

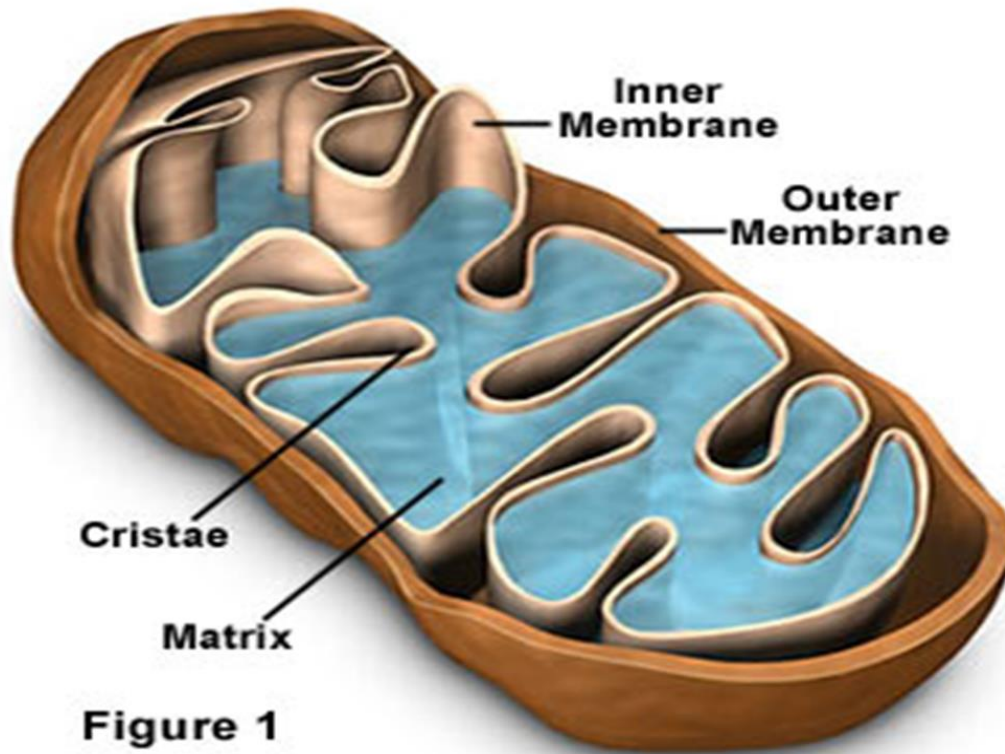
Mitochondria

- **Mitochondria were first seen by Kolliker in 1850 in muscles and called them ‘sarcosomes’.**
- **Flemming (1882) described these organelles as ‘filia’**
- **Altmann (1890) observed these structures and named them ‘bioblasts’.**
- **Benda (1898) stained these organelles with crystal violet and renamed them ‘mitochondria’.**
- **Michaelis (1900) used Janus green B as a vital stain to observe mitochondria in living cells.**

Mitochondria

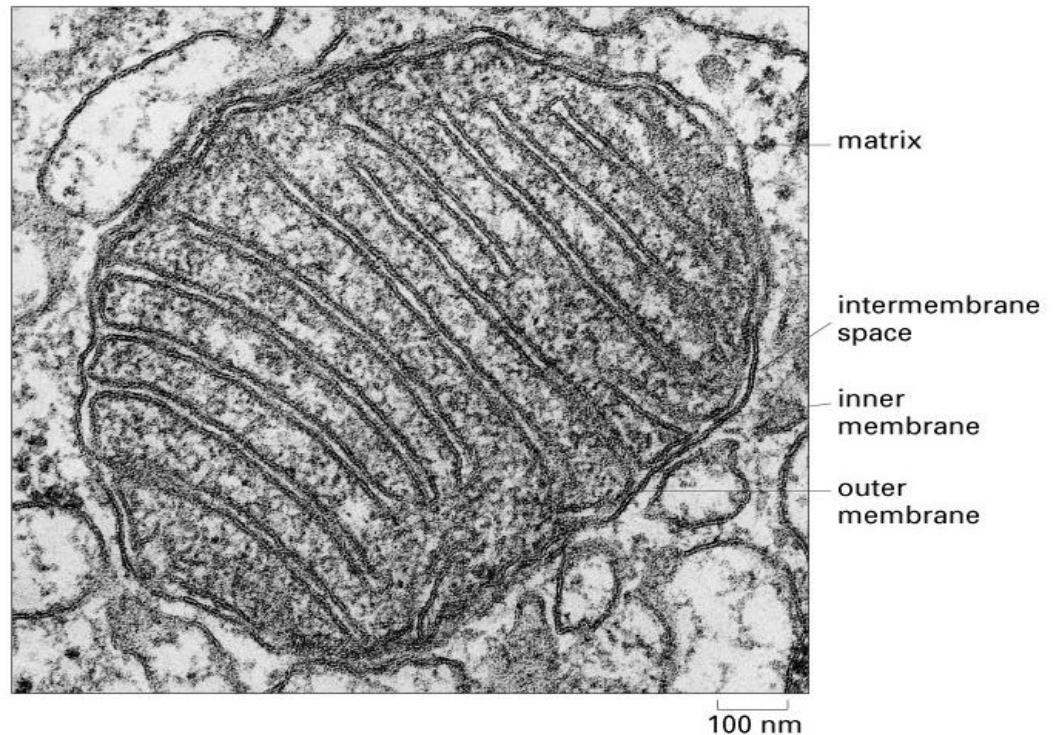
- **The power plant of eukaryotic cell.**
- **These structures vary widely in size, shape, number and location, depending on the species of cell.**
- **They have a diameter of about 1 μ m close to the size of bacterial cells.**
- **In each liver cell of the rat there are perhaps 1000 mitochondria.**
- **Some types of eukaryotic cells, e.g., sperm cells or yeast cells, contain only a few very large mitochondria whereas others, e.g., egg cells contain many thousands.**

- Are able to regenerate themselves without the whole cell undergoing division.



Mitochondrial structure

- *Outer membrane*
- *Intermembrane space*
- *Inner membrane*
- *Matrix*

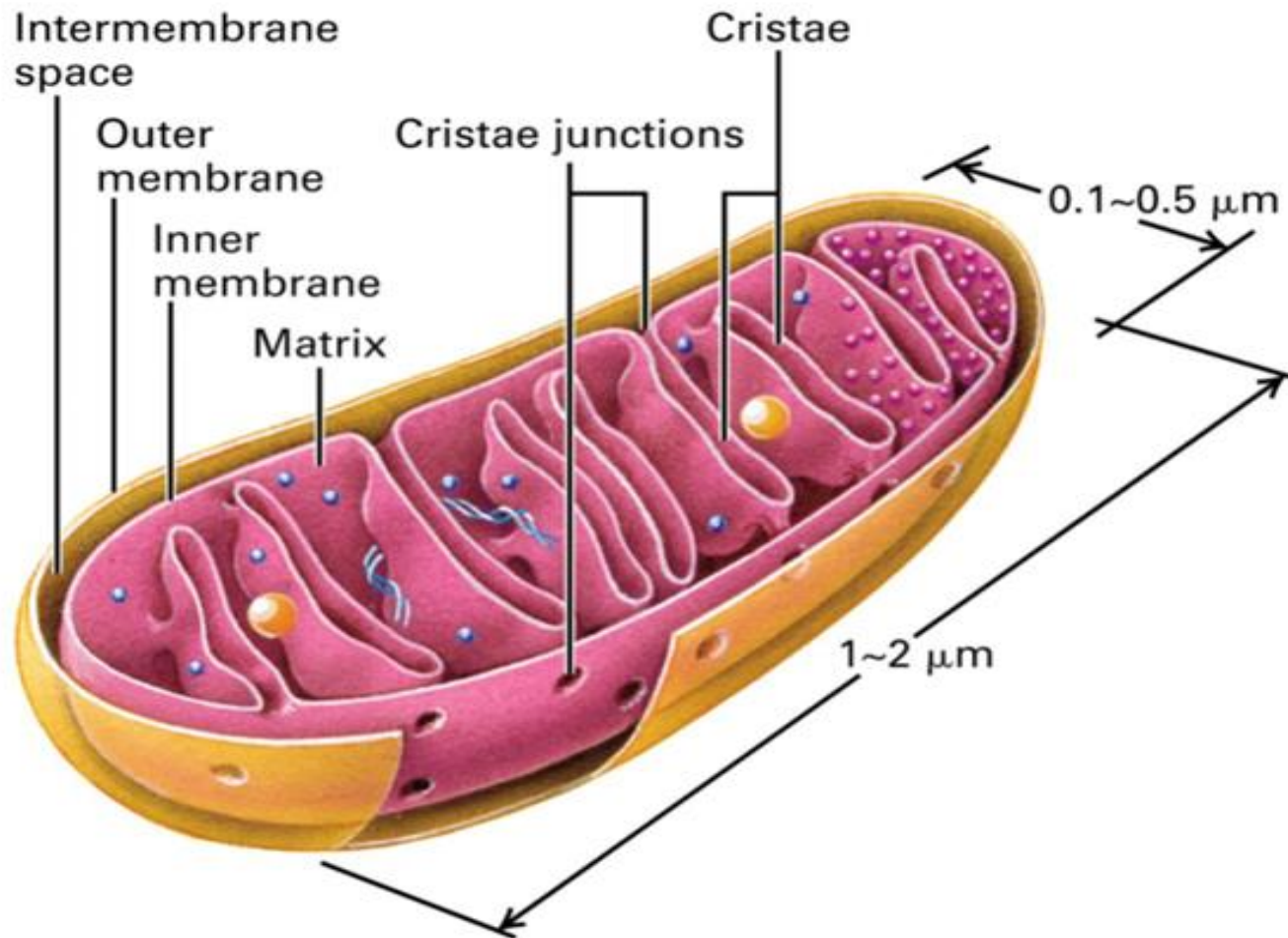


Mitochondria Outer membrane

- **Perforated with large channels (porins) that allow entry of molecules < 5000 kD.**
- **Enzymes involved in mitochondrial lipid synthesis.**

Mitochondria Intermembrane space

- **Space between inner and outer membranes.**
- **Enzymes that use newly-made ATP to phosphorylate other nucleotides.**
- **Compartment into which H^+ is pumped**



Mitochondria Inner membrane:

- **Folded into cristae to maximize surface area**
- **Impermeable to most charged molecules**
- **Proteins that carry out redox reactions of the electron transport chain**
- **Proteins that synthesize ATP**
- **Transport proteins that move molecules into and out of the matrix**
- **In liver mitochondria there are relatively few cristae, but in the mitochondria of heart cells the cristae are very numerous and parallel.**

Mitochondria Matrix

- **Internal space containing enzymes for Krebs cycle.**
- **Contains mitochondrial DNA, special ribosomes, tRNAs, and enzymes required for gene expression.**

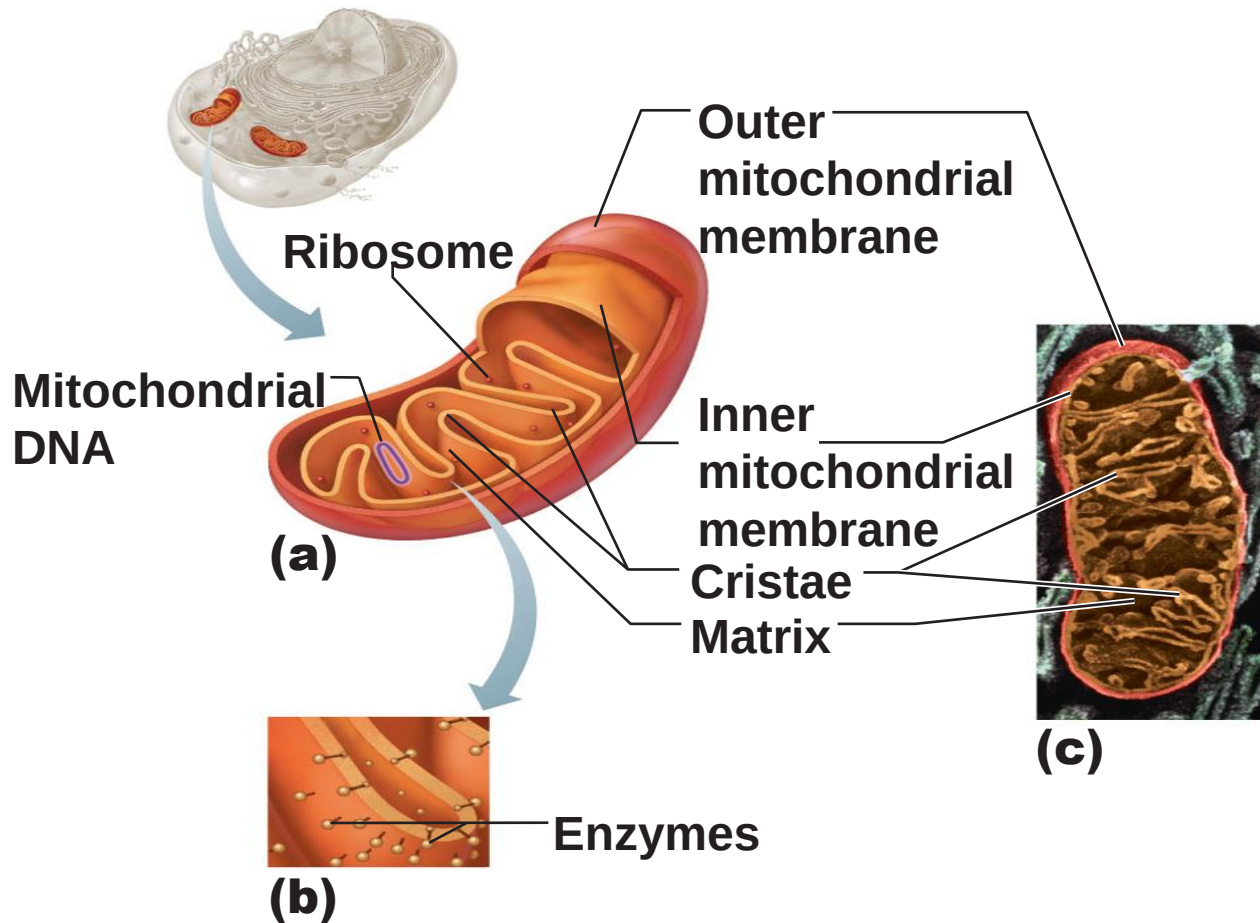
Chemical Composition

Cohn gives the following composition of dry mitochondria:

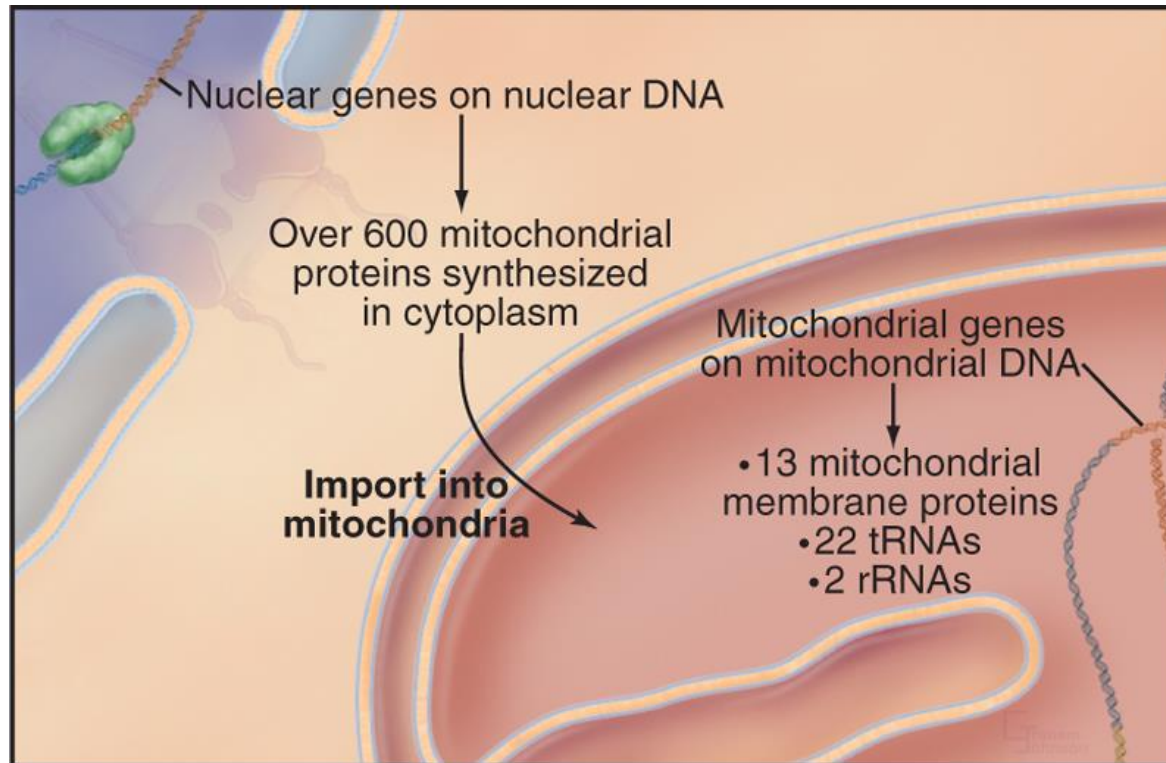
- 70% protein and 25-30% lipids.**
- 0.5% of RNA and small amount of DNA .**
- Mitochondrial DNA comprises about 1% of total cell DNA.**
- Mitochondria contain enzymes for oxidation phosphorylation and electron transfer.**
- Contain their own copies of DNA and RNA along with transcription and translation system (ribosomes).**

- They contain many enzymes that together catalyze the oxidation of the organic cell nutrients by molecular oxygen to yield carbon dioxide and water.
- Some of these enzymes are located in the matrix and some in the inner membrane.
- Much chemical energy is released during these oxidations, which is used to generate adenosine triphosphate (ATP), the major energy- carrying molecule of cells.

ATP formed by the mitochondria diffuses to all parts of the cell, where it is used to carry out cellular work.



Relative contributions of nuclear and mitochondrial genes to protein composition



Function

- They are the primary sites for ATP synthesis in the cell
- They have a key role in apoptosis - programmed cell death

Examples of mitochondrial diseases include:

- **Leigh syndrome**
- **Neonatal lactic acidosis**