

KREBS' CYCLE

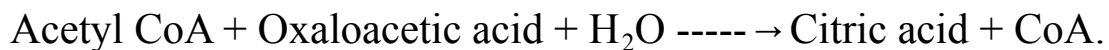
Pinaki K. Rabha

The cycle is named as krebs cycle to honour Hans A Kreb who discovered it. He discovered it in 1937 and was awarded the Nobel Prize in 1953. It is also known as citric acid cycle as citric acid is the first intermediate compound of the cycle. This acid has three carboxylic groups, and hence is also called Tricarboxylic Acid cycle(TCA). This aerobic process takes place in mitochondria where necessary enzymes are present in the matrix.

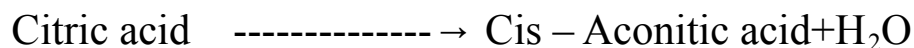
Biochemistry of TCA:

Following are the reactions in TCA

1. Acetyl CoA is the connecting link between glycolysis and Krebs cycle. Acetyl-CoA condenses with oxaloacetic acid in the presence of citrate synthase enzyme and water molecule to form citric acid. CoA becomes free.



2. Citric acid is dehydrated in the presence of aconitase to form cis – aconitic acid



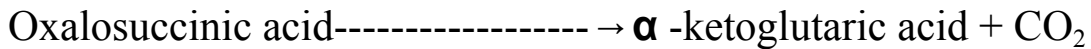
3. Cis-aconitic acid reacts with one molecule of water to form Isocitric acid.



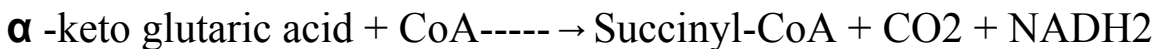
4. Iso-citric acid is oxidized to oxalo succinic acid in the presence of Isocitric dehydrogenase. This is the first oxidation in Krebs cycle where NAD accepts electrons and is reduced to NADH.



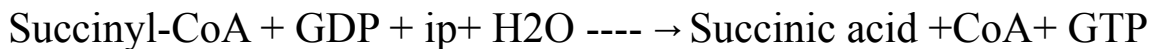
5. Oxalosuccinic acid is decarboxylated in the presence of oxalo succinic decarboxylase to form α - ketoglutaric acid and a molecule of CO_2 is released.



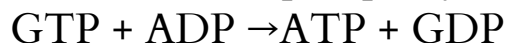
6. α - ketoglutaric acid reacts with CoA and NAD in the presence of α - ketoglutaric acid dehydrogenase complex and is oxidatively decarboxylated to form succinyl CoA and a molecule of CO_2 is released. NAD is reduced in the reaction to NADH.



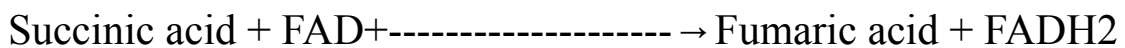
7. Succinyl CoA reacts with water molecule to form succinic acid. CoA becomes free and one molecule of GDP (Guanosine diphosphate) is phosphorylated in presence of inorganic phosphate to form one molecule of GTP.



GTP may react with ADP to form one molecule of ATP. This is called substrate level phosphorylation.



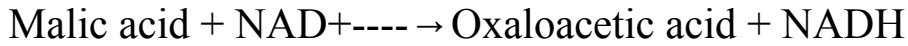
8. In the 3rd oxidation step, Succinic acid is oxidized to fumaric acid in the presence of succinic dehydrogenase and coenzyme FAD is reduced in this reaction.



9. One mole of H_2O is added to Fumaric acid in the presence of fumarase to form malic acid.



10. In the last step, malic acid is oxidized to oxaloacetic acid in the presence of malic acid dehydrogenase and one molecule of coenzyme i.e. NAD is reduced to NADH.



In this way Oxaloacetic acid is regenerated. In Krebs cycle, there are four oxidation steps. Three molecules of reduced co-enzyme NADH and one molecule of FADH are produced. These reduced coenzymes are reoxidized via ETS to produce ATP molecules which is known as oxidative phosphorylation.

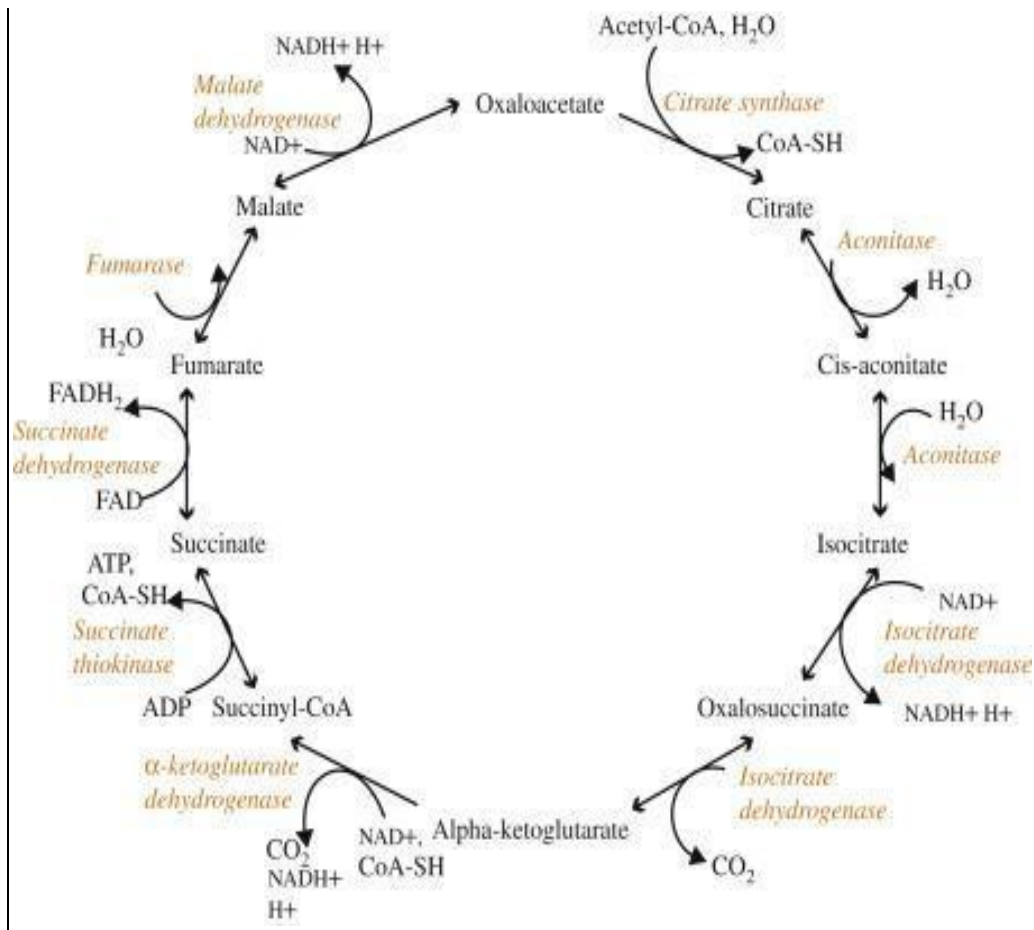


Fig: Krebs Cycle.