

# ELECTRON TRANSPORT CHAIN

Final Stage of Cellular  
Respiration

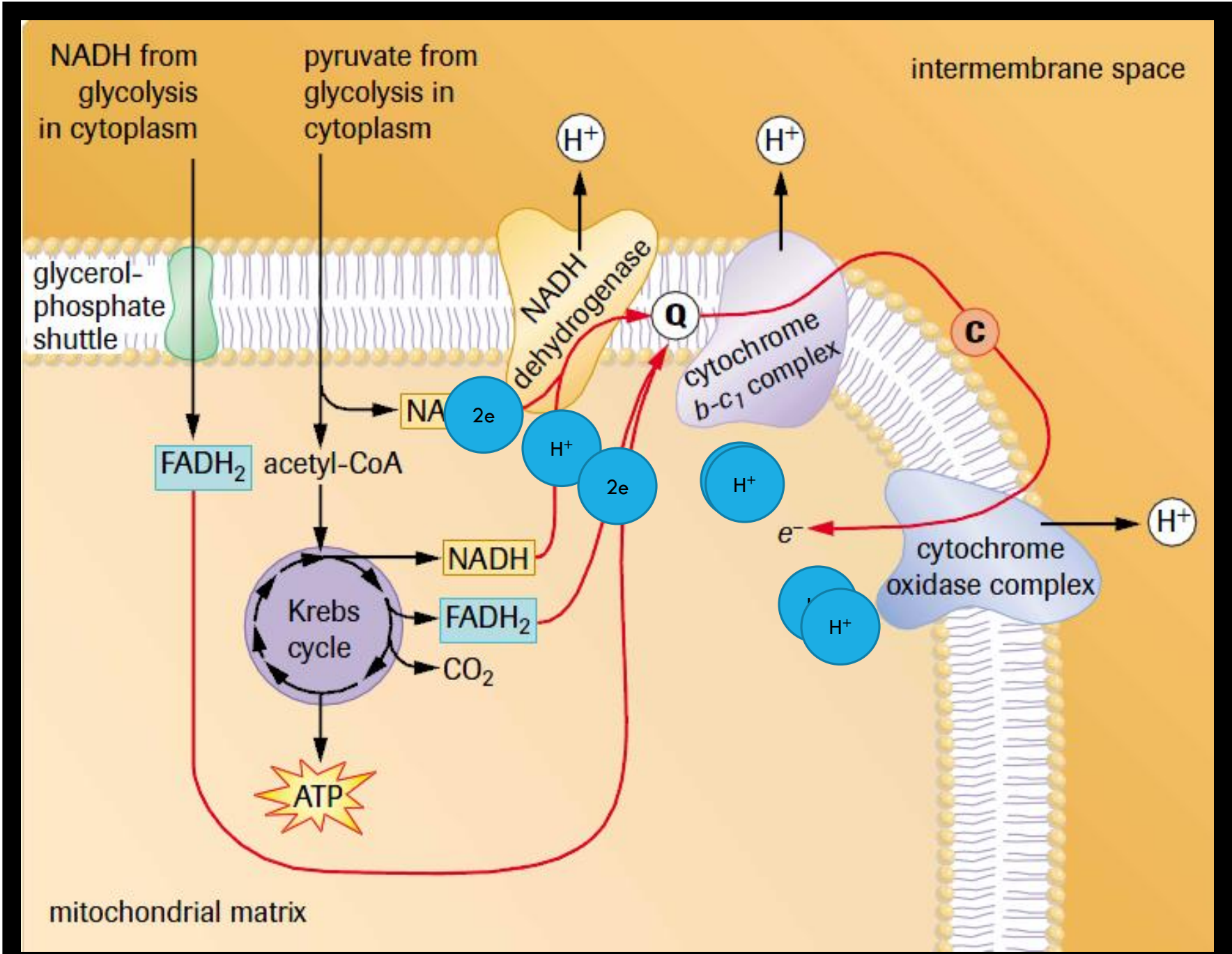
# UP TO THIS POINT....

1 molecule of glucose has produced:

- 4 ATP from glycolysis (2 NET ATP)
- 2 ATP from Krebs cycle

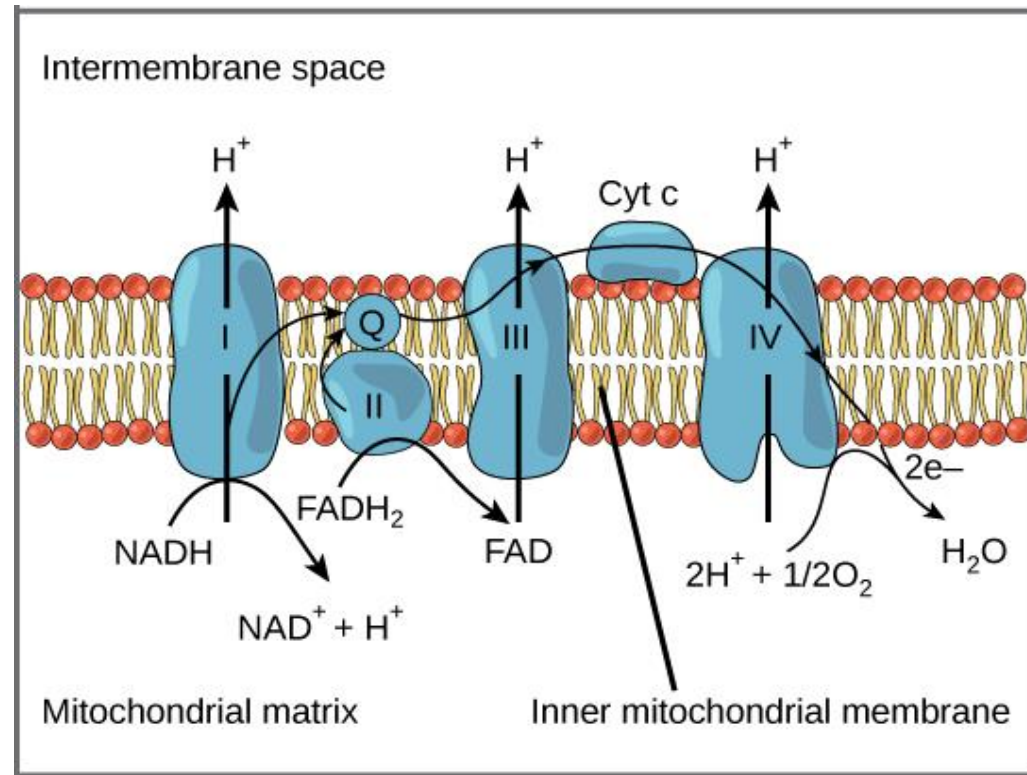
The cell has also captured energetic electrons in electron carrier molecules (coenzymes)

- 2 NADH from glycolysis
- 2 NADH from pyruvate oxidation
- 6 NADH from Krebs cycle
- 2 FADH<sub>2</sub> from Krebs cycle



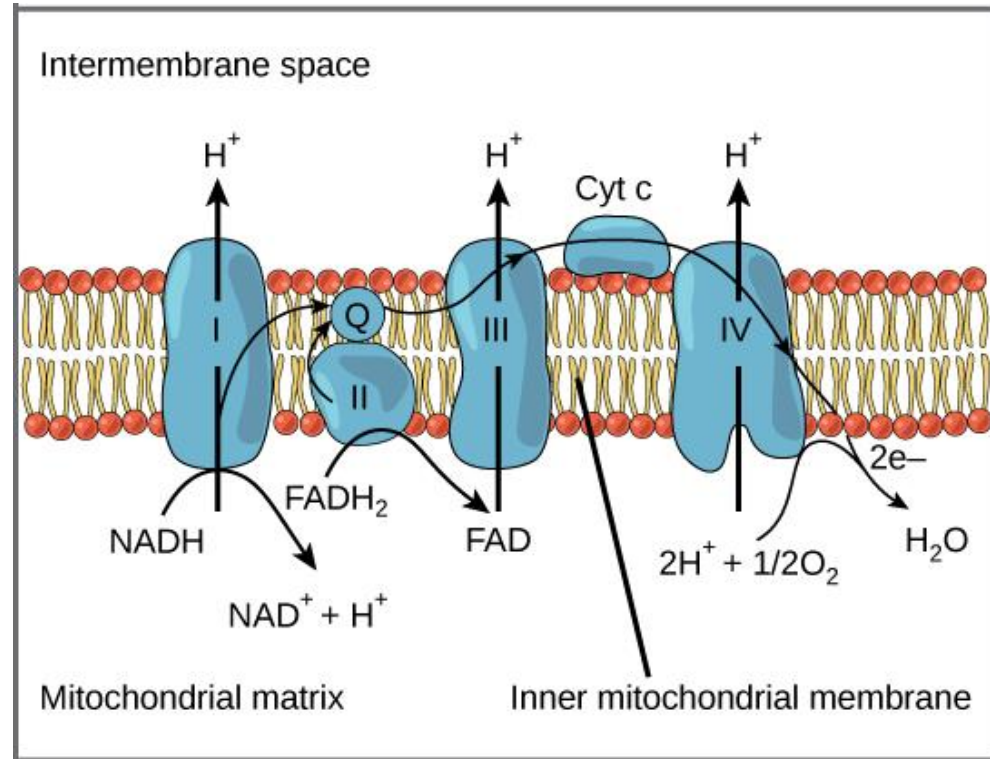
# COMPLEX IV

- Cytochrome Oxidase
- Protein complex
- Loses 2 electrons to oxygen
- Oxygen combines with 2 protons and 2 electrons to make  $H_2O$



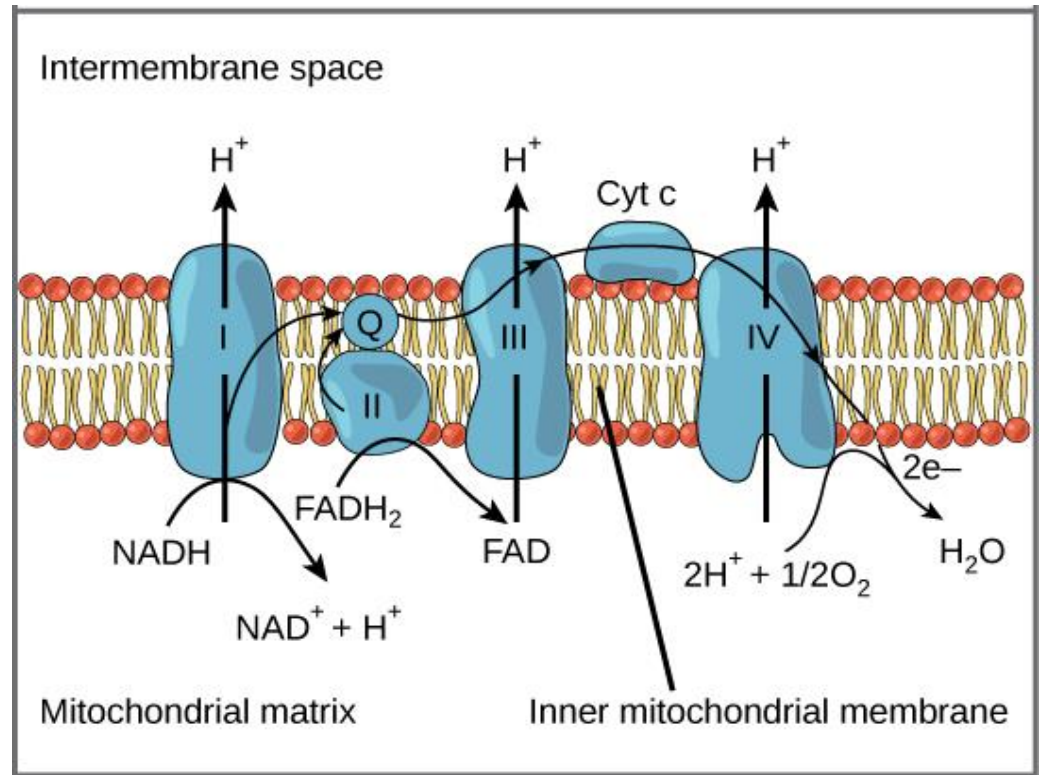
# COMPLEX III

- Cytochrome B-C<sub>1</sub> Complex
- Protein complex
- Loses 2 electrons to  
Cytochrome Oxidase
- Transfers electrons via  
Cytochrome C
  - An electron shuttle



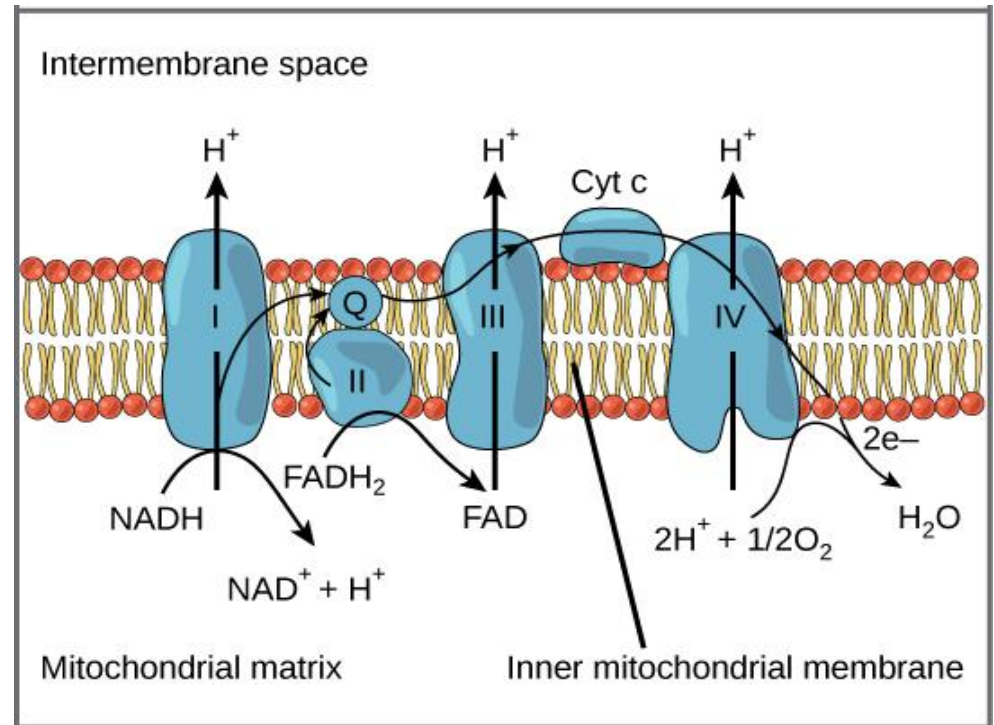
# COMPLEX I

- NADH Dehydrogenase
- Protein complex
- Loses 2 electrons to Cytochrome B-C<sub>1</sub> Complex
- Transfers electrons via Ubiquinone (Q)
  - A hydrophobic electron shuttle
- Receives 2 electrons from NADH



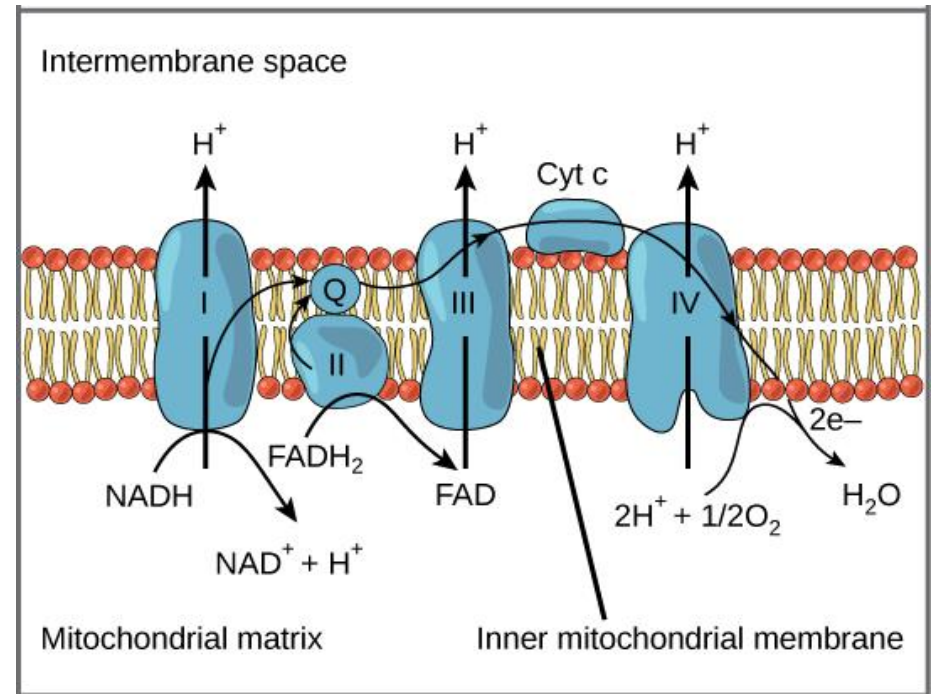
# COMPLEX II

- Succinate Dehydrogenase
- Protein complex
- Receives 2 electrons from  $\text{FADH}_2$
- Transfers electrons via Ubiquinone (Q) to Cytochrome B-C<sub>1</sub> Complex



# PUMPING PROTONS

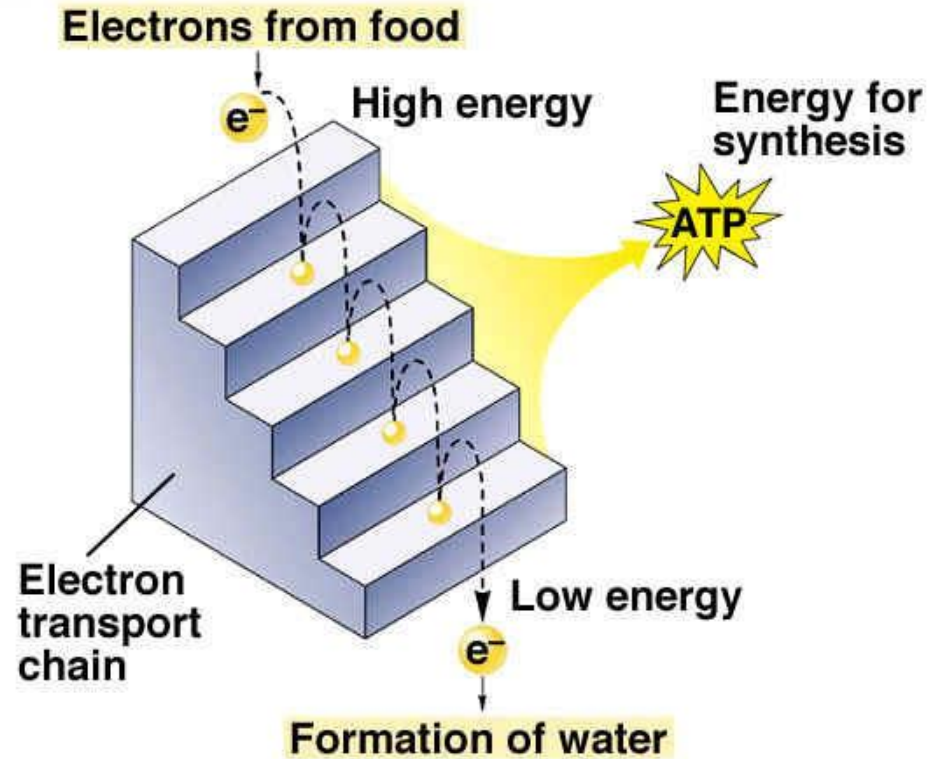
- NADH Dehydrogenase
- Cytochrome B-C<sub>1</sub> Complex
- Cytochrome Oxidase



- Protons **pumped** into **intermembrane space** due to energy released when electrons move
- Build up H<sup>+</sup> gradient in the intermembrane space

# Electron Transport Schematic

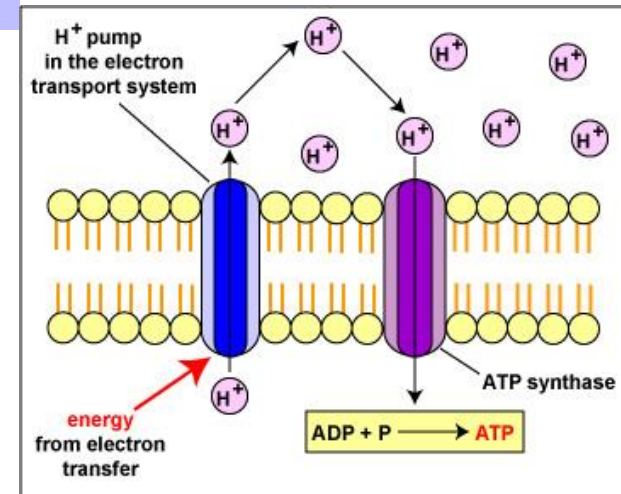
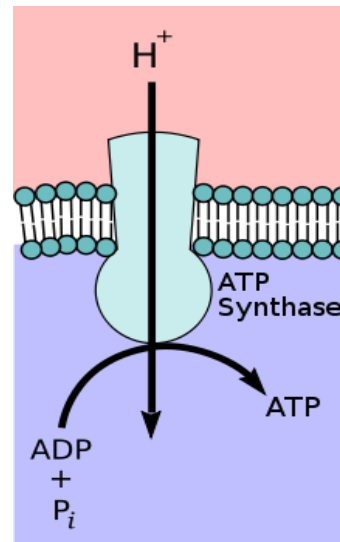
## ENERGY



- Electrons release energy (exergonic reaction) as they are pulled through the ETC

# ATP SYNTHESIS

- Oxidative phosphorylation
- Protons move passively into matrix through ATP Synthase
- ATP synthase turns as protons pass, phosphorylates ADP to create ATP



- 3 protons pumped for each NADH » **3 ATP each NADH**
- 2 protons pumped for each FADH<sub>2</sub> » **2 ATP each FADH<sub>2</sub>**

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