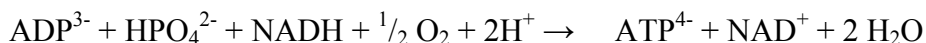


Lecture 20

Electron Transport Chain & Oxidative Phosphorylation

1. How are the reducing agents (NADH and FADH₂) able to generate the free-energy currency molecule (ATP)?

Answer: The oxidation reaction for NADH has a larger, but negative, ΔG than the positive ΔG required for the formation of ATP from ADP and phosphate. This set of coupled reactions is so important that it has been given a special name: oxidative phosphorylation. This name emphasizes the fact that an oxidation (of NADH) reaction is being coupled to a phosphorylation (of ADP) reaction. In addition, we must consider the reduction reaction (gaining of electrons) that accompanies the oxidation of NADH. (Oxidation reactions are always accompanied by reduction reactions, because an electron given up by one group must be accepted by another group.) In this case, molecular oxygen (O₂) is the electron acceptor, and the oxygen is reduced to water.



2. Which of the following enzymes does not directly link to the electron transport system?

- a) malate dehydrogenase (MDH)
- b) succinate dehydrogenase
- c) the first reductase in β oxidation
- d) Site II

Answer: (c) The first reductase in β oxidation.

3. Comparing the effect of an inhibitor with an uncoupler of oxidative phosphorylation,

- a) **The uncoupler would stop the oxidation of NADH by the electron transport chain**
- b) **The inhibitor would allow electrons to pass through the electron transport chain**
- c) **The uncoupler would inhibit the reduction of oxygen by the electron transport chain**
- d) **The inhibitor would increase the pumping of protons by the electron transport chain**
- e) **The uncoupler would increase heat production by the mitochondria**

Answer: The uncoupler would increase heat production by the mitochondria

4. Cytochrome oxidase

- a) **Uses H_2O as a substrate**
- b) **Produces $HOOH$ as a product**
- c) **Cannot function if oxygen is absent**
- d) **Accepts electrons from hydrogen ions**
- e) **Uses ADP and Pi as substrates**

Answer: Can not function if oxygen is absent.

5. Where does the electron transport chain occur?

Answer: Plants, fungi, and animals are all eukaryotes and possess mitochondria, which is the site of the electron transport chain. Prokaryotes have no mitochondria and perform the electron transport chain across their cell membranes.