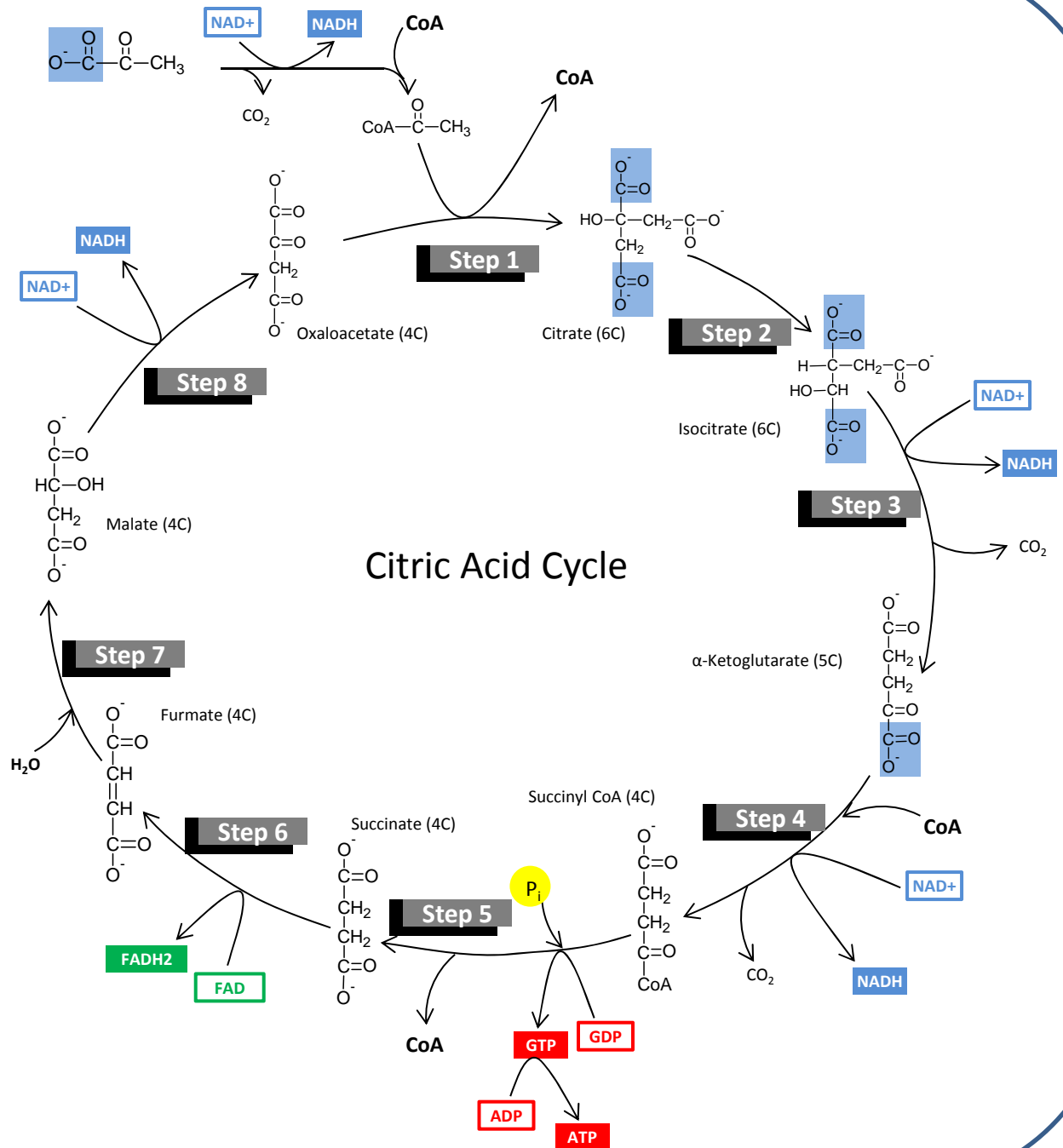


FIGURE 9 - 8 STEPS OF THE CITRIC ACID CYCLE

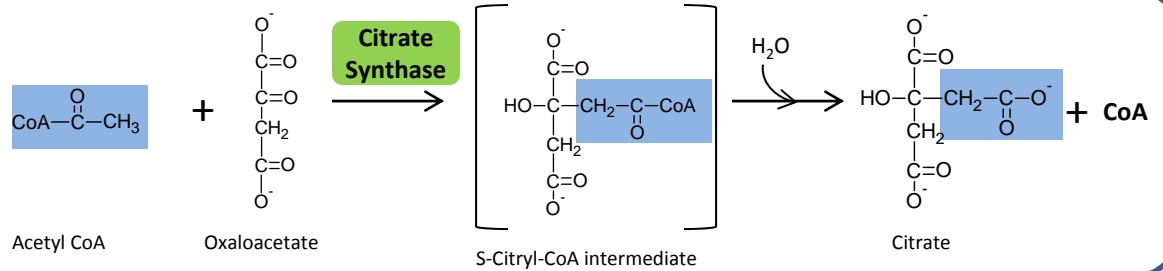


The figure above represents the Citric Acid Cycle (also called the “Krebs Cycle”). The part of the molecule that becomes carbon dioxide is highlighted in a **blue box**. Notice that a 4 carbon molecule called Oxaloacetate picks up 2 more carbons when it is joined with an acetyl group from Acetyl CoA. Through the beginning steps of the cycle, 2 carbons are lost as carbon dioxide and the molecule is again restored to a 4 carbon state, ready to pick up another acetyl group.

The details of the eight steps above are shown in the following pages. This time, the part of the molecule that undergoes a change is highlighted **in blue** and the name of the enzyme that catalyzes the reaction is in a **green box**.

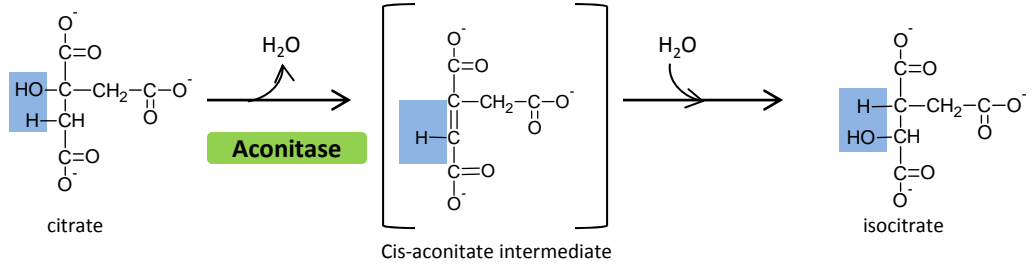
Step 1

The CH₃ end of the acetyl CoA loses a proton and becomes bonded to the second carbonyl carbon (C=O) of oxaloacetate. The coenzyme (CoA) is subsequently lost with the input of water.



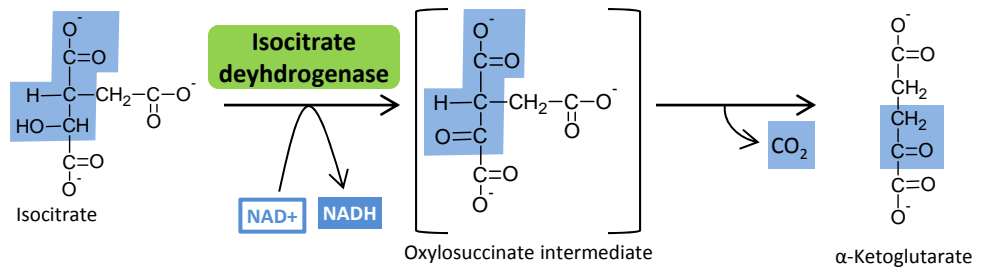
Step 2

An isomerization reaction takes place. This involves the removal of a water molecule and then the insertion of a water molecule. The hydroxyl (OH) group changes position to a different carbon as a result.



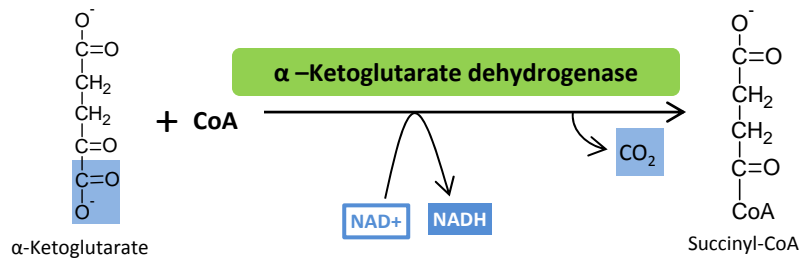
Step 3

This is the first of 4 oxidation steps in the cycle. The carbon carrying the hydroxyl group (OH) is converted to a carbonyl group (C=O). CO₂ is lost from the intermediate and alpha ketoglutarate is produced. NADH is produced.



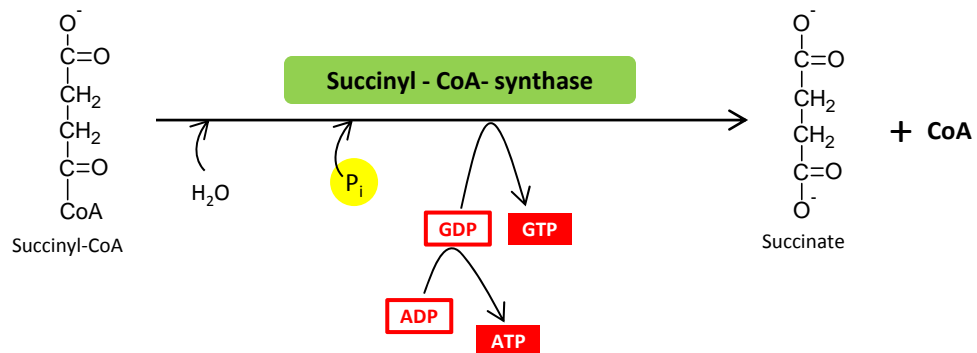
Step 4

Another oxidation step that results in another loss of CO₂. This reaction is very complex and is similar to the reaction that converts pyruvate to acetyl CoA. NADH is produced.



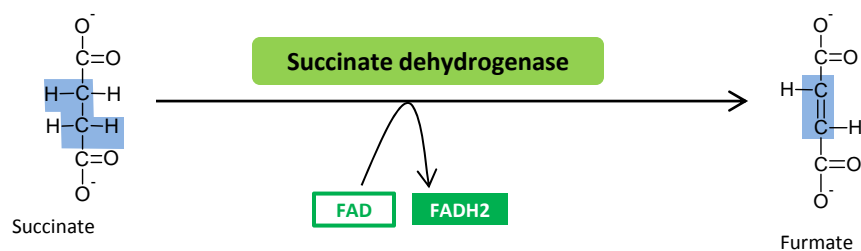
Step 5

CoA is displaced when an inorganic phosphate replaces CoA. Then the phosphate is used to phosphorylate GDP to make GTP. Later the high energy phosphate on GTP can be used to phosphorylate ADP to make ATP.



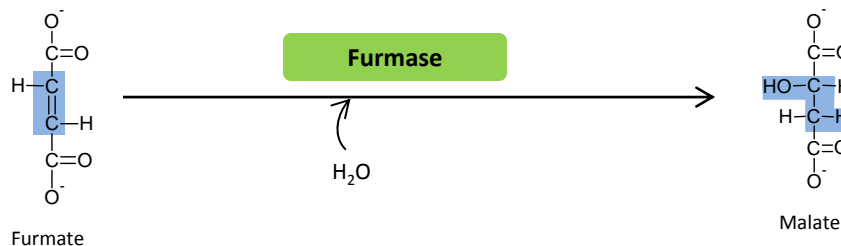
Step 6

In this, the third oxidation reaction, two hydrogens are removed from succinate. FAD+ becomes reduced to FADH₂.



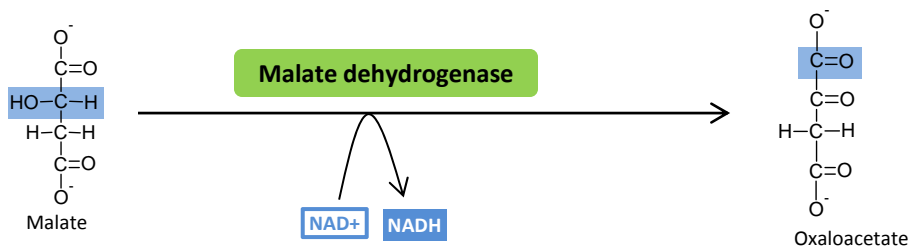
Step 7

Water is used in this reaction to place a hydroxyl (OH) group on a carbon.

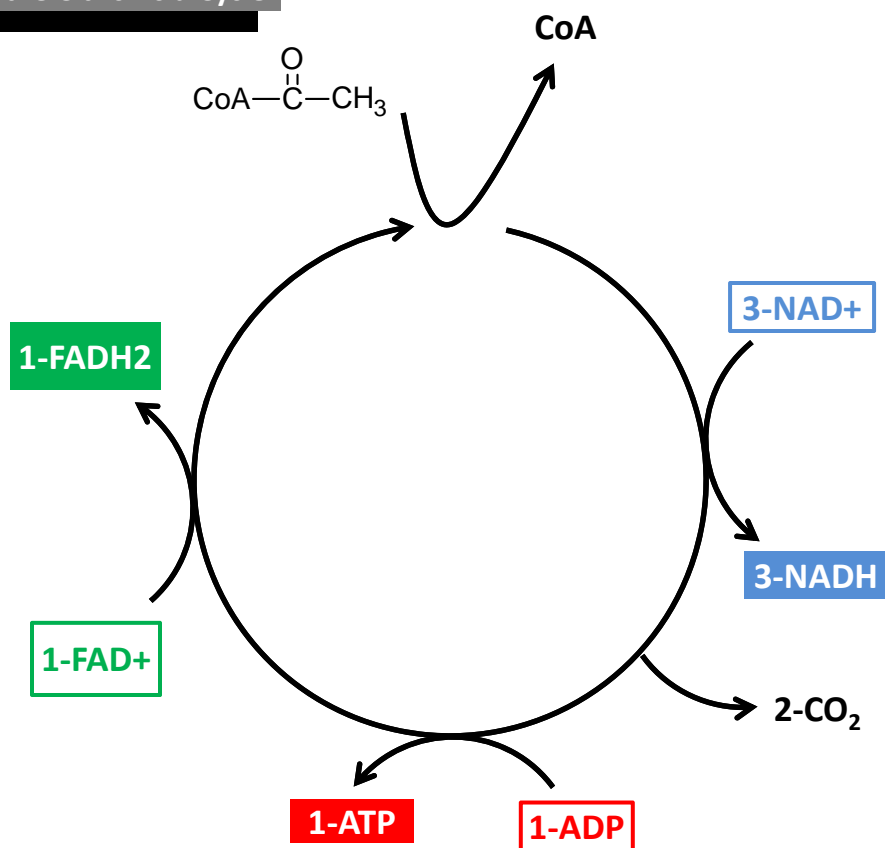


Step 8

In this the final of the four oxidation reactions, the carbon carrying the hydroxyl group (OH) is converted to a carbonyl group ($\text{C}=\text{O}$). NADH is created as NAD^+ accepts the proton and electrons. Oxaloacetate is regenerated and ready to begin step 1 again.



Net Results of the Citric Acid Cycle



The citric acid cycle requires the input of an acetyl CoA. This acetyl CoA generally comes from the break down of glucose (Glycolysis) or from the break down of fatty acids (Beta-oxidation). One turn of the citric acid cycle releases two carbons as carbon dioxide and produces 3 NADHs, 1 ATP, and 1 FADH₂. Ultimately the NADHs and the FADH₂ will help with ATP synthesis in the electron transport chain.