

# **ULTRASTRUCTURE OF MITOCHON DRIA**

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# Mitochondria

- The mitochondria are thread like or granular cytoplasmic organelles . They contain many enzymes and coenzymes which are responsible for energy metabolism. They are described as the power plants or power house of cells.(Gr. Mito= Thread, chondrion = granules ).
- The mitochondria were first observed by Kolliker in 1850 as granular structure in the striated muscles.
- Richard Altmann (1890) developed a specific stain that had useful specificity for the mitochondria. He named this organelles, the bioblast.

# Occurrence

- they are found both in animal and plant.
- And also of certain microorganism including Algae, Protozoa, & Fungi.
- These are absent in bacterial cells.
- They have lipoprotein framework which contain enzyme and coenzymes required for energy metabolism.
- They also contain a specific DNA for the cytoplasmic inheritance and ribosomes for the protein synthesis

# Shape of the Mitochondria

- **The mitochondria may be filamentous or granular in shape.**
- **The shape of mitochondria may change from one cell to another depending upon the physiological condition of the cell.**
- **They may be rod, club, ring, rounded or vesicular shaped.**

# Number of the Mitochondria

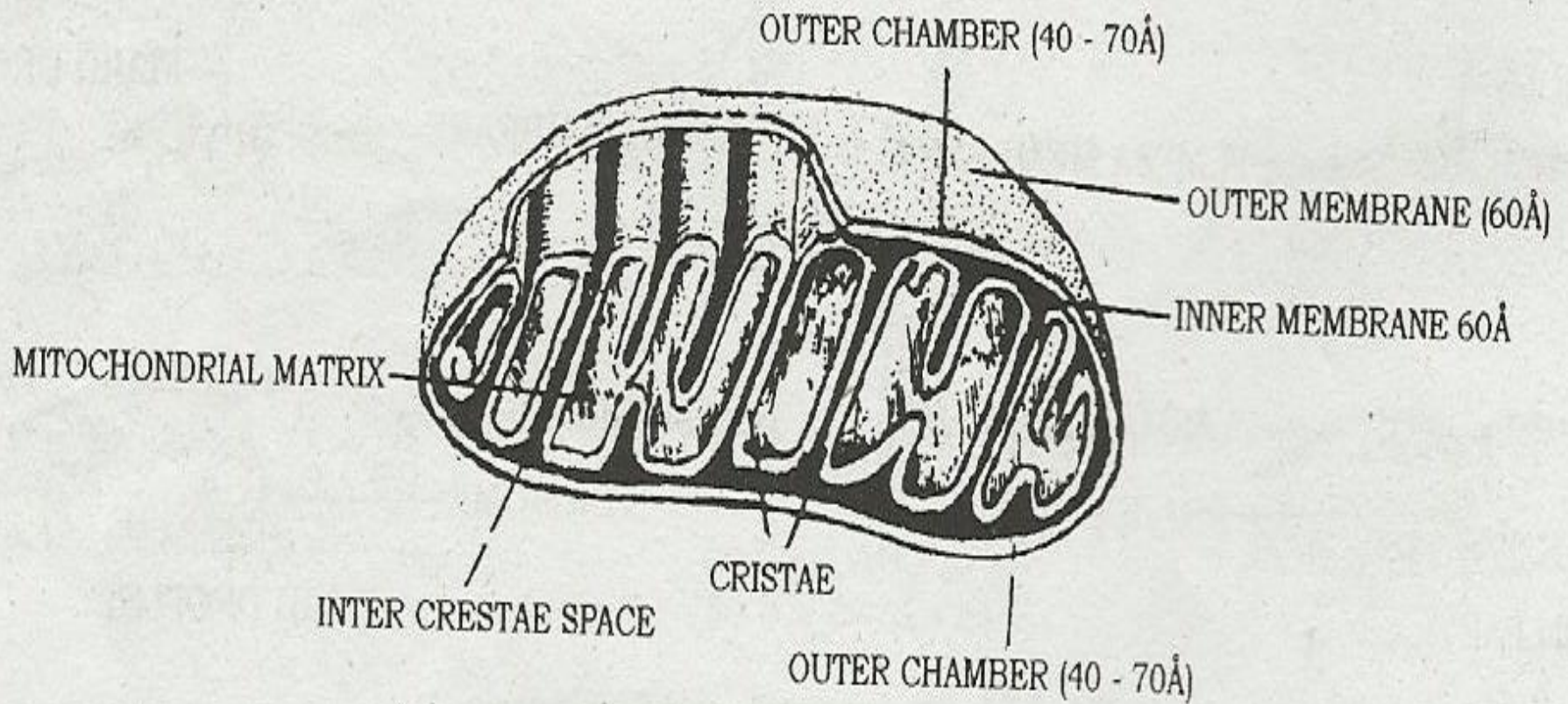
- **The number is particularly related to the functional state of the cell. If metabolic activity high the number of mitochondria is also high. A small number indicates cells of low metabolic activity. Thus they are found to be more abundant in liver and kidney.**
- **The Amoeba contains 50,000 whereas egg of sea urchin contains 1, 40,000 to 1, 50, 000 mitochondria.**

# Size of the Mitochondria

- **Normally mitochondria vary in size from 0.5 micron to 2.0 micron in diameter and 3 to 5 micron in length .**
- **Distribution - normally mitochondria are distributed in cytoplasm,**
- **In kidney are found in basal cell.**
- **In skeletal muscles, mitochondria are located between myofibrils**

# Ultrastructure of Mitochondria

- **Mitochondrial membrane or envelope –**
- **Matrix**
- **Elementary particles**
- **Mitochondria acts as a power house of cells**
- **Chemical composition of Mitochondria**
- **Function of mitochondria**



**Fig. 2.12 : Mitochondria - structure**

**MITOCHONDRIA : ELECTRON MICROSCOPE**



## Ultra structure of Mitochondria

- **1) Mitochondrial membrane or envelop -**
- **Each mitochondria is bounded by two unit membrane called as outer and inner membrane**
- **Each membrane is 40-60 A0. .It is made up of lipoprotein**
- **Outer membrane is 40-70 A in width and filled with watery fluid.**
- **The Outer membrane is smooth and continuous, permeable to small molecules or solute.**

# Ultra structure of Mitochondria

- **1) Mitochondrial membrane or envelop –**
- The inner membrane is rough, selectively permeable and infolded in to number of finger like projections called **Cristae or crests**. They increase surface area of inner membrane for enzymatic activity.
- The side of inner membrane facing the matrix is called M-side (inner matrix) while the side facing outer chamber is C- side. (Cytostol).
- *Outer membrane posses porion or minute pores or protein lined channels for passage of low molecular weight substances. They make outer membrane more permeable.*

# Ultrastructure of Mitochondria

- **2) Matrix** – Inner membrane is filled with colourless, granular matrix of protein and lipid
- The matrix contains 70s types of ribosomes called mitoribosomes, 2-6 circular, naked DNA molecules, RNAs.
- The matrix also consist of insoluble salts like  $Mg^{++}$  and  $Ca^{++}$ .

# Ultrastructure of Mitochondria

- **Elementary particles** - on the M-face of inner membrane, number of stalk particles are present called **Elementary particles /F1 particles/Oxysomes/Electron transport particles/respiratory assemblies/inner membrane spheres/fo – f1 particles/subunits of Fernandez Moran.**
- Each f1 particle consist of three parts, base, stalk and head.
- **Base piece (Fo subunit)-** *It is embedded in inner mitochondrial membrane. it is rectangular and 115x 45 Å. It functions as proton channel or tunnel.*
- **Stalk (F5-F6 subunit)-** It is about 50Å in length, spherical head is connected to base piece by cylindrical short stalk.
- **Head piece (F1- subunit)-** It is spherical and is about 75-100 Å in diameter . It contains the enzymes like, ATP synthase or ATPase which controls ATP synthesis, hence, they are called as ATP particles.
- They project into matrix and contain electron acceptors, enzymes, co-enzymes, required for ATP synthesis during ETS.

# Mitochondria acts as power houses of cell :

- Mitochondria is the site of respiration.
- It produces the energy rich ATP molecules during the oxidation of glucose by using oxidative energy.
- The energy rich ATP molecules are readily for various activities of the cells.
- As, mitochondria produces, stored and supplies biological energy, hence called as power houses of cells .

# Chemical composition of Mitochondria

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- They are found to contain 65 to 75 % protein, 25 to 30% lipid, 0.5% RNA and small amount of DNA.
- The lipid part of mitochondria is composed of 90% phospholipids, 5% free fatty acids.
- Small amount of sulphur iron, copper and some vitamins are present.
- There are more than 70 enzymes and coenzymes in mitochondria.

# Function of Mitochondria

- They provide site for aerobic respiration .
- Krebs's cycle takes place in matrix and ETS takes place in F1 particles.
- Generation ATP molecules takes place.
- During krebs's cycle and ETS, organic substrates are completely oxidized with the release of energy. They are also called as power house of the cell.
- It is unit of extranuclear inheritance i.e. mitochondrial DNA control characters like male sterility.
- Mitochondria can store and release calcium and regulate its concentration in cell.

*Thanking You*