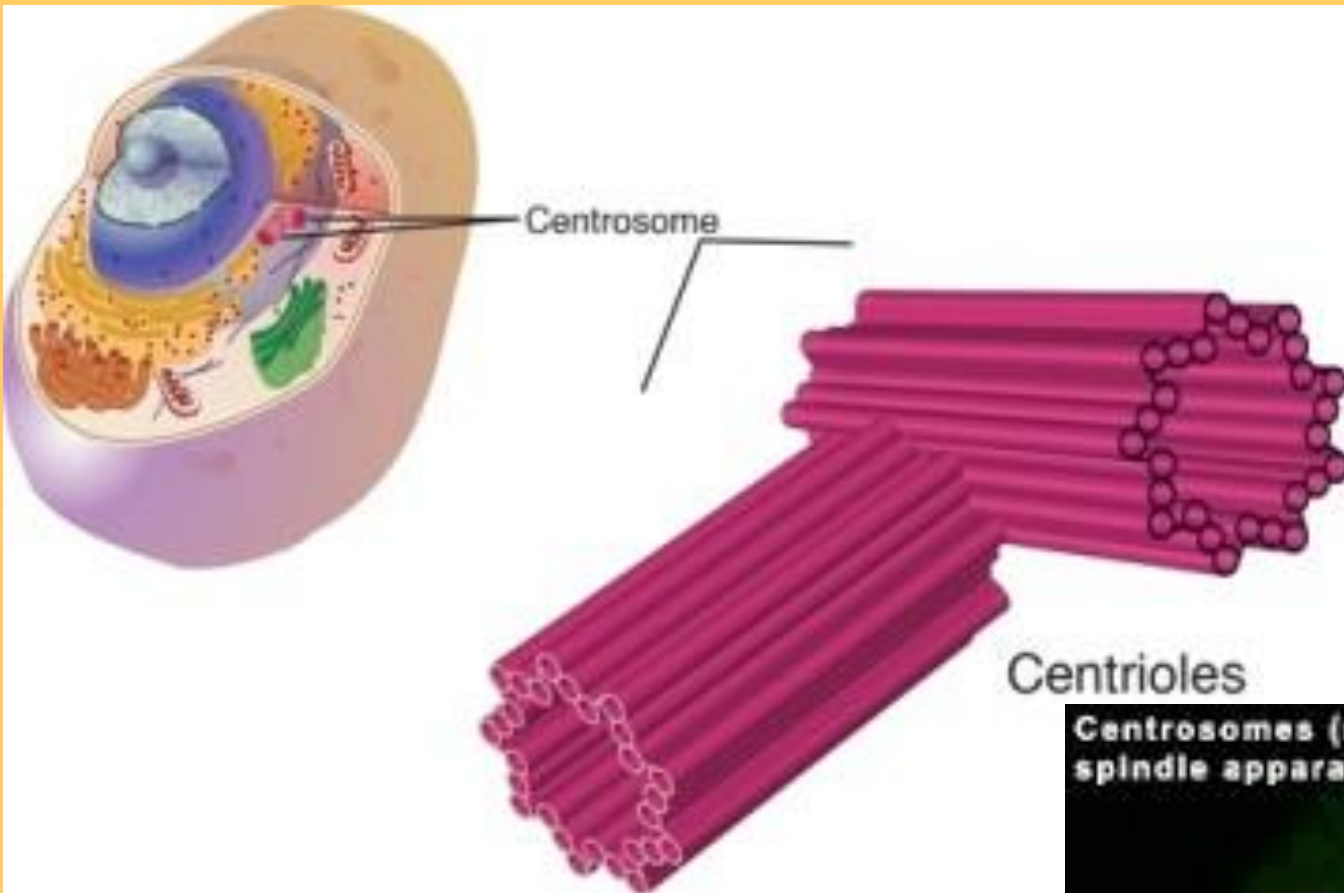
(7) Chloroplasts: They are only present in the cells of **photosynthetic organisms** such as plants and some protists. They are organelles with a double membrane. They contain a series of disc-shaped sacs, called **thylakoids**, which contain **chlorophyll**, the pigment that gives them their characteristic green colour. **Photosynthesis** happens here: chemical reactions through which plants obtain organic matter using CO₂, H₂O and light.

CO₂ + H₂O + light  **organic matter**

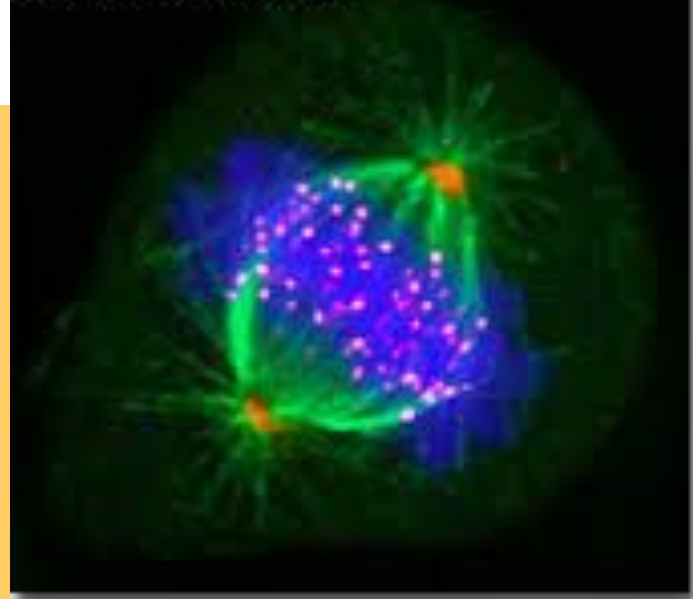


(8) Centrosome: This organelle is only present in **animal cells**. It is made up of a pair of hollow tubes (the **centrioles**) surrounded by protein fibers in a star-like arrangement. Centrosomes form the **spindle apparatus`s fibers**, which are responsible for the **the segregation of chromosomes during cell division**.

Fungi and plants lack centrosomes and therefore use other structures during cell division.



Centrosomes (red) and the mitotic spindle apparatus



Large central vacuole

Tonoplast
Chloroplast

Plasmodesmata

Cell wall

Cytoskeleton

Peroxisome

Mitochondrion

Ribosomes

Rough endoplasmic reticulum

Nucleus

Smooth endoplasmic reticulum

Golgi apparatus

Lysosome

Plasma membrane

Centrioles

