What Are Mitochondria?

Worksheet

Mitochondria are organelles that produce ATP by breaking down glucose (with oxygen) through cellular respiration, using their folded inner membrane (cristae) to maximize energy output.

Questions

1. What is the main product of cellular respiration in mitochondria?

A) Glucose
B) Oxygen
C) ATP
D) Chlorophyll

2. What are cristae?

A) Folds of the outer membrane
B) Folds of the inner membrane
C) DNA loops
D) Ribosome clusters

3. Which gas is required for the electron transport chain to keep running?

A) Nitrogen
B) Oxygen
C) Carbon dioxide
D) Hydrogen gas

4. Roughly how much more ATP does aerobic respiration yield per glucose than glycolysis alone?

A) About the same
B) Roughly double
C) Roughly 15 times more
D) Zero - glycolysis makes more

5. A muscle cell needs a burst of energy during a sprint. Why does it rely heavily on mitochondria?

6. Explain why cristae (the folds of the inner mitochondrial membrane) increase ATP production.

7. A cell is starved of oxygen. What happens to its ATP production, and why?

8. Define: What is the main job of mitochondria?

9. Define: Why are mitochondria called the 'powerhouse of the cell'?

10. Define: What are cristae?

Answer Key

1. C) ATP - Mitochondria convert glucose's chemical energy into ATP.

2. B) Folds of the inner membrane - Cristae are folds of the inner mitochondrial membrane that boost surface area for ATP synthesis.

3. B) Oxygen - Oxygen is the final electron acceptor in the electron transport chain.

4. C) Roughly 15 times more - Aerobic respiration yields about 30-32 ATP vs about 2 ATP from glycolysis alone.

5. Sprinting demands large amounts of ATP quickly for muscle contraction. Mitochondria run aerobic respiration, which yields far more ATP per glucose molecule than glycolysis alone (about 30-32 vs 2). Muscle cells therefore pack many mitochondria to keep up with high energy demand.

6. ATP synthase and the electron transport chain proteins sit on the inner membrane. Folding the membrane into cristae greatly increases its surface area. More surface area means more electron transport chains working at once, so more ATP is made.

7. The electron transport chain needs oxygen as the final electron acceptor. Without oxygen, the chain backs up and stops, so the Krebs cycle also stalls. ATP production drops sharply, leaving only the small amount made by glycolysis (anaerobic).

8. To produce ATP (usable energy) for the cell through cellular respiration.

9. Because they generate most of a cell's usable energy (ATP).

10. Folds of the mitochondria's inner membrane that increase surface area for ATP production.