What is the Electron Transport Chain?

Worksheet

The electron transport chain passes electrons from NADH and FADH2 through protein complexes to oxygen, pumping protons that drive ATP synthase - yielding about 2.5 ATP per NADH and 1.5 ATP per FADH2.

$$NADH + H^+ + \frac{1}{2} O_2 \rightarrow NAD^+ + H_2O + \text{er}$$

Questions

1. Where does the electron transport chain occur?

A) Cytoplasm
B) Mitochondrial matrix
C) Inner mitochondrial membrane
D) Nucleus

2. What is the final electron acceptor of the ETC?

A) Carbon dioxide
B) Water
C) Oxygen
D) Glucose

3. Approximately how much ATP does one NADH yield in the ETC?

A) 1 ATP
B) 1.5 ATP
C) 2.5 ATP
D) 4 ATP

4. What process directly powers ATP synthase?

A) Glycolysis
B) Chemiosmosis (proton gradient)
C) Substrate-level phosphorylation
D) Fermentation

5. One glucose molecule's NADH (10 total) and FADH2 (2 total) reach the ETC. How much ATP is produced?

6. If only 4 NADH reach the ETC (no FADH2), how much ATP results?

7. A cell has 6 NADH and 4 FADH2 to oxidize. Find the ATP yield.

8. Define: Where is the electron transport chain located?

9. Define: What is the final electron acceptor in the ETC?

10. Define: How does the ETC make ATP?

Answer Key

1. C) Inner mitochondrial membrane - The ETC's protein complexes are embedded in the inner mitochondrial membrane.

2. C) Oxygen - Oxygen accepts electrons and combines with protons to form water.

3. C) 2.5 ATP - Each NADH yields about 2.5 ATP through oxidative phosphorylation.

4. B) Chemiosmosis (proton gradient) - Protons flowing back through ATP synthase down their gradient drive ATP production.

5. ATP from NADH = 10 2.5 = 25 ATP ATP from FADH2 = 2 1.5 = 3 ATP Total ATP = 25 + 3 = 28 ATP

6. ATP from NADH = 4 2.5 = 10 ATP ATP from FADH2 = 0 Total ATP = 10 ATP

7. ATP from NADH = 6 2.5 = 15 ATP ATP from FADH2 = 4 1.5 = 6 ATP Total ATP = 15 + 6 = 21 ATP

8. In the inner mitochondrial membrane.

9. Oxygen, which combines with electrons and protons to form water.

10. By pumping protons to create a gradient that drives ATP synthase (chemiosmosis).