

RESPIRATION: MITOCHONDRIAL STRUCTURE

11/13/91, rvsd 11/5/93, 11/7/94, 11/6/95, 8 Nov 99, 7 Nov 01, 10 Nov 03, 24 Oct 07, 29 Oct 08, 28Oct09, 29Oct10
B&D p. 275-, BKH 5th: 398-415, 6th: 248-255, 7th: 248-265

All aerobic energy metabolism beyond pyruvate occurs in mitochondrion

stepwise oxidation of organic intermediates by NAD + FAD

of 36 moles ATP/glucose, 34 generated in mitochondrion (more are produced from F.A.)

Five steps of respiratory mech:

1. glycolysis	in cytoplasm
2. TCA cycle	in mitochondrial matrix
3. electron transport chain	in mitochondrial membranes of cristae
4. pumping of protons producing proton gradient	into intermembranous space
5. phosphorylation of ADP using proton gradient	on interior of inner membrane

MITOCHONDRION STRUCTURE & FUNCTION:

Kolliker 1850 noted 'ordered arrays of particles' in muscle cells these **swelled in water**, deduced that they were **membrane bound**

(We saw these in chicken muscle in lab.)

Warburg 1913 showed oxygen consumption associated with mitochondria

Kennedy and Lehninger 1948 isolated intact mitochondria, showed them to be capable of TCA cycle, electron transport and oxidative phosphorylation

MITOCHONDRION STRUCTURE: two membranes: (p 256)

Outer membrane readily permeable to <5000 MW (no barrier to most solutes)

(therefore intermembranous space same as cytoplasm)

Inner membrane folded into cristae (increases surface area).

Has high density of **proteins**, esp inner face (shown by freeze fracture).

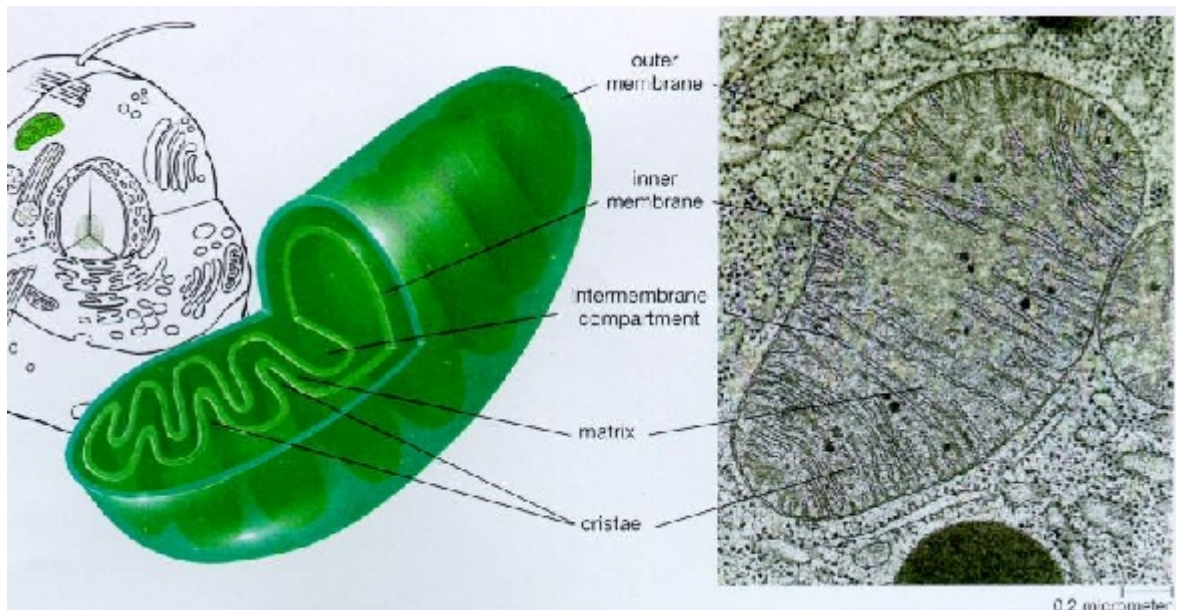
Contains matrix, gel-like fluid, contains:

DNA (11 mil)

ribosomes

enzymes

Higher numbers in cells with high energy requirements, more cristae (500-1000 in hepatocytes)



LOCALIZATION OF FUNCTIONS:

MATRIX

pyruvate oxidation

TCA enzymes, generate NADH and FADH₂

catabolism of AA and FA

MEMBRANE BOUND

electron transport

F-1 particles (ATP synthase) and F-0 complex imbedded in membrane