Biology Lecture Notes

Aerobic Respiration: The Krebs Cycle

>> Key Concepts:

- **Review:** During **glycolysis**, one molecule of glucose is split to form two **pyruvate** molecules, with a net profit of two ATP. The two pyruvate molecules then enter the mitochondria, where they are converted to **acetyl CoA**.
- Once pyruvate is converted to acetyl CoA, it enters the Krebs cycle (also known as the citric acid cycle).
- The **Krebs cycle** is an eight–step cycle in which acetyl CoA is added to oxaloacetate, which is further broken down producing CO_2, reduced coenzymes ($NADH + H^+$ and $FADH_2$), and ATP.

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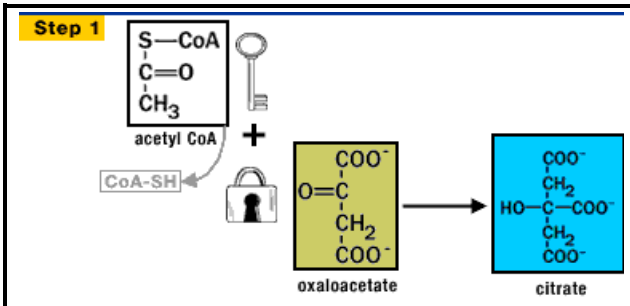
<td> 
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<td>The Krebs Cycle

Step 1: In the first step of the Krebs cycle, acetyl CoA is added to oxaloacetate to form citrate.

Note that coenzyme A (CoA-SH) is removed in the process.</td>
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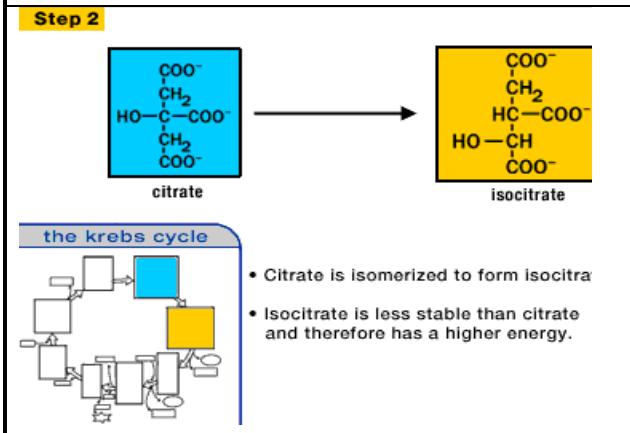
<td> 
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<td>Step 2: Citrate is isomerized forming isocitrate, which is less stable than citrate.

During this step, one water molecule is removed and another water molecule is added.</td>
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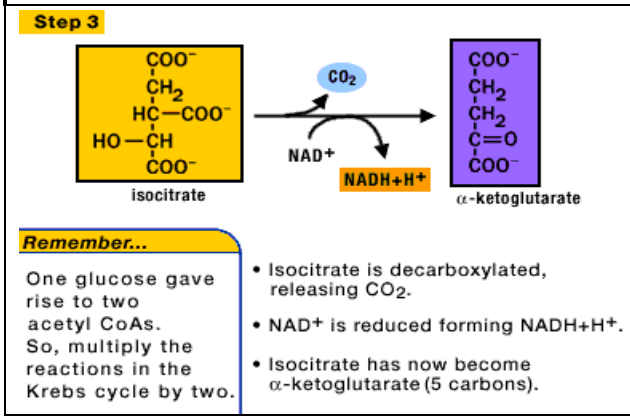
<td> 
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<td>Step 3: Isocitrate is converted into alpha-ketoglutarate. In this process, isocitrate is decarboxylated (carbon dioxide is removed), and NAD^+ is reduced, forming $NADH + H^+$.</td>
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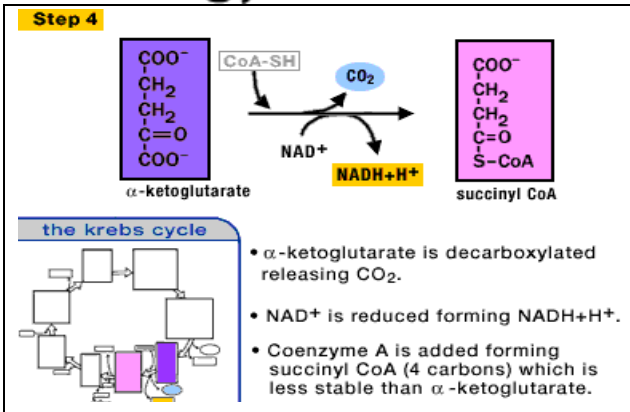
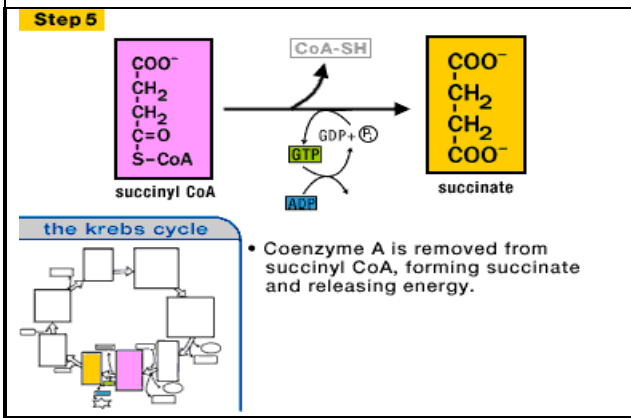
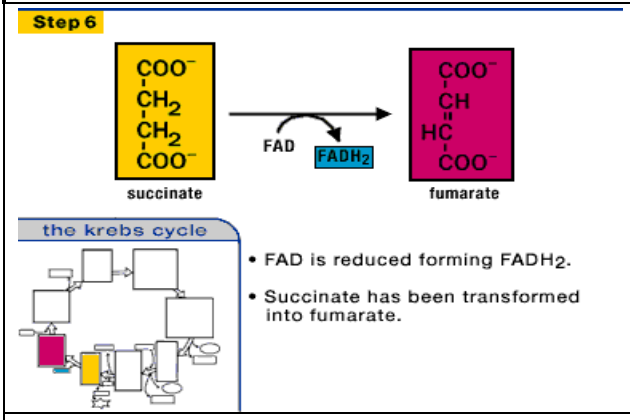


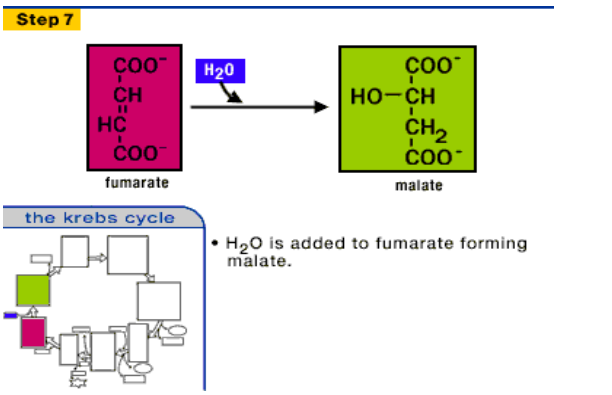
Step 4: Alpha-ketoglutarate is converted to succinyl CoA. During this step coenzyme A is added, carbon dioxide is lost, and NAD^+ is reduced, forming NADH + H^+.



Step 5: Succinyl CoA is converted to succinate. During this step, coenzyme A is released and GTP is made. GTP is then hydrolyzed to form ATP.



Step 6: Succinate is converted to fumarate. During this step FAD is reduced forming $FADH_2$.



Step 7: Fumarate is converted to malate with the addition of water.

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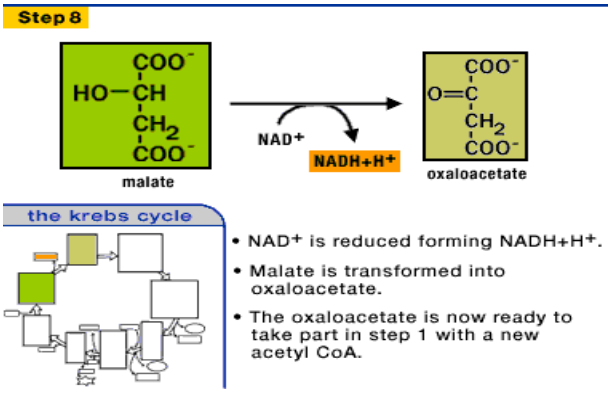

Step 8: In the last step of the Krebs cycle, malate is converted to oxaloacetate. In the process, NAD^+ is reduced to form NADH + H^+.

Oxaloacetate can then accept another acetyl CoA and begin the Krebs cycle again.