Electron Transport Chain

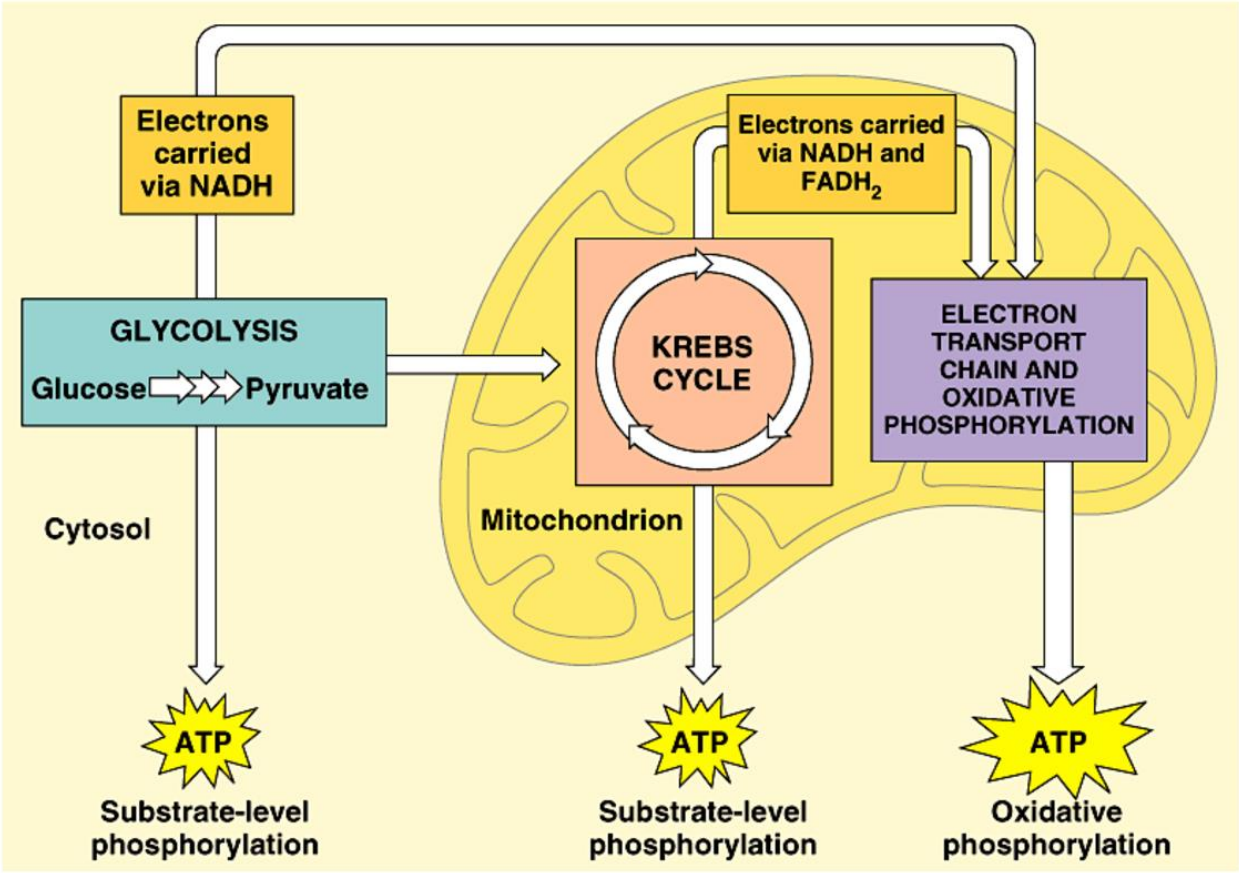
SBI4UP

MRS. FRANKLIN

Recap . . . Electron Carriers

What are the two electron carriers involved in the process of Cellular Respiration?

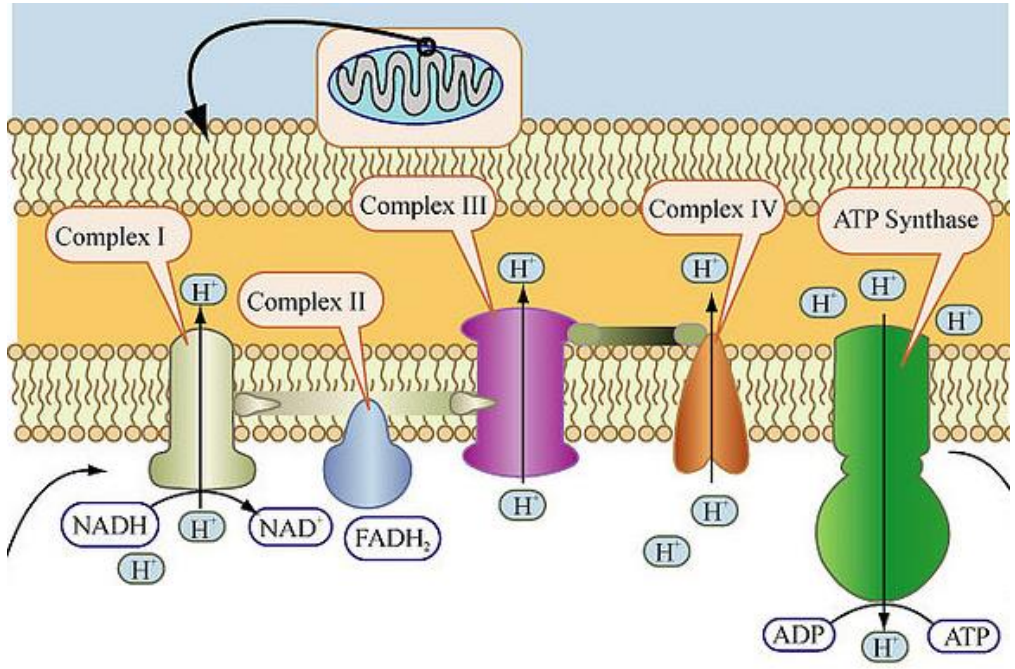
Where are they produced?



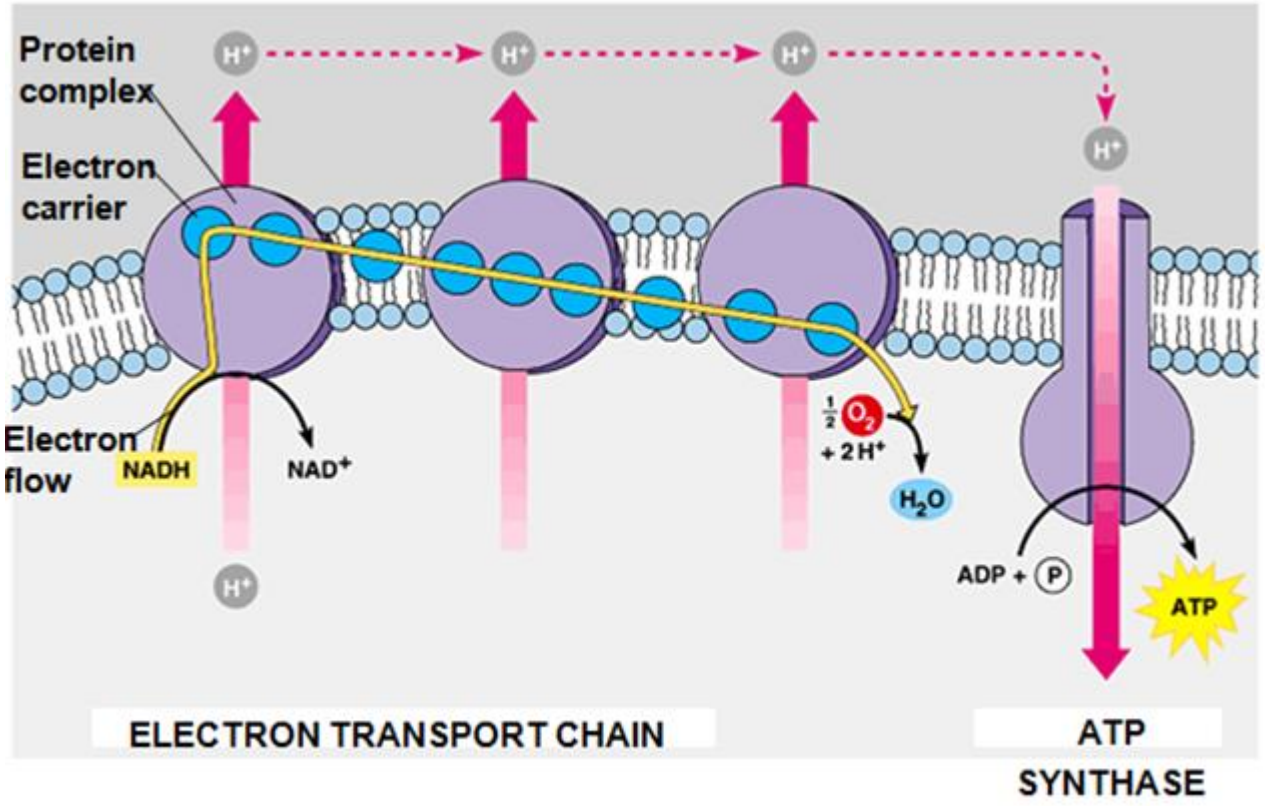
Electron Transport Chain

The electrons form NADH and $FADH_2$ are donated o the electron carrier proteins that are located within the ***'Electron Transport Chain'.***

The proteins are arranged in order of increasing electronegativity. The most electronegative protein is at the end of the ETC.



Electron Transport Chain



A series of REDOX reactions occur between each protein complex to transfer the electrons.

Two electrons are transferred each time.

As the electrons move down the ETC, energy is released and the electrons become more stable.

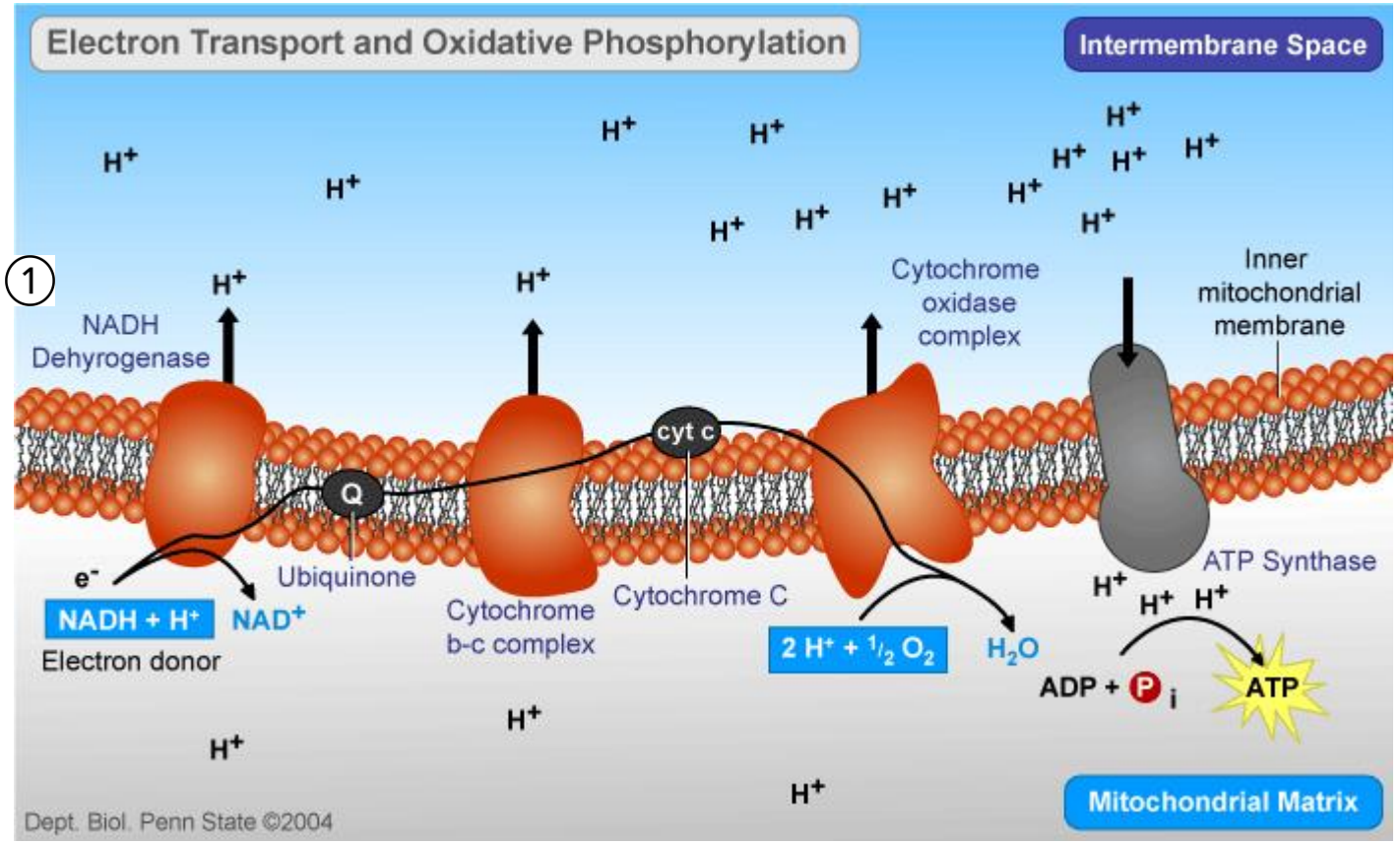
Electron Transport Chain

STEP 1:

NADH reduces Complex I ***(NADH dehydrogenase)*** in the ETC.

Ubiquitone helps to shuttle the electrons to Complex III.

The free energy released during the REDOX reaction helps to shuttle H+ into the intermembrane space.



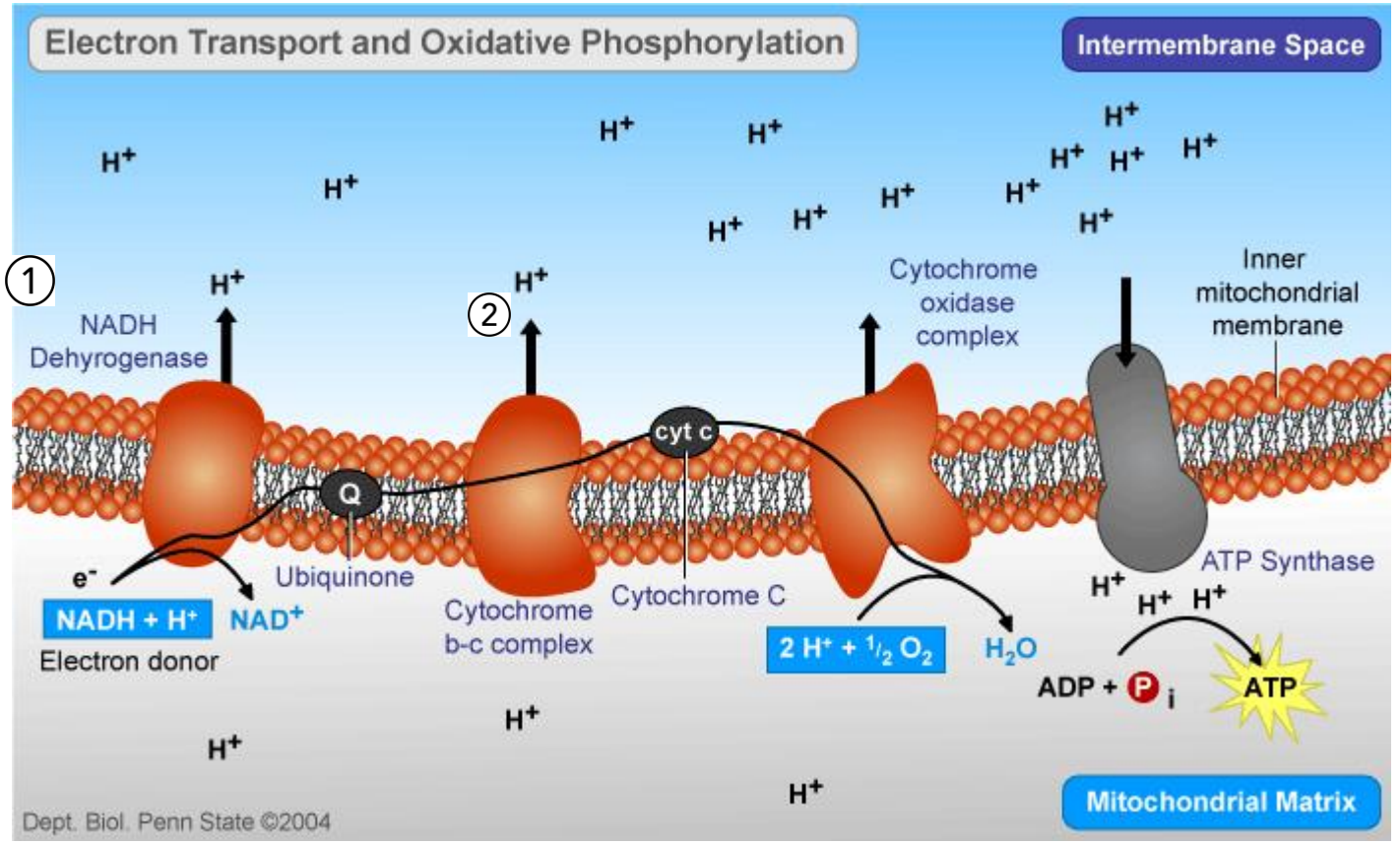
Electron Transport Chain

STEP 2:

Complex III ***(cytochrome b-c1 complex)*** is reduced and receives the electrons from ubiquitone.

Cytochrome C can shuttle those electrons to Complex IV.

The energy released from this REDOX reaction is used to pump out a H+.



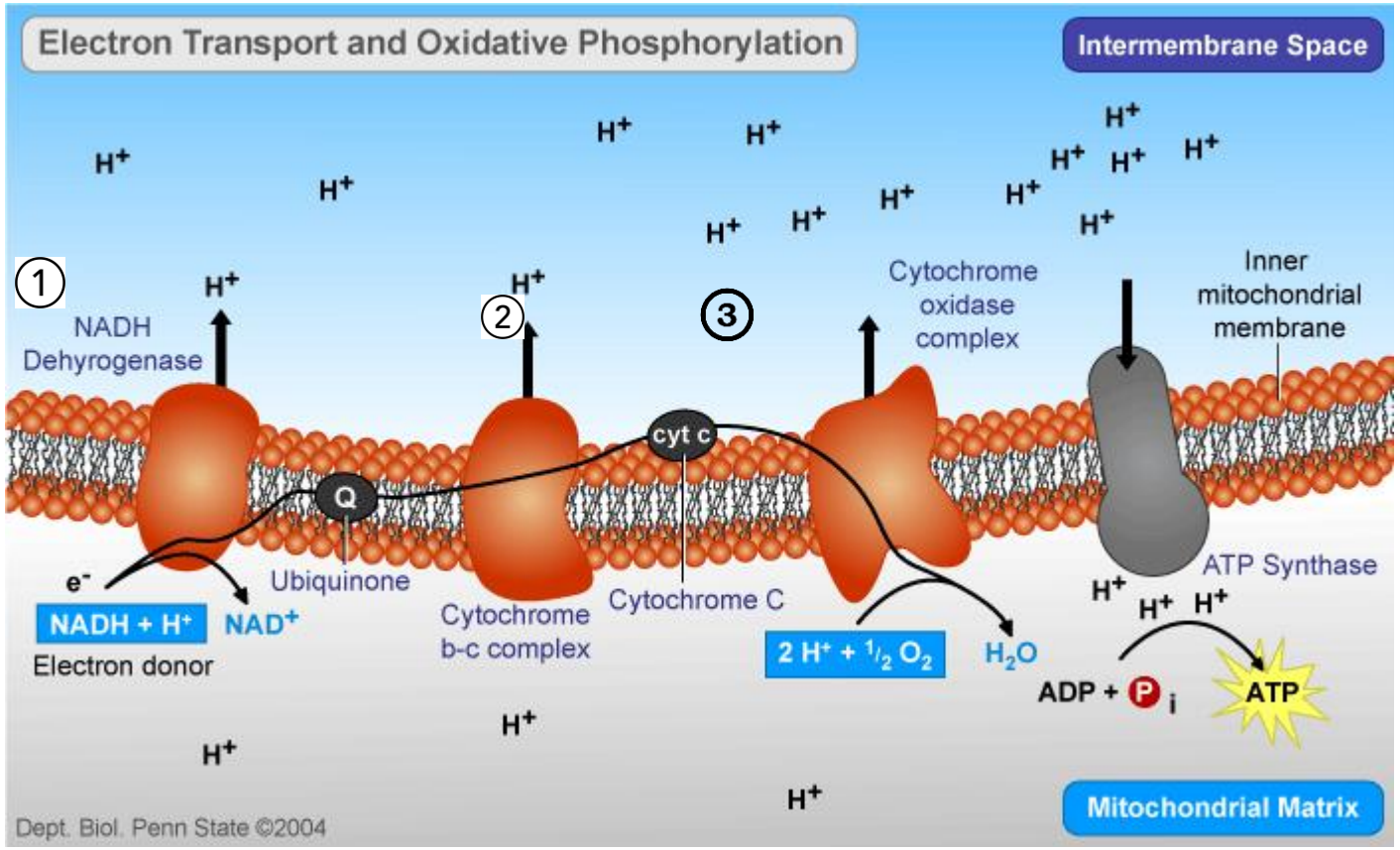
Electron Transport Chain

STEP 3:

Cytochrome C reduces Complex III ***(cytochrome oxidase complex).***

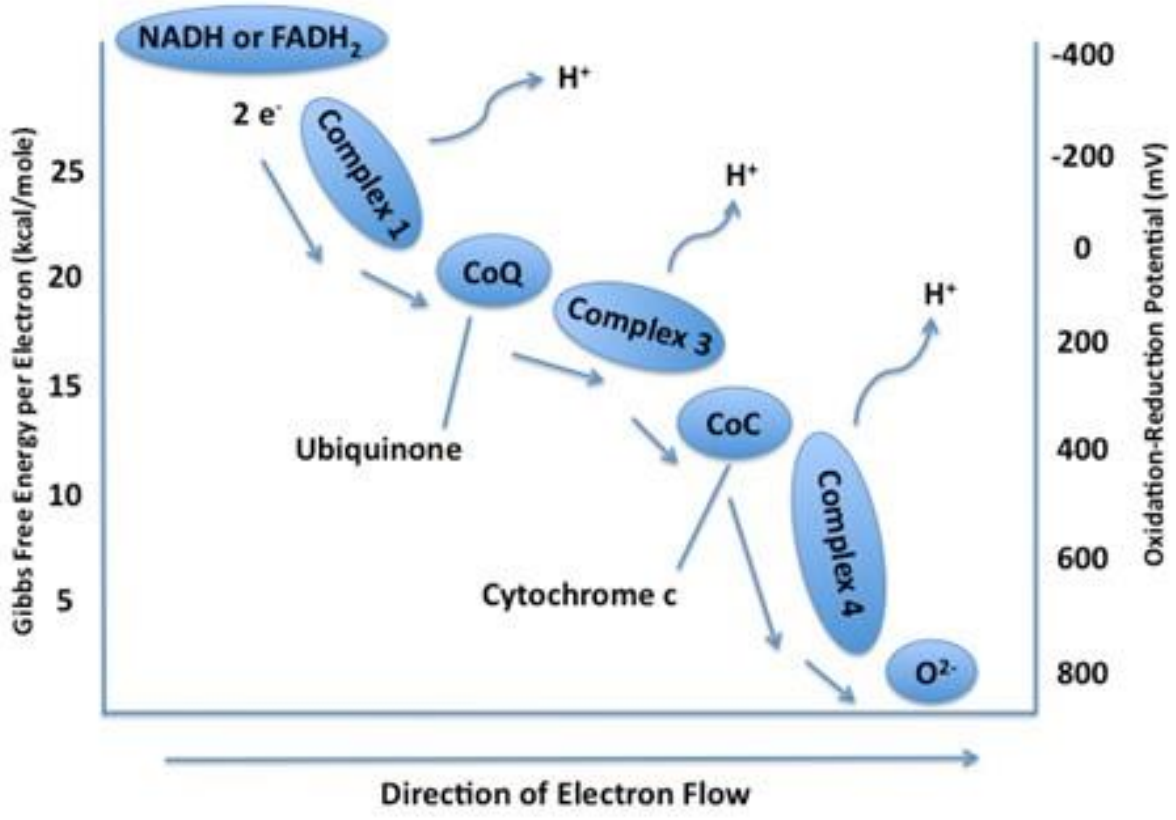
Oxygen is very electronegative and is able to pluck the electrons away from Complex IV.

O_2 combines with 2 H+ to form H_2O.



Electron Transport Chain – Energy

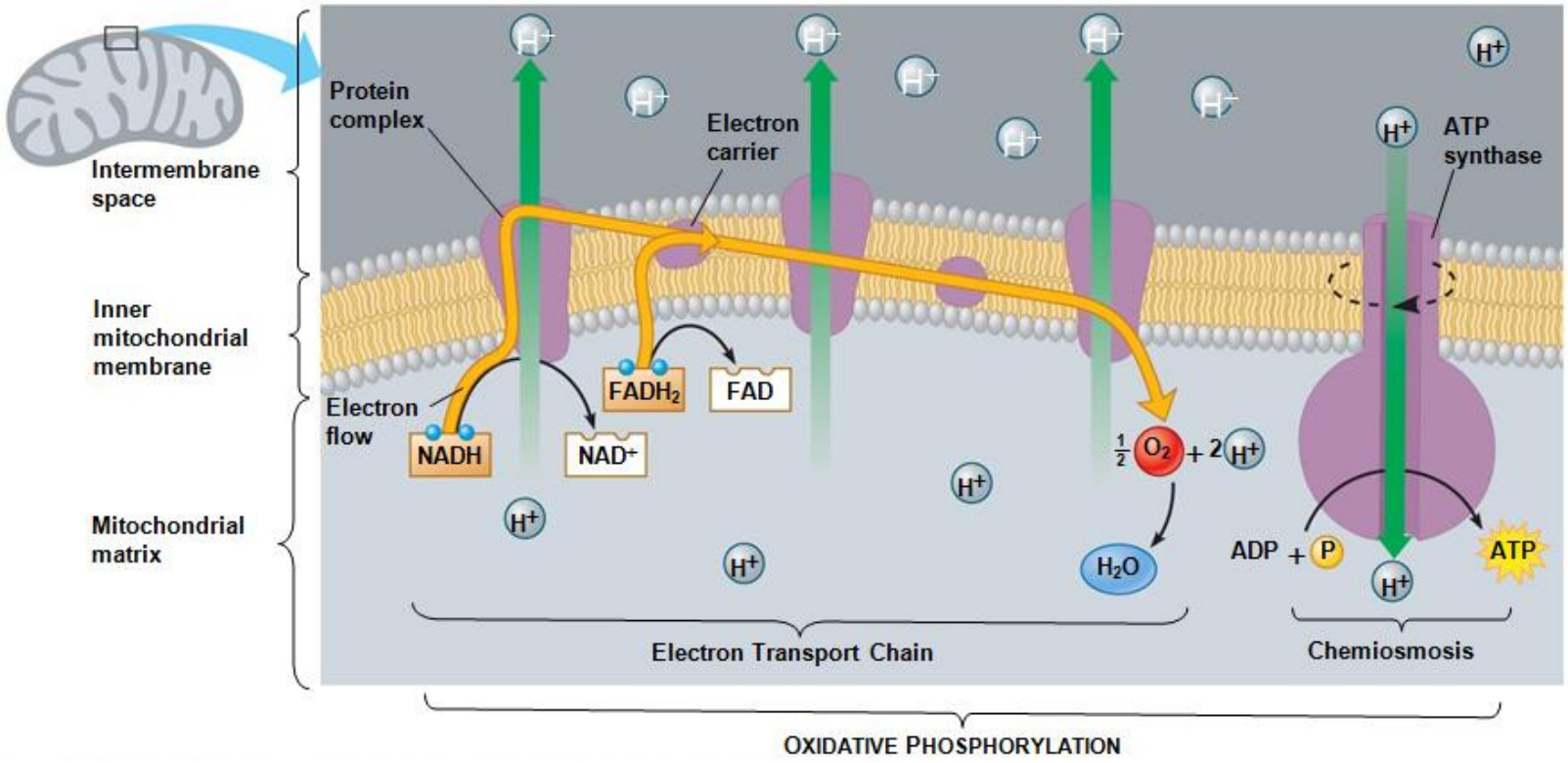
The process used to transfer the electrons in the ETC is highly exergonic and the free energy released is used to pump p+ into the intermembrane space.



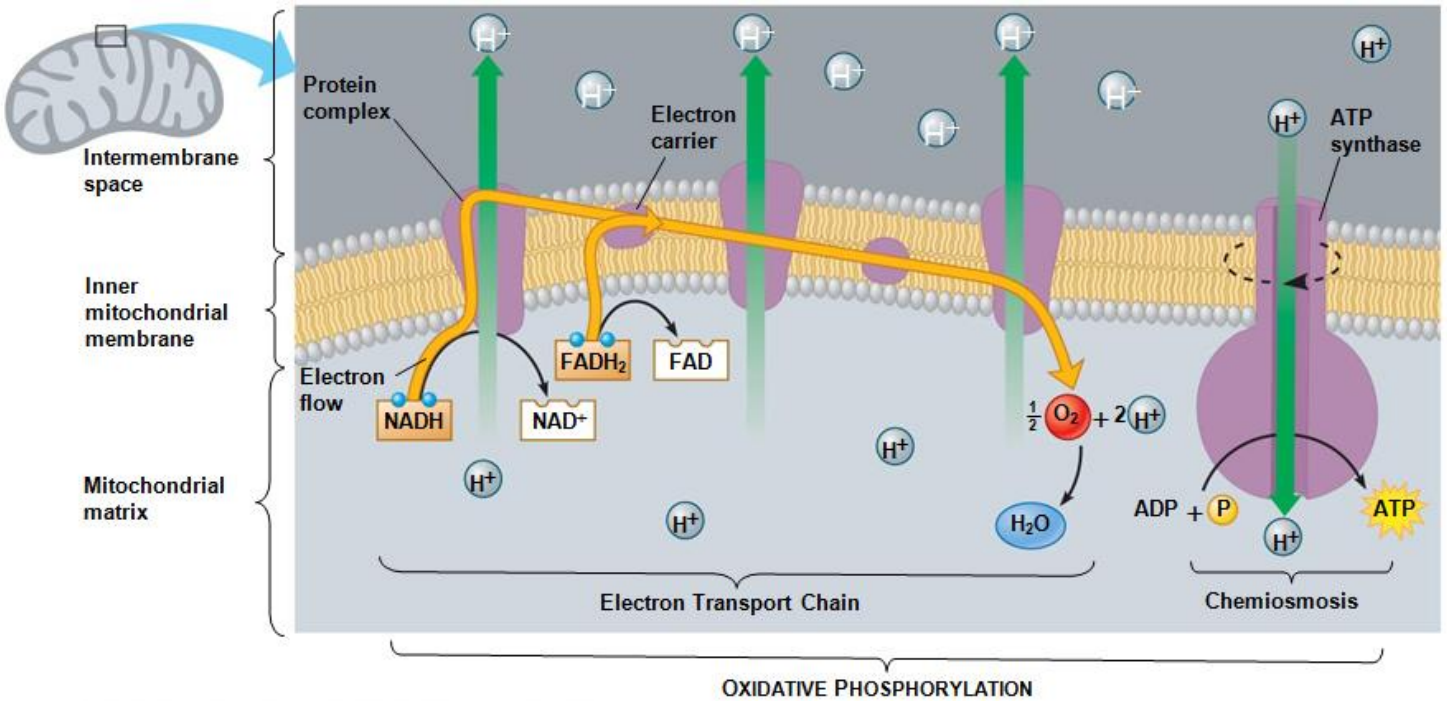
Electron Transport Chain

NADH can help to pump out 3 H+ into the intermembrane space and in turn produce more ATP.

$FADH_2$ can only pump out 2 H+ because it can only enter the ETC at ubiquitone.

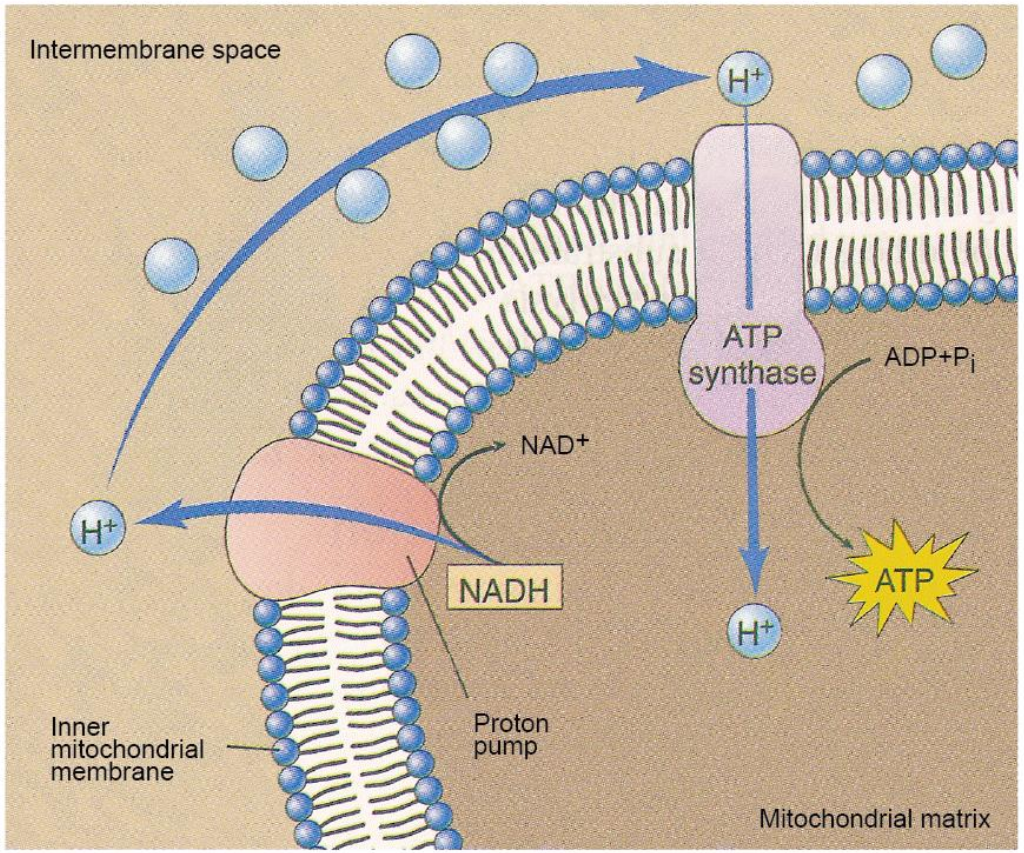


Chemiosmosis (Oxidative Phosphorylation)



The protons that have been released during the ETC creates an electrochemical gradient that can be used to drive the synthesis of ATP.

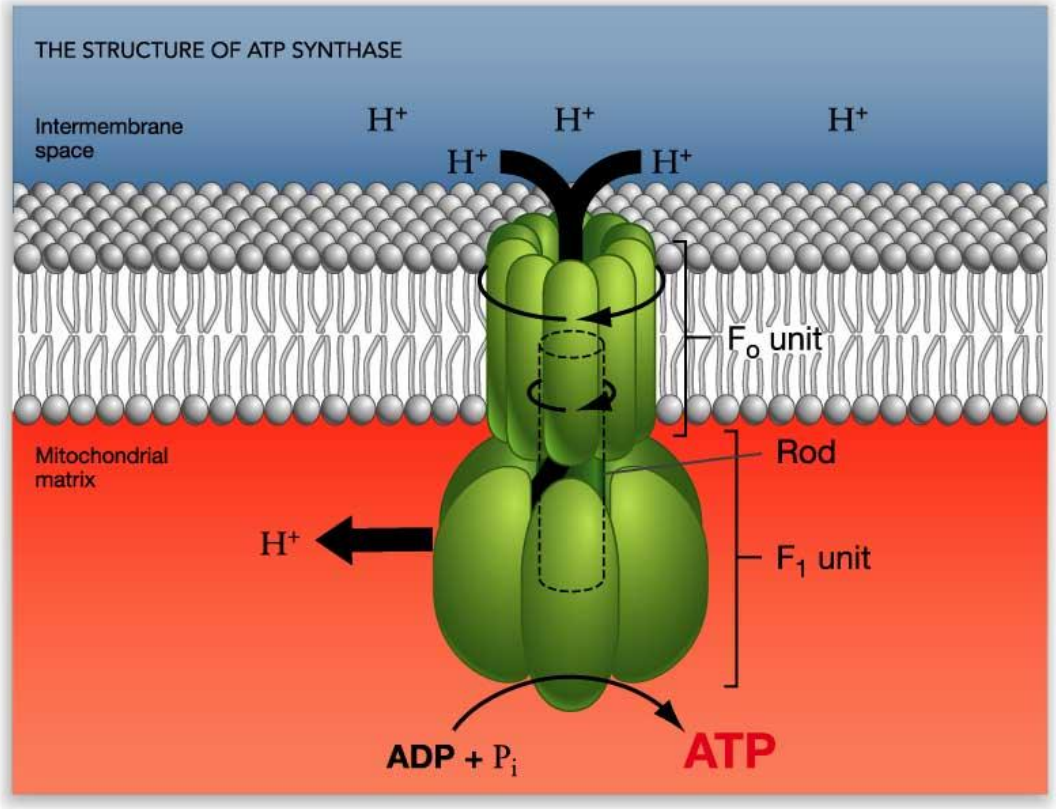
Chemiosmosis (Oxidative Phosphorylation)



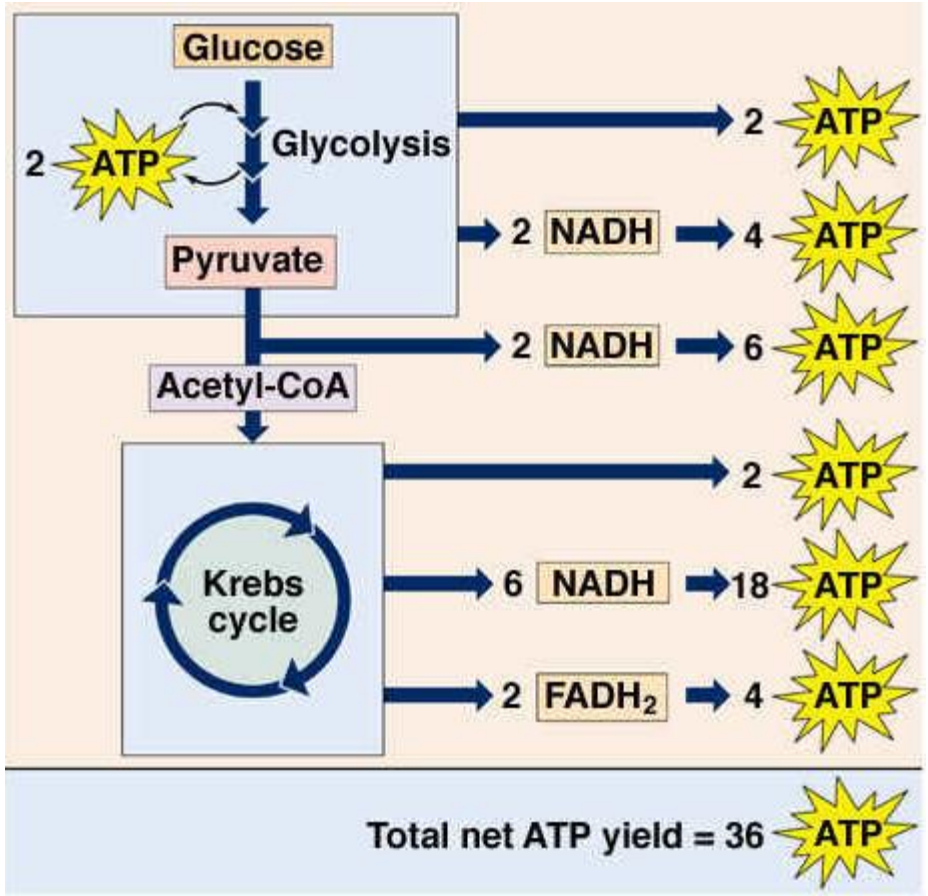
The intermembrane space is impermeable to protons which enables them to accumulate in the intermembrane space. To re-enter the matrix, the protons must be pumped through the protein channel ***ATP-synthase (a.k.a ATPase)***

Chemiosmosis (Oxidative Phosphorylation)

Chemiosmosis: process whereby the energy converted from the electrochemical gradient and the ATPase is used to synthesize ATP.



Energy Balance Sheet



Remember . . . Every NADH yields 3 H+ (3 ATP)

Remember . . . Every $FADH_2$ yields 2 H+ (2 ATP)