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Paper III
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MITOCHONDRIA

INTRODUCTION

- The mitochondrion (Plural - Mitochondria) greek.
- It is a double membrane structure found in eukaryotes.
- Mito - thread, chondrion - granule like.
- Found in cytoplasm of the cell.
- First observed by Richard Altman (1894).
- Term Mito. was coined by Benda Carl (1898).
- Produce enzymes for the metabolic conversion of food to energy.

ORIGIN OF MITOCHONDRIA

Mito. derived from a bacteria by a process termed as endosymbiosis.
It arose about 2 billion yrs. ago when a bacterium fused with an archael cell or established a symbiotic relationship with a primitive eukaryotic cell.
The closest extant relatives of Bacteria that give rise to mito. are Rickettsia.
The first person to recognize mito. as descendents of endosymbiotic bacteria Ivan.

MORPHOLOGY :-

Size - It range from 0.5 to 1.0 μm in diameter
Shape - normally saucer shaped. In fibroblast elongated & thread like
Number - Depends on type, size and function status of cell. Ex - Livercells contain 1500 M
Location - cells with high energy requirements
Ex - Sperm tail, Muscles, Flagella.

STRUCTURE — 1) outer membrane.
2) Intermediate space.
3) Inner membrane
4) Cristae

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5) Matrix

Diagram.

OUTER MEMBRANE 1) Simple Phospholipid layer
2) It encloses the Mito
3) Containing Protein Structures called Porins
4) Ions, nutrient mole. ATP, ADP etc can pass through the outer mem: with ease.

INNER MEM
1) Freely permeable only to O_2, CO_2 & water
2) Contains complexes of ETS (Electron transport system) the ATP Synthatase complex & Transport prot
3) Presence of Sophisticated ions Transporters exist
4). Several antiport sys. exist allowing exchang of anions between the cytosol and the mito. me
5) devoid of cholesterol & rich in phospholipid and Cardiolipin.

INTERMEMBRANE SPACE
1) The space between inner mem & outer membrane
2) It has high proton concentration.
3). The space between the inner & outer membran is about 70 angstrom.
4) concentration is same as that of cytosol.

CRISTAE
1) Are folds of inner mitochondrial membrane.
2) Stalked particles of inner mem. spheres; Crista is covered with this inner mem. spheres calle stalked particles or knobs or heads.
3). They contain Protein F_1 portion & F_0 portion. For ATP production and ATO Oxidation.

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MITOCHONDRIAL MATRIX

1). Gel like consistency.
2). Dense homogenous.
3). 2/3rd of total protein of mitochondria.

Mito have
- enzymes
- ribosomes.
- DNA
- mRNA
- Granules
- Fibrils.
- tubules.

Major enzymes include enzymes involved in Syntheris of nucleic acids & proteins.
Fatty acid oxidation.
TCA cycle (except succinic dehydrogenase)

MITOCHONDRIAL DNA

1) Circular mole. double stranded, covalently closed
2) occurs in multiple copies.
3). Can undergo replication and duplication
4). Stores biological information required for growth and multiplication of mitochondria.
5). Usually attached to inner mito. membrane.
6). Human mito DNA ← 2 r RNA, 22 t RNA
7) Not absolutely autonomous. Depends on nuclear DNA (partially autonomous)

FUNCTIONS

Energy transducers of the cell - Synthesis of ATP
1) Krebs cycle in matrix.
2) ETC system.
3) Phosphorylating system ATPase.

Extramitochondrial inheritance
mit. DNA contains Plasmagenes (extrachro. genes)
Transmitted from mother to offsprings.
Synthesis of mit DNA, RNA Protein.
Bring about genes expressions through gene duplication; transcription & translation.
Synthesis 13 polypeptides in humans.
Sites of several metabolic reactions

outer membrane
- oxidation of epinephrine
- Degradation of tryptophan
- Elongation of fatty acid.

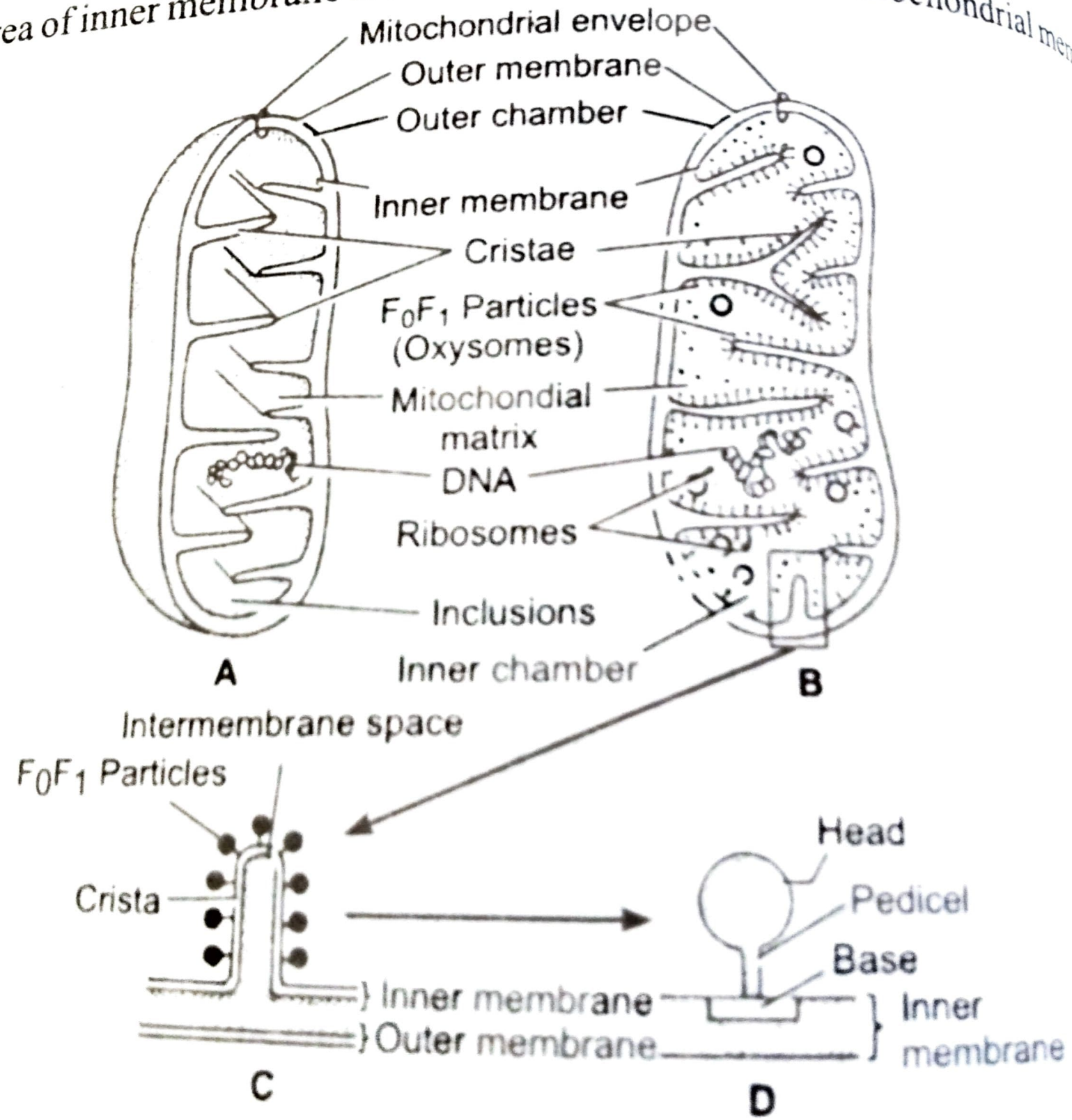
Inner membrane oxidative Phosphorylation.

Matrix
- Krebs cycle.
- Beta oxidation
- Detoxification of Ammonia in Ur cycle
- storage of Ca^{++} ions.

OTHER FUNCTIONS
Production of heat (non shivering thermogenesis)
Role in apoptosis (Programmed cell death)
Synthesis of oestrogen & testosterone
Role in neurotransmitter metabolism.

— X —

e area of inner membrane is 5–15 times more of outer mitochondrial mem



Section of mitoch

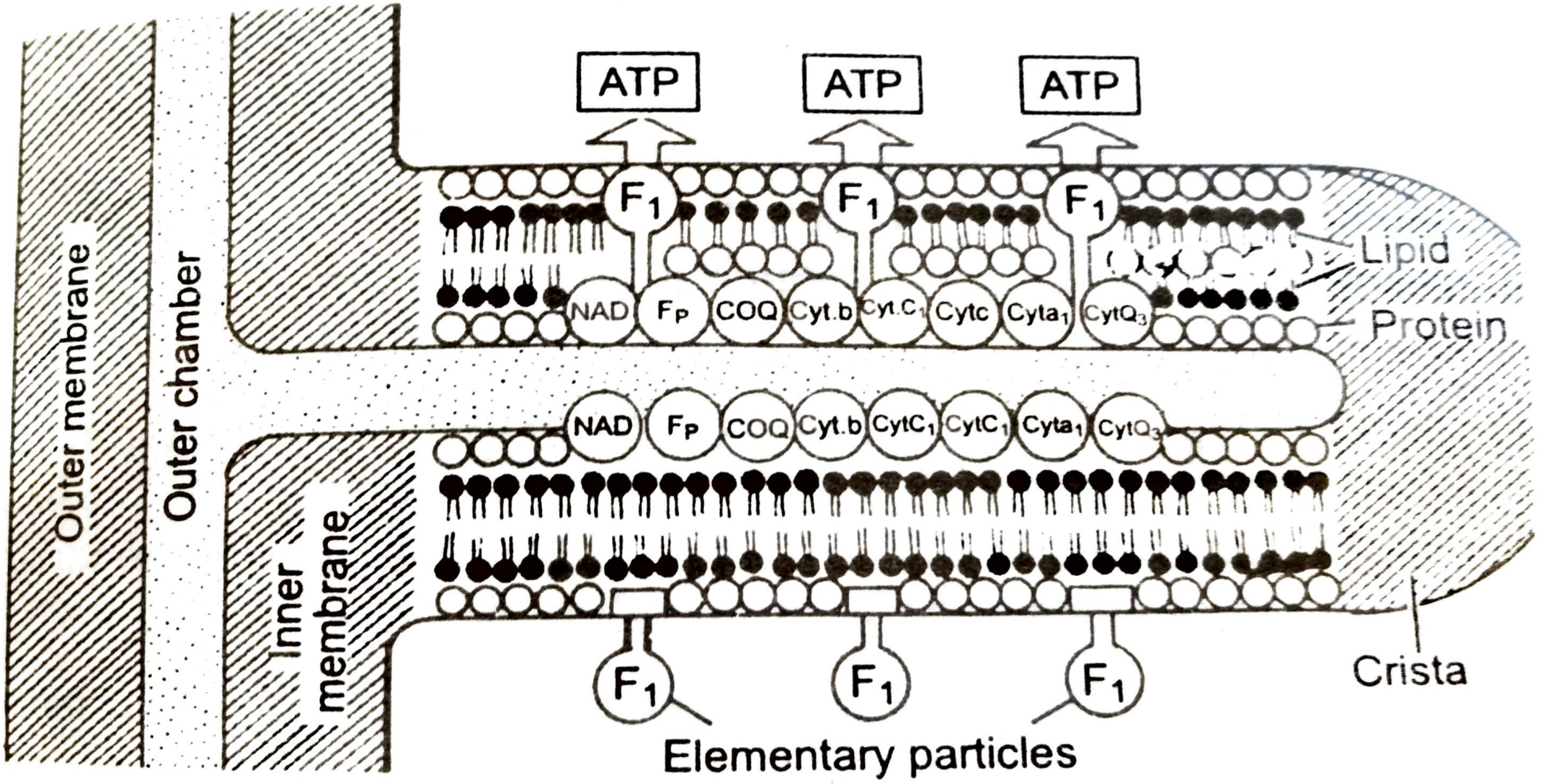


Fig. 15.2 Ultrastructure of mitochondrial crest showing F_1 particles.