Topic Page: Krebs cycle

Definition: **Krebs' Cycle** from *Black's Medical Dictionary, 43rd Edition*

A series of key cellular chemical reactions starting and ending with oxaloacetic acid. Also called the citric acid – or tricarboxylic acid – cycle, it produces energy in the form of ADENOSINE TRIPHOSPHATE (ATP) and is the last stage in the biological oxidation of fats, proteins, and carbohydrates. Named after Sir Hans Krebs, a German biochemist working in England in 1900, who won the Nobel Prize for his discovery.

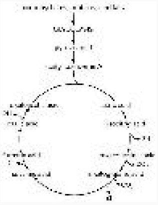

Image from: **Krebs cycle (citric acid cycle or tricarboxylic acid cycle)** in *The Macmillan Encyclopedia*

Summary Article: **Krebs cycle**
From *The Hutchinson Unabridged Encyclopedia with Atlas and Weather Guide*

Final part of the chain of biochemical reactions by which organisms break down food using oxygen to release energy (respiration). It takes place within structures called mitochondria in the body's cells, and breaks down organic molecules in a series of small steps, producing energy-rich molecules of ATP.

Virtually all molecules that serve as fuel for aerobic metabolism, including amino acids, lipids, and carbohydrates, will have been degraded to pieces containing only two carbon atoms, and thus enter the Krebs cycle as acetyl groups, which are activated by binding to coenzyme A (CoA).

In the first step after entering the cycle, acetyl CoA reacts with oxaloacetate (an organic compound with four carbon atoms) to form the compound citrate, the anion of citric acid, which contains three carboxylic acid groups. After this compound, the cycle is also known as citric acid cycle or tricarboxylic acid cycle. This first step is catalysed by the enzyme citrate synthase.

In a sequence of eight further steps, each catalysed by a different enzyme, citrate is first rearranged and then cut down to leave the cycle carrier, oxaloacetate, which will then enter the next round. In each round, two carbon atoms leave the cycle as CO_2. Two molecules of NAD^+ (nicotinamide adenine dinucleotide) are converted to NADH, one GDP to GTP (guanosine triphosphate), and one FAD (flavin adenine dinucleotide) to $FADH_2$.

In a separate process known as the electron transport chain, each NADH generates three molecules of the energy carrier ATP, while each $FADH_2$ generates two ATP. Thus, the Krebs cycle generates 11 ATP and one GTP from each acetyl unit fed into it.

Complete oxidation of one glucose molecule produces 36 molecules of ATP, while anaerobic metabolism, using only glycolysis, only produces two molecules of ATP.

The cell may also run parts of the Krebs cycle separately in order to produce some of the molecules normally built and destroyed in each cycle, such as alpha-ketoglutarate, which is used in the synthesis of certain biomolecules. When this happens, the oxaloacetate with which each turn of the cycle begins needs to be replenished by a separate pathway, starting from the compound pyruvate.

In 2007, it was shown that deep-sea chemosynthetic organisms can run the Krebs cycle backwards, as an alternative to the Calvin cycle.

The Krebs cycle was discovered in the 1930s by Hans Krebs, who received a Nobel prize for this achievement.

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