Oxidative Phosphorylation Cheat Sheet

by rhettbro via cheatography.com/133961/cs/27539/

outlines

Oxidative phosphorylation (Electron transport chain + Chemiosmosis)

Eukaryotic Oxidative Phosphorylation Takes Place in Mitochondria

Oxidative Phosphorylation Depends on Electron Transfer (loss of electrons)

The Respiratory Chain Consists of Four Complexes: Three Proton Pumps and a Physical Link to the Citric Acid Cycle

A Proton Gradient Powers the Synthesis of ATP

Many Shuttles Allow Movement Across the Mitochondrial Membranes

The Regulation of Cellular Respiration Is Governed Primarily by the Need for ATP

Electron transfer potential of NADH and $FADH_2$ -> Phosphoryl transfer potential of ATP

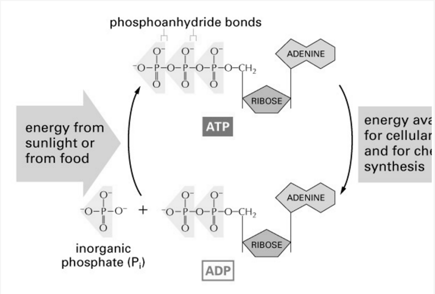
outline

A sedentary male of 70 kg (154 lbs) requires about 8400 kJ (2000 kcal) for a day’s worth of activity.

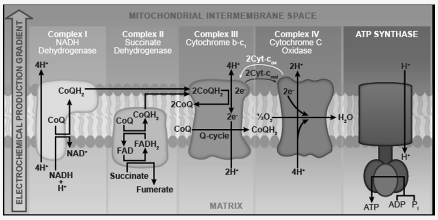
To provide this much energy requires 83 kg of ATP. However, human beings possess only about 250 g of ATP at any given moment.

The disparity between the amount of ATP that we have and the amount that we require is compensated by recycling ADP back to ATP. Each ATP molecule is recycled approximately 300 times per day. This recycling takes place primarily through oxidative phosphorylation.

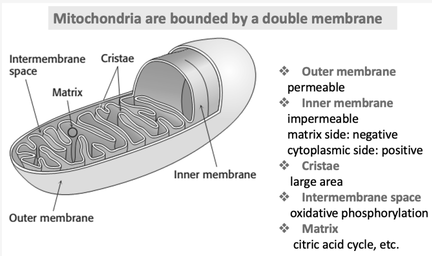
bonding



Overview of oxidative phosphorylation



Eukaryotic Oxi_Phos_ take place in Mitochondria



Mitochondria

Humans contain an estimated 14,000 m2 of inner mitochondrial membrane.

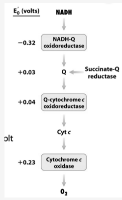
The mitochondrial matrix is the site of most of the reactions of the citric acid cycle and fatty acid oxidation. In contrast, oxidative phosphorylation takes place in the inner mitochondrial membrane

The outer membrane is quite permeable to most small molecules and ions because it contains many copies of mitochondrial porin,a 30- to 35-kd pore-forming protein also known as VDAC, for voltage-dependent anion channel.

Mitochondria (cont)

In contrast, the inner membrane is impermeable to nearly all ions and polar molecules.

Electron transfer



Electron transfer

Volt potential difference between NADH and O2 drives electron transport and favors formation of a proton gradient

NADH->Pump1->CoQ->Pump3->CytC-->Pump4->2O2->2H2O

Respiratory Chain have Four Complexes

Three Proton Pumps and a Physical Link to the Citric Acid Cycle

Electrons are transferred from NADH to O2 through a chain of three large protein complexes called **NADH-Q oxidoreductase(I), Q-cytochrome c oxidoreductase (III), and cytochrome c oxidase (IV).**

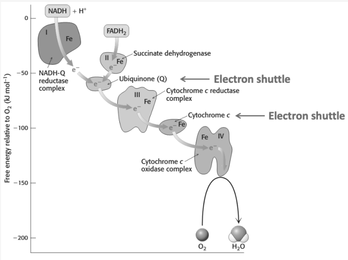
Electron flow within these transmembrane complexes leads to the transport of protons across the inner mitochondrial membrane.

A fourth large protein complex, called **succinate-Q reductase (II)**, contains the succinate dehydrogenase that generates $FADH_2$ in the citric acid cycle.

Oxidoreductase = reductase = dehydrogenase

Ubiquinone (Coenzyme Q) also carries electrons from FADH2 (generated by citric acid cycle) generated through succinate-Q reductase

Electronsflowdown an energy gradient from NADHtoO2



Components of mitochondrial etc

Enzyme complex	Prosthetic group	Oxidant or reductant: Matrix side	Oxidant or reductant: Membrane core	Oxidant or reductant: Cytoplasmic side
NADH-Q oxidoreductase **Complexes I**	FMN Fe-S	NADH	Q	
Succinate-Q reductase **Complexes II**	FAD Fe-S	Succinate	Q	
Q-cytochrome *c* oxidoreductase **Complexes III**	Heme b_H Heme b_L Heme c_1 Fe-S		Q	Cytochrome *c*
Cytochrome *c* oxidase **Complexes IV**	Heme *a* Heme a_3 Cu_A and Cu_B			Cytochrome *c*