

MITOCHONDRIA

- Its Structure & Functions

Introduction

∴, Mitos = thread; chondrion = ~~the~~ granules

that in cytoplasm of cells. Physiologically, they are "Biochemical machines" that recover the energy contained in food-stuffs thru' "Krebs's Cycle & Resp. Chain" & convert it by "Oxidative Phosphorylation" into high energy phosphate bond ($\sim P$) of adenosine triphosphate (ATP). Hence, "Mitochondria are also called the POWER HOUSE of the cell that produces the energy necessary for many cellular functions".

HISTORICAL ACCOUNT

- | | | |
|---------------------------|---|---|
| Flemming (1882) | — | called it " <u>Filia</u> " |
| Holtmann (1892) | — | as " <u>Bioplast</u> " |
| Zenker (1897) | — | coined the term " <u>Mitochondria</u> " |
| Michaelis (1900) | — | stained them w/ a dye, " <u>Janus Green</u> " |
| Lewis & Lewis (1914) | — | studied them in tissue culture. |
| Palade & Sjostrand (1952) | — | gave 1st ultrastr. details. |

STRUCTURE

The overall str. of mitochondria displays them as "Double Membrane Str." consisting of an outer memb. & an inner memb. leaving a compartment in betⁿ them known as "Outer Compartment". The inner memb. encloses a central cavity, the inner compartment filled up & w/it matrix into which are thrown ridges like str. called "Cristae". On the outer surface of cristae, there are numerous tiny particles ~~that on the cristae~~ known as - F_1 -particles.

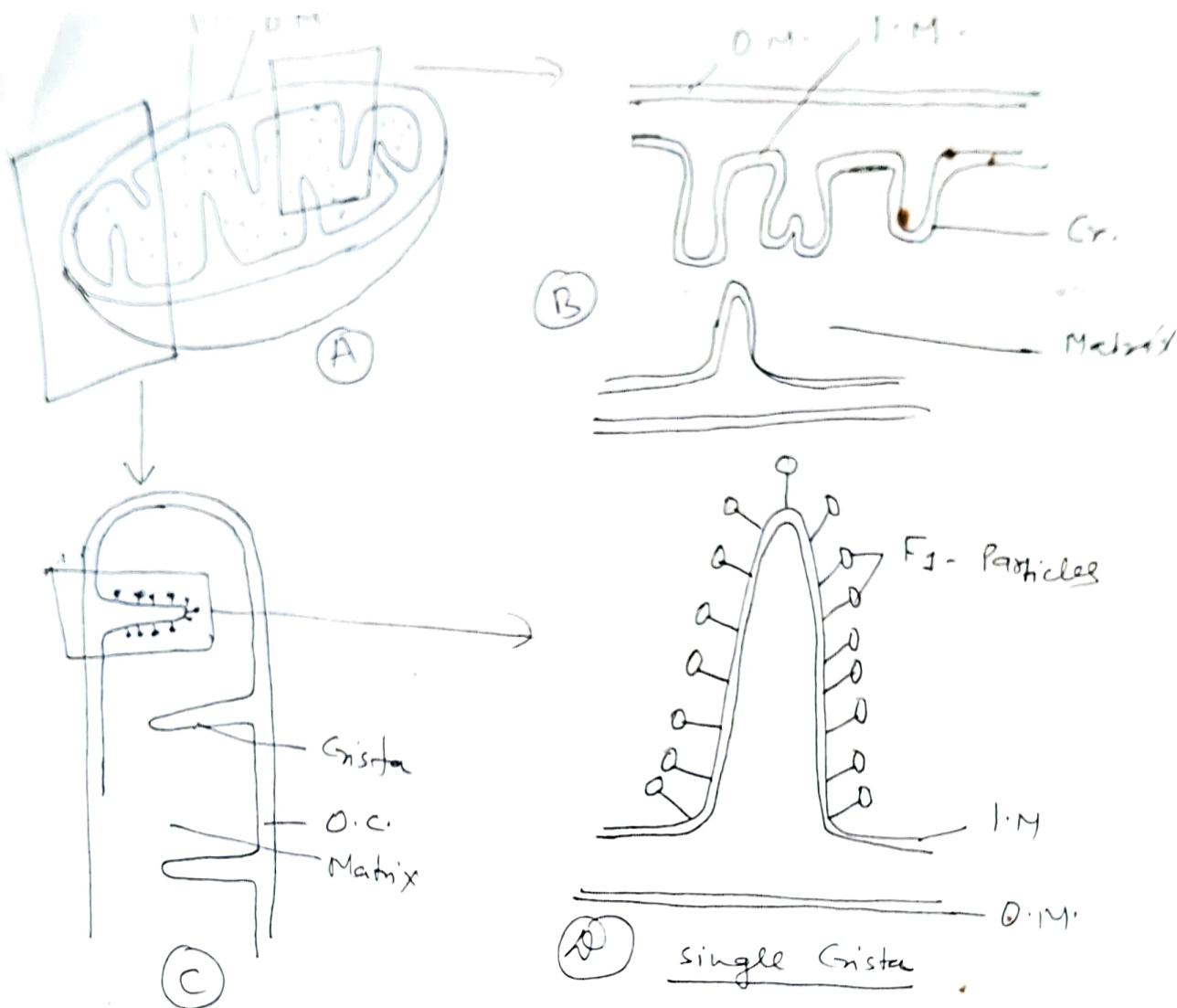


Fig: Str. of a Mitochondrion (A-D)

ULTRA STR. OF MITOCHONDRIA

Following are the different components of mitochondria:→

(A) MIT. MEMBRANES:

- i) Bounded by 2-membranes — Outer (O.M.) & Inner Membr. (I.M.)
- ii) Thickness of O.M. & I.M. varies betⁿ 50-70 Å.
- iii) Each memb. is a bilaminar & unit memb. in str. like cell memb. composed of "Protein-Lipid-Protein".
- iv) Each layer of protein [on each side of lipid middle lipid layer] is osmophilic in nature.
- v) In contrast, osmophobic layer (20 Å) of lipid, [in the form of a bilayer, in betⁿ them.]
- vi) at some points, O.M. is connected to the memb. of ER.
- vii) ~~the outer face of I.M. is called "cytosol or C-face" directed towards outer~~

MIT. COMPARTMENTS:

- I.M. of mitochondria divides ~~the~~ it into 2 - chambers / compartments: -

- a. Outer Comp. (O.C.)
- b. Inner Comp. (I.C.)

a. Outer Compartment: (O.C.)

- i) It is a perimit. or intermembranous space surrounded by O.M. & I.M.
- xii) I.M. also extends into the core of crests.]
- iii) thickness of O.C. varies from $60-80 \text{ \AA}$.
- iv) filled w a fluid of low density & viscosity & is rich in co-enzymes.

b. Inner Chamber: (I.C.)

- space bounded by inn. memb. is called "Inner Chamber".
- greatly homogeneous & contains enzymes for Kreb's cycle & other rxns.
- side of I.M. facing matrix is called "M-side" & facing O.C. is called "C-side".

~~I.M. is thrown up into folds called "Cristae"~~

- Mit. matrix in it contains following stors.: →
 - a. Intra-mit. granules, $300-500 \text{ \AA}$ in dia, are cation sending sites.
 - b. DNA + mt.
 - c. All the 3-types of ~~RNA~~ RNAs $\Rightarrow$ mRNA, tRNA & rRNA are found in it.
 - d. Ribosomes, the machinery of protein synthesis are + mt. ~~their~~ their sed. value is 55-70S

© MIT. CRISTAE:

- cristae are impushings of I.M. into matrix which increase the surface area for oxi. rxns. occurring in mitochondria.
- x- [Their memb. is I.M. & hence, it resembles to the I.M. in mole. orgn.]
- it carries 2-types of proteins - str. protein & the resp. chain.
- tiny - knob like particles + mt on them are F₁ - particles.

MITOCHONDRIA



Molec. Str. of Mit. Membr.

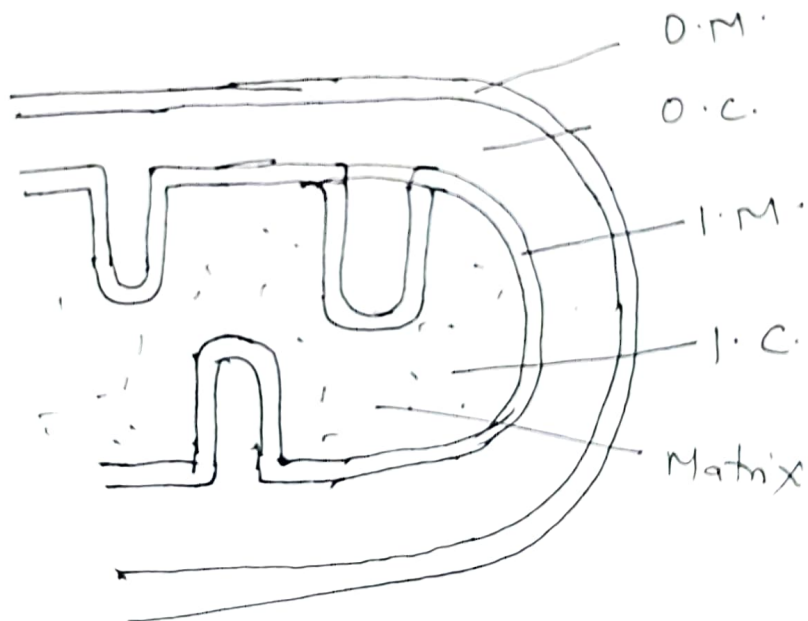


Fig: Membrs. & Chambers of Mitochondria

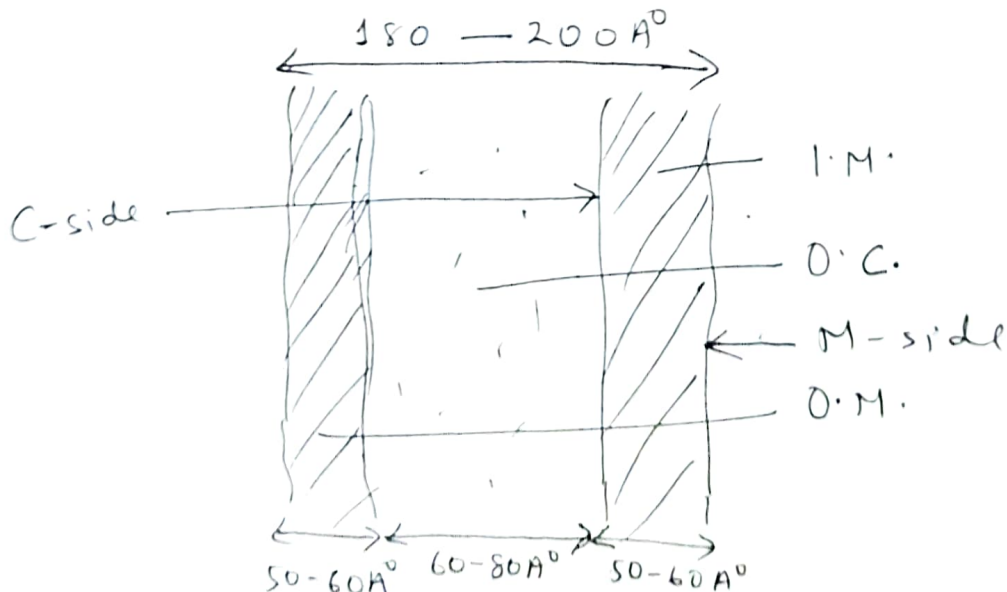


Fig: str. of Mit. Double Membr.

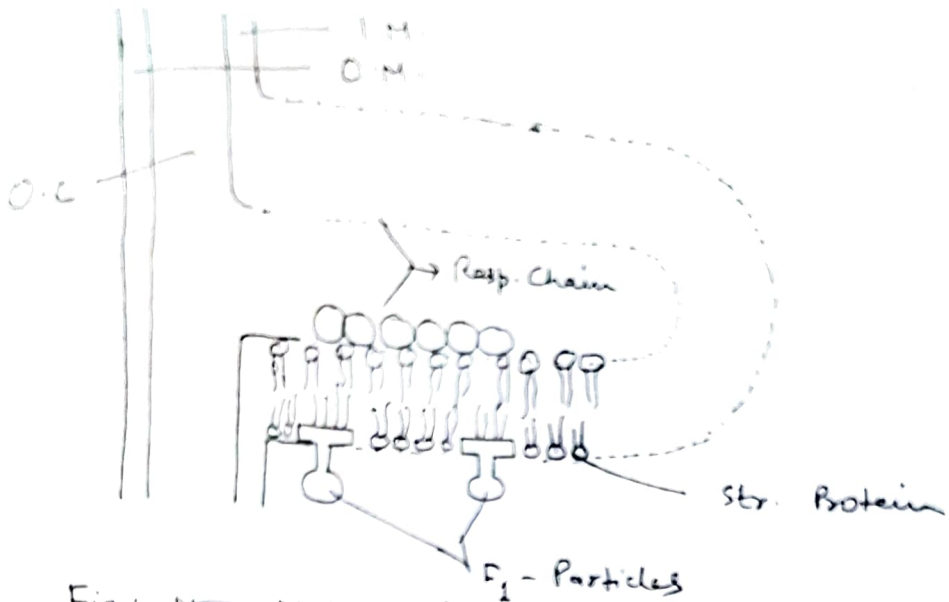


Fig: ~~Mole. Org.~~ Mole. Org. of a mit. crista
(Afts. Garobertis - 1975)

① MIT. PARTICLES:

Usually, 2-types of particles are formed on the ~~outer & inner~~ inner surface of outer memb. (O.M.) & on the inner surface of I.M. Respectively, they are: —

- O.M. particles &
- I.M. particles

② O.M. Particles:

- stalkless particles as simple spheres. ~~of 60A~~
- also known as "subunits of Parson" (Parson, 1967).
- each stalkless particle is a hollow cylinder of 60A long & 60A wide & a central hole of 20A.
- X[- centre to centre spacing betⁿ subunits is 80A]

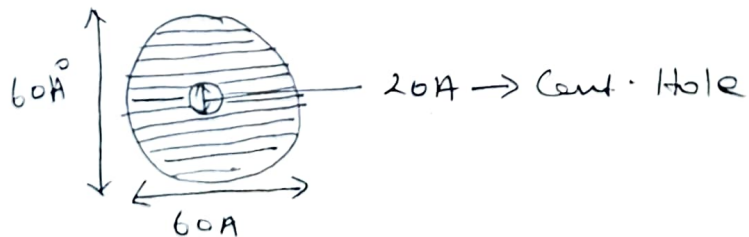


Fig: O.M. Particle

③ I.M. Particles:

- also called as "subunits of Fernandez-Moran" or "elementary particles" or "ATPase - Complex" or "F₁ - particles".
- spaced at 100A intervals.