

Krebs cycle/TCA (Tri carboxylic acid) Cycle/Citric acid cycle

Krebs cycle occupies central position in oxidation of any kind of respiratory substrate.

Location: In eukaryotes it takes place in mitochondrial matrix. All enzymes for Krebs cycle are present in matrix, except succinate dehydrogenase which is bound to inner mitochondrial membrane.

In prokaryotes it takes place in cytoplasm and succinate dehydrogenase is bound to plasma membrane.

Pathway:

–Acetyl CoA **condenses** with oxaloacetate in presence of citrate synthase to form citrate, a tricarboxylic acid. The cycle has got the name on the basis of this compound.

–Citrate is **dehydrated** to form *cis*-aconitate which is hydrated to form iso-citrate. Both these steps are catalysed by aconitase.

–Isocitrate undergoes **oxidative decarboxylation** under catalytic effect of isocitrate dehydrogenase. It leads to formation of α -keto glutarate.

In this step, CO_2 is released and NAD^+ is reduced to NADH.

– α -ketoglutarate is subjected to **oxidative decarboxylation** which leads to formation of Succinyl Coenzyme A (Succinyl CoA). In this step, CO_2 is released and NAD^+ is

reduced to NADH. The step is catalysed by α -ketoglutarate dehydrogenase which shows resemblance with pyruvate dehydrogenase complex, regarding type of reaction catalysed and requirement of coenzymes.

–Succinyl CoA is converted into succinate in presence of thiokinase or succinate CoA synthetase.

The step is coupled with phosphorylation of GDP into GTP with the help of P_i (GTP is utilised to form ATP). Such ATP formation is another example of Substrate Level Phosphorylation.

–Succinate is **oxidised** in presence of succinate dehydrogenase which is bound to inner mitochondrial membrane.

Oxidation of succinate leads to formation of fumarate and the step is coupled with reduction of FAD to FADH_2 .

–Fumarate is **hydrated** to form malate in presence of fumarase.

–Malate is **oxidised** to form oxaloacetate. The step is catalysed by malate dehydrogenase. The step is coupled with reduction of NAD^+ into NADH.

With generation of oxaloacetate the cycle is ready to operate again.

Oxidation of one molecule of acetyl coenzyme-A by Krebs cycle yields

1ATP
3($\text{NADH} + \text{H}^+$)
1 FADH_2

