

Mitochondria

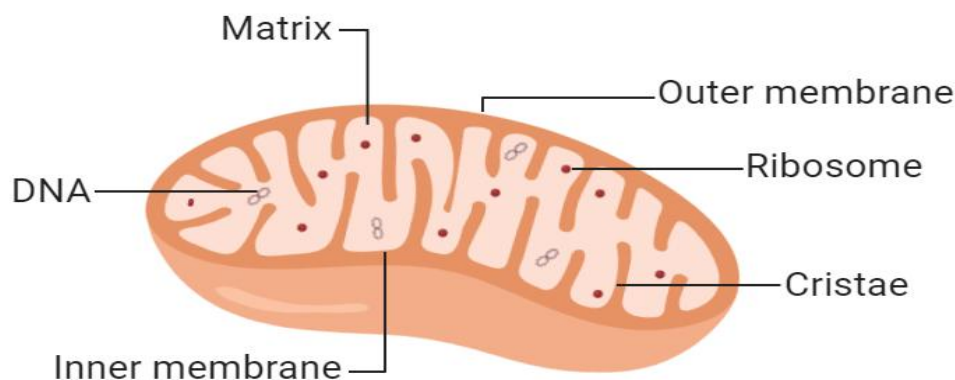
“Mitochondria are membrane-bound organelles present in the cytoplasm of all eukaryotic cells that produce adenosine triphosphate (ATP), the main energy molecule used by the cell.”

It was first described by a German pathologist named **Richard Altmann** in the year 1890.

Popularly known as the “**Powerhouse of the cell**,” mitochondria (singular: mitochondrion) are a double membrane-bound organelle found in most eukaryotic organisms.

They play a major role in breaking down nutrients and generating energy-rich molecules for the cell. Many of the biochemical reactions involved in cellular respiration take place within the mitochondria. The term ‘mitochondrion’ is derived from the Greek words “*mitos*” and “*chondrion*” which means “**thread**” and “**granules-like**”, respectively.

Structure of Mitochondria



- The mitochondrion is a **double-membraned, rod-shaped structure** found in both plant and animal cell.
- Its size ranges from **0.5 to 1.0 micrometre** in diameter.
- The structure comprises an **outer membrane**, an **inner membrane**, and a gel-like material called the **matrix**.
- The outer membrane and the inner membrane are made of **proteins and phospholipid** layers separated by the **intermembrane space**.
- The outer membrane covers the surface of the mitochondrion and has a large number of special proteins known as porins.

Cristae

The inner membrane of mitochondria is rather complex in structure. It has many folds that form a layered structure called **cristae**, and this helps in **increasing the surface area** inside the organelle. The cristae and the proteins of the inner membrane aid in the **production of ATP** molecules. The inner mitochondrial membrane is strictly permeable only to oxygen and ATP molecules. A number of chemical reactions take place within the inner membrane of mitochondria.

Mitochondrial Matrix

The mitochondrial matrix is a viscous fluid that contains a mixture of enzymes and proteins. It also comprises ribosomes, inorganic ions, mitochondrial DNA, nucleotide cofactors, and organic molecules. The enzymes present in the matrix play an important role in the synthesis of ATP molecules.

Functions of Mitochondria

The most important function of mitochondria is to produce energy through the process of **oxidative phosphorylation**. It is also involved in the following process:

1. Regulates the metabolic activity of the cell
2. Promotes the growth of new cells and cell multiplication
3. Helps in detoxifying ammonia in the liver cells
4. Plays an important role in apoptosis or programmed cell death
5. Responsible for building certain parts of the blood and various hormones like testosterone and oestrogen
6. Helps in maintaining an adequate concentration of calcium ions within the compartments of the cell
7. It is also involved in various cellular activities like cellular differentiation, cell signalling, cell senescence, controlling the cell cycle and also in cell growth.

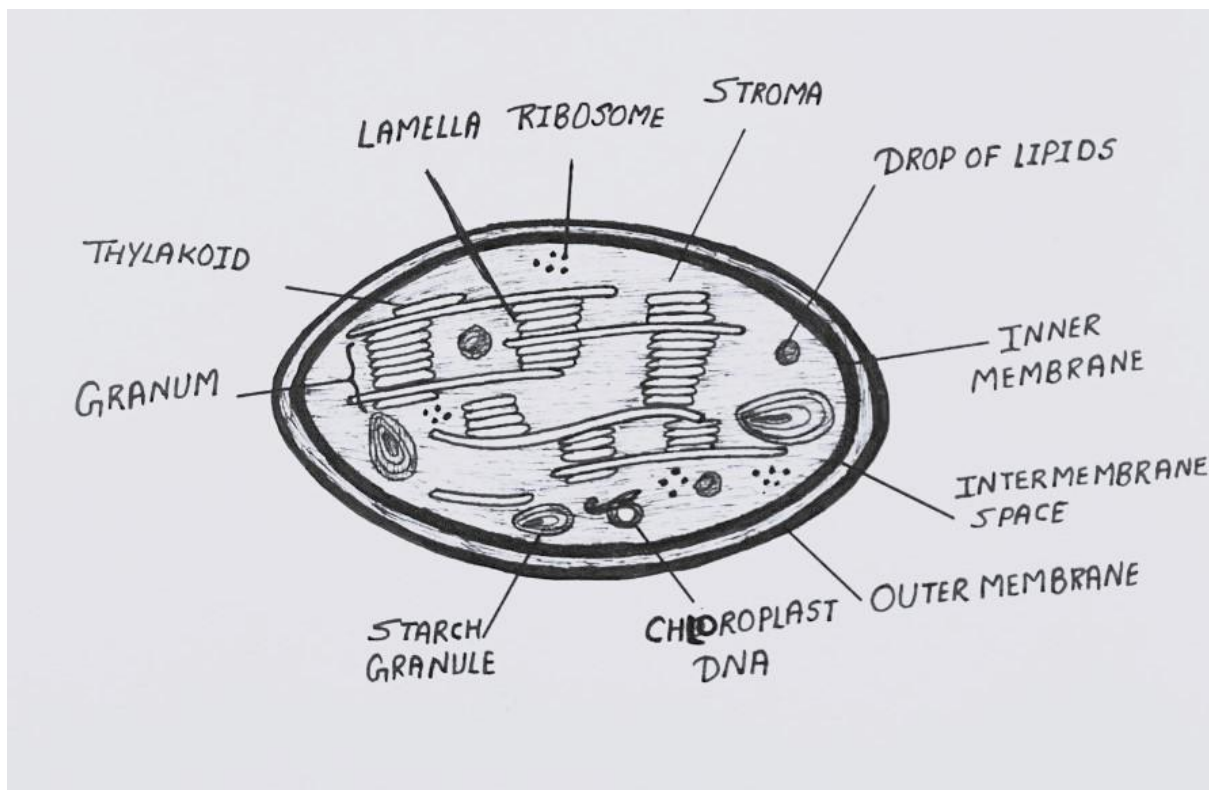
Chloroplast

“Chloroplast is an organelle that contains the photosynthetic pigment chlorophyll that captures sunlight and converts it into useful energy, thereby, releasing oxygen from water. “

- The first definitive description of a chloroplast was given by **Hugo von Mohl** in 1837 as discrete bodies within the green plant cell.
- Chloroplasts are found in all green plants and algae. They are the food producers of plants. These are found in mesophyll cells located in the leaves of the plants. They contain a high concentration of chlorophyll that traps sunlight.
- This cell organelle is not present in animal cells.
- Chloroplast has its own extra-nuclear DNA and therefore are semiautonomous, like mitochondria.
- They also produce proteins and lipids required for the production of chloroplast membrane.

Structure of Chloroplast

The chloroplast diagram below represents the chloroplast structure mentioning the different parts of the chloroplast. The parts of a chloroplast such as the inner membrane, outer membrane, intermembrane space, thylakoid membrane, stroma and lamella can be clearly marked out.



Chloroplasts are found in all higher plants. It is oval or biconvex, found within the mesophyll of the plant cell. The size of the chloroplast usually varies between 4-6 μm in diameter and 1-3 μm in thickness. They are double-membrane organelle with the presence of outer, inner and intermembrane space. There are two distinct regions present inside a chloroplast known as the grana and stroma.

- Grana are made up of stacks of disc-shaped structures known as thylakoids or lamellae. The grana of the chloroplast consists of chlorophyll pigments and are the functional units of chloroplasts.
- Stroma is the homogenous matrix which contains grana and is similar to the cytoplasm in cells in which all the organelles are embedded. Stroma also contains various enzymes, DNA, ribosomes, and other substances. Stroma lamellae function by connecting the stacks of thylakoid sacs or grana.

The chloroplast structure consists of the following parts:

Membrane Envelope

It comprises inner and outer lipid bilayer membranes. The inner membrane separates the stroma from the intermembrane space.

Intermembrane Space

The space between inner and outer membranes.

Thylakoid System (Lamellae)

The system is suspended in the stroma. It is a collection of membranous sacs called thylakoids or lamellae. The green coloured pigments called chlorophyll are found in the thylakoid membranes. It is the site for the process of light-dependent reactions of the photosynthesis process. The thylakoids are arranged in stacks known as grana and each granum contains around 10-20 thylakoids.

Stroma

It is a colourless, alkaline, aqueous, protein-rich fluid present within the inner membrane of the chloroplast present surrounding the grana.

Grana

Stack of lamellae in plastids is known as grana. These are the sites of conversion of light energy into chemical energy.

Chlorophyll

It is a green photosynthetic pigment that helps in the process of photosynthesis.

Functions of Chloroplast

Following are the important chloroplast functions:

- The most important function of the chloroplast is to synthesise food by the process of **photosynthesis**.
- Absorbs light energy and converts it into chemical energy.
- Chloroplast has a structure called chlorophyll which functions by trapping the solar energy and is used for the synthesis of food in all green plants.
- Produces NADPH and molecular oxygen (O₂) by photolysis of water.
- Produces ATP – Adenosine triphosphate by the process of photosynthesis.
- The carbon dioxide (CO₂) obtained from the air is used to generate carbon and sugar during the Calvin Cycle or dark reaction of photosynthesis.