

MITOCHONDRIA STRUCTURE AND FUNCTIONS

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Introduction :

- Like other cell organelles which found in eukaryotic cells the mitochondria are most important cell organelles.
- These are lacking in bacterial cells.
- Mitochondria(mito=thread chondrion=granule) are thread like or granular structures are also called as “power house” of cells one associated with aerobic respiration.
- These are the sites of cellular respiration, primarily concerned with the oxidation of organic acids and transformation of their potential energy into chemical energy stored in high energy ATP (adenosine triphosphate) molecules.

Mitochondrion (plural = mitochondria)

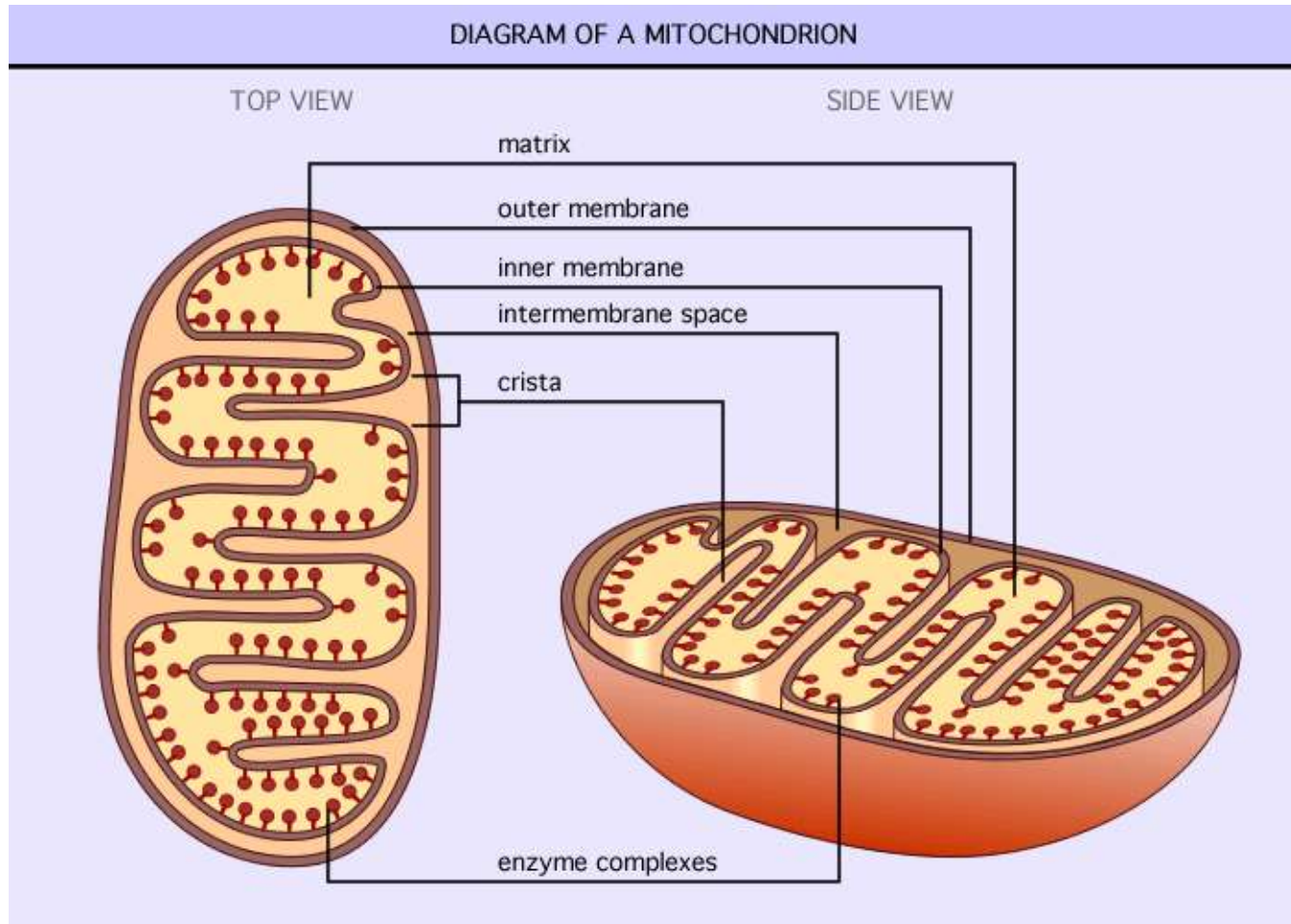
- “Powerhouse” of the cell
- Generate cellular **energy (ATP)**
- More **active cells** like **muscle cells** have **MORE mitochondria**
- Both plants & animal cells have mitochondria
- Site of **CELLULAR RESPIRATION** (burning glucose)
- copyright massengale **Kolliker (1880)** was first observed the granules in



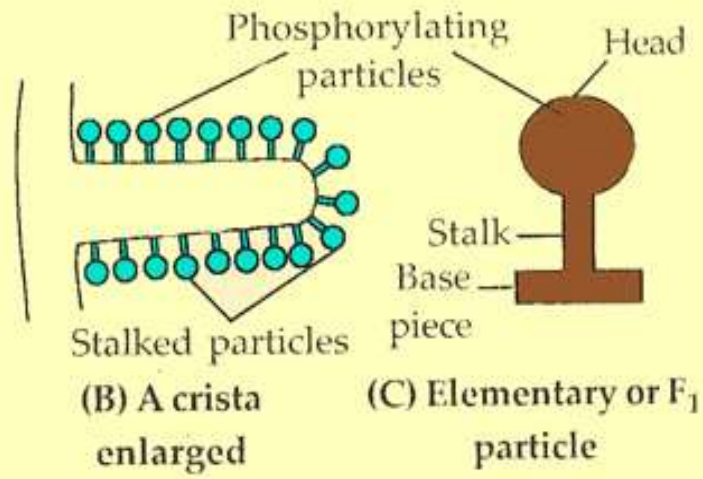
Shape ,Size & Number :

- The shape, size & number of mitochondria are variable in cells.
- Usually these are filamentous or granular.
- They can change their shape like club, tennis racket or vesicular.
- Size is averagely $0.5\ \mu$ to $1.0\ \mu$ in diameter and about $2-8\ \mu$ in length.
- The number per cell is about 300 to 800.

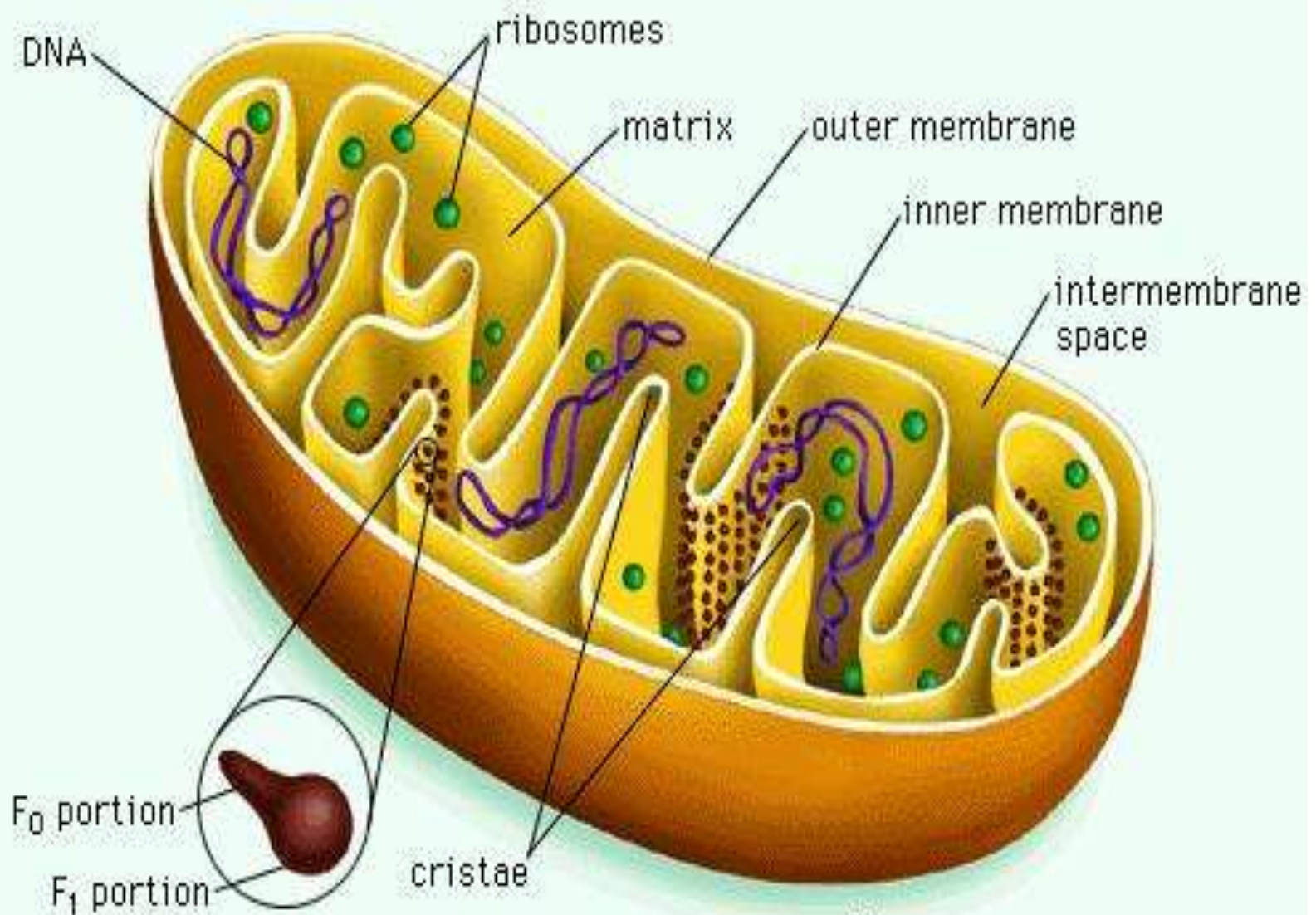
Structure



F1 particles



Structure



MITOCHONDRIA

Mitochondria Inner Structure

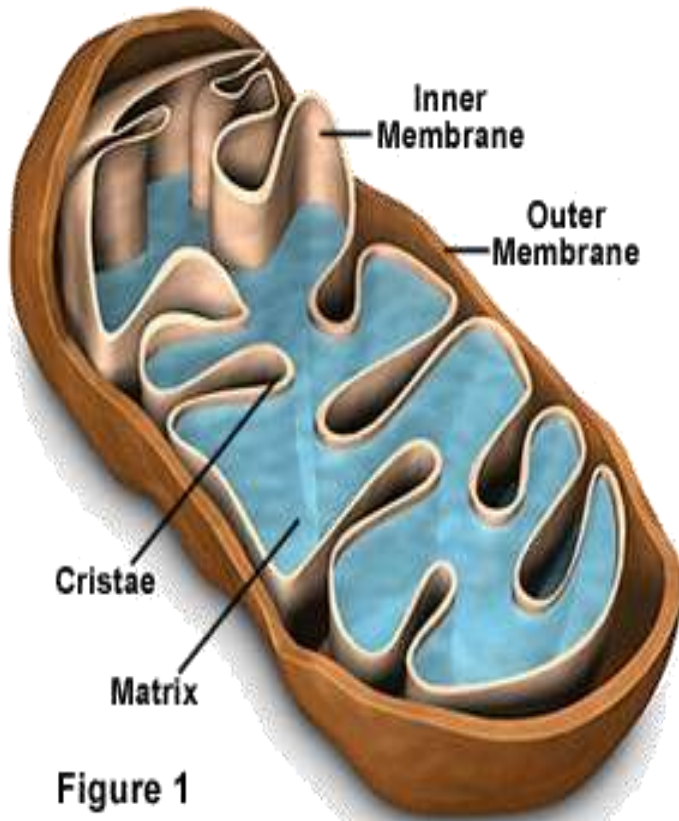


Figure 1

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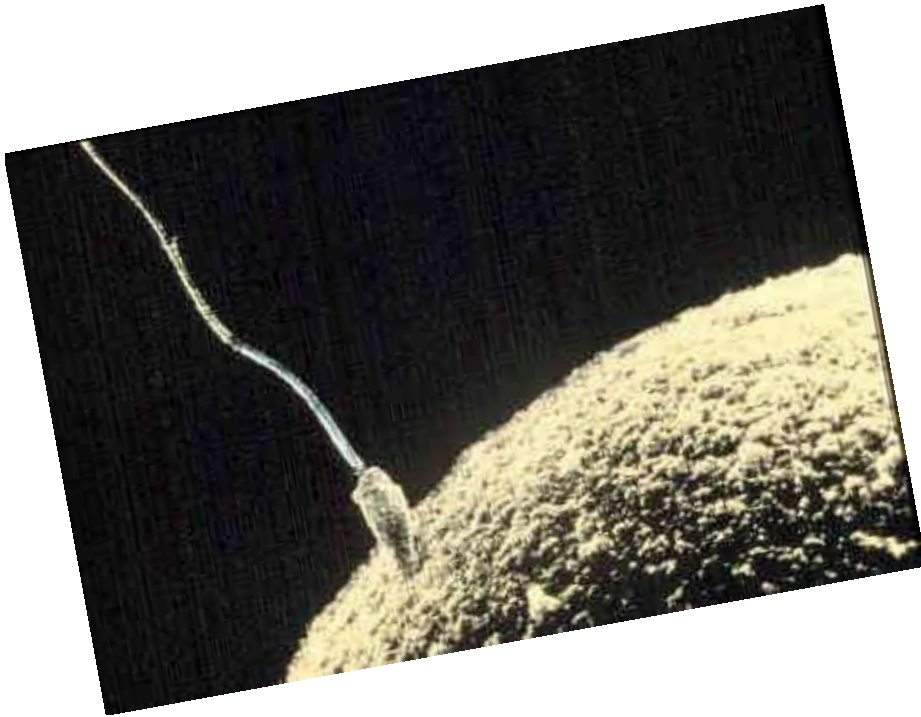
Surrounded by a DOUBLE membrane

Has its own DNA

Folded inner membrane called **CRISTAE**
(increases surface area
for more chemical
Reactions)

Interior called **MATRIX**

Interesting Fact ---



- **Mitochondria
Come from
cytoplasm in the
EGG cell during
fertilization**
Therefore ...
- **You inherit your
mitochondria
from your mother!**

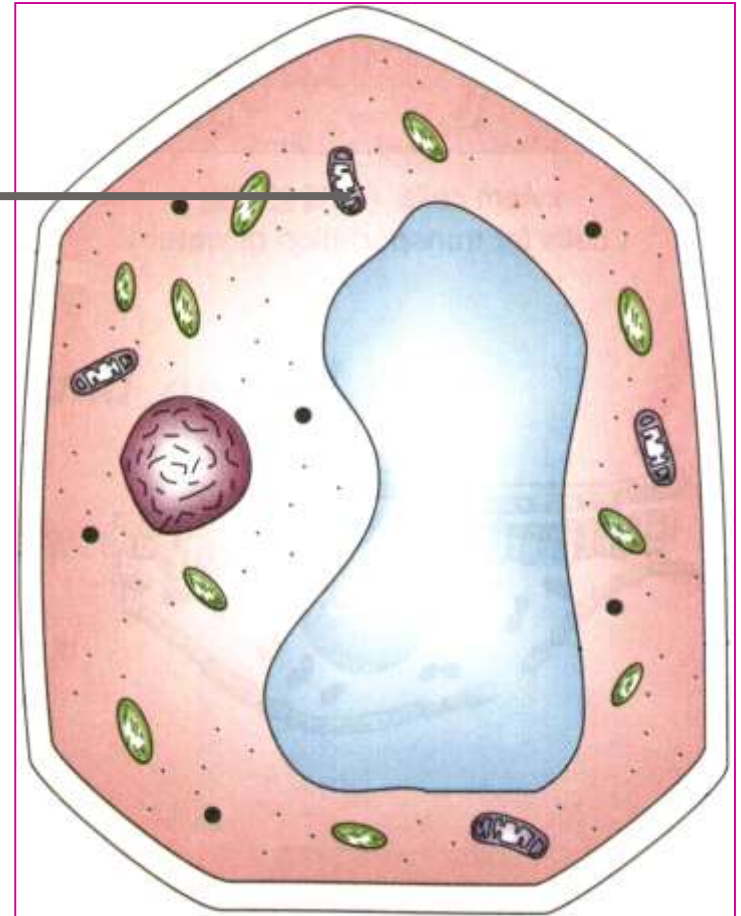
Structure :

- **A mitochondrion consist of mainly two parts-**
- **Limiting membrane**
- **Inner mass or matrix**
- **Each mitochondrion is enclosed by two membranes, made up of lipo-protein.**
- **Outer membrane :-**
- **The outer membrane is 6 nm thick, it is smooth and permeable in nature.**

Cell Powerhouse

Mitochondrion
(mitochondria)

Rod shape



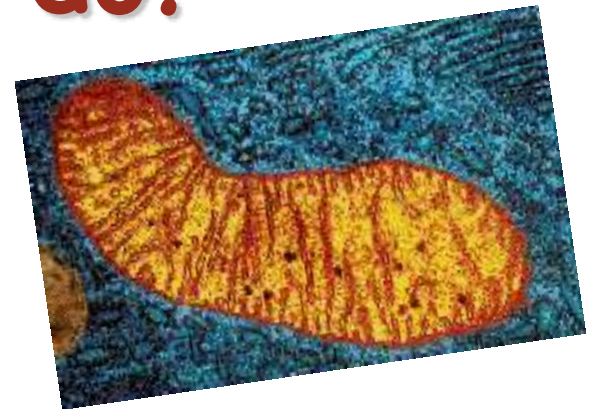
STRUCTURE

- **Inner membrane :**
- It is 50 to 70 A^0 thick and show many infoldings (plate-like) into the cavity of mitochondrion these are called **mitochondrial crests or cristae**.
- They penetrate the matrix of mitochondrion.
- The cristae may be branched, complete or incomplete, straight or zigzag.
- The cristae is usually run as right angles to the axis of mitochondrion.
- The space between two membrane is called **perimitochondrial space** (60-80 A^0 thick).
- The inner membrane of mitochondria is the site of electron transport system.
- The enzymes involved in fatty acid synthesis and ATP-synthesizing complexes are also located in the inner

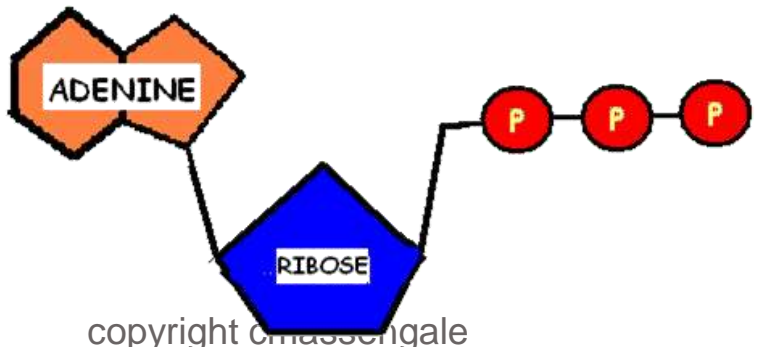
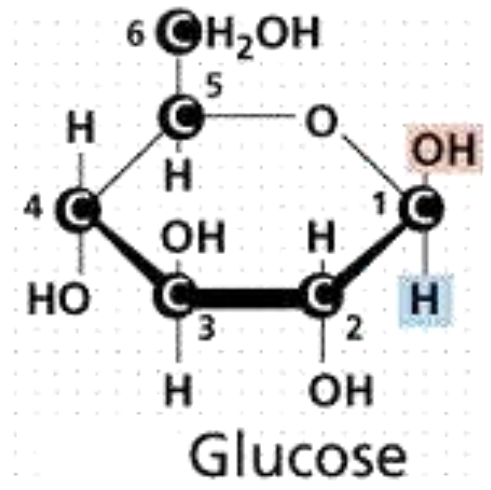
What do mitochondria do?



“Power plant” of the cell



Burns glucose to release energy (ATP)



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Stores energy as ATP

Mitochondria

Mitochondria: Organelles which are the sites of **cellular respiration**, a catabolic oxygen-requiring process that uses energy extracted from organic macromolecules to produce **ATP**.

- Found in nearly all **eukaryotic** cells.
- Number of mitochondria per cell varies and directly correlates with the cell's metabolic activity.
- Are about **1 μm** in diameter and **1-10 μm** in length.
- Are **dynamic** structure that move, change their shapes and divide.

❖ The inner and outer membranes divide the mitochondrion

into two internal compartments:

1. **The intermembrane space:**

➤ Narrow region between the inner and outer mitochondrial membrane

2. **Mitochondrial Matrix**

➤ Compartment enclosed by the inner mitochondrial membrane.

➤ Contains enzymes that catalyze some metabolic steps of cellular respiration.

➤ Contains mitochondrial DNA and ribosomes

Elementary or F1 particles :

- The inner membrane of mitochondria and the inner surface of cristae appears to have knob like projections known as **elementary particles** also called **F1 particles**.
- These particles consist of a base, a stalk and spherical head. The inner membrane surface contains more than 10,000 to 30,000 electron transport chains & ATP synthesizing enzymes.
- The inner membrane of mitochondria contains the ATP synthesizing enzyme **ATP synthetase**.
- This enzyme complex has two parts or components F_0 and F_1 (F = Factor).
- The F_1 component is like a doorknob protrudes into the matrix.

Elementary or F1 particles :

- It is attached by a stalk to Fo – component which is embedded in the membrane.
- The round knob like component contain a polypeptide chain sub-units.
- It has many binding sites for ATP and ADP.
- The Fo act as a base piece. It is photon channel of enzyme complex.
- The stalk between Fo and F1 is communication portion of enzyme complex .
- The enzyme complex synthesize ATP from ADP, hence called **ATP synthetase**.
- The spherical head consists of a soluble protein called as F1 coupling factor, which is considered as an enzyme responsible for ATP synthesis during oxidative phosphorylation.

Matrix:

- It is present in the mitochondrial cavity.
- It is dense homogenous gel- like substance containing lipids, proteins, and certain granules.
- It contains most of the enzymes of citric acid cycle, fatty acid oxidation & pyruvate dehydrogenase system.
- It also contains coenzymes like ATP ADP, NAD, NADP and several ions like Mg^{++} , K, and Ca^{++} .

Functions:

- Mitochondria catalyze the reactions of Krebs cycle and perform oxidative phosphorylation to release high grade energy in the form of ATP, NADH₂, FADH₂.
- The energy of ATP is utilized by metabolic activities.
- It play an important role in the oxidation of long chain fatty acids to carbon dioxide H₂O.
- They are “power house of cell” as about 90% of total energy (ATP) is formed in

them

THANKS