AP Biology
Notes: Krebs cycle

Most of the chemical energy originally stored in glucose still resides in the two pyruvate molecules produced by glycolysis. The fate of pyruvate depends upon the presence or absence of oxygen. If oxygen is present, pyruvate enters the mitochondrion where it is completely oxidized by a series of enzyme-controlled reactions.

Formations of acetyl CoA (pre-krebs)

Pyruvate molecules are translocated from the cytosol into the mitochondrion by a carrier protein in the mitochondrial membrane.
This step is catalyzed by a multienzyme complex which:

1. Removes CO_2 from the carboxyl group of pyruvate, changing it from a three-carbon to a two-carobn compound. This is the first step where CO_2 is released.
2. Oxidizes the two-carbon fragment to acetate, while reducing NAD^+ to NADH. Since glycolysis produces two pyruvate molecules per glucose, there are two NADH molecules produced.
3. Attaches coenzyme A to the acetyl group, forming acetyl CoA. This bond is unstable, making the acetyl group very reactive

Krebs cylce

The krebs cycle reactions oxidizes the remaining acetyl fragments of acetyl CoA to CO_2.

A German-British scientist Hans Krebs described this catabolic pathway in the 1930s.
The krebs cycle, which is also known as the citric acid cycle or TCA cycle has eight enzyme-controlled steps that occur in the mitochondrial matrix.

Step 1 the unstable bond of acetyl CoA breaks and the two-carbon acetyl group bound sot he four-carbon oxaloacetate to form six-carbon citrate.

Step 2 Citrate is isomerized to isocitrate.

Step 3 Two major events occur during this step:

1. Isocitrate loses CO_2, leaving a five-carbon molecule
2. The five-carbon compound is oxidized and NAD^+ is reduced.

Step 4 A mutlienzyme complete catalyzes
Removla of CO2.
Oxidation of the remaining four-carbon compound and reduction of NAD+
Attachment of CoA with a high energy bond to form succinyl CoA

Step 5 Substrate-level phosphorylation occurs in a series of enzyme catalyzed reactions

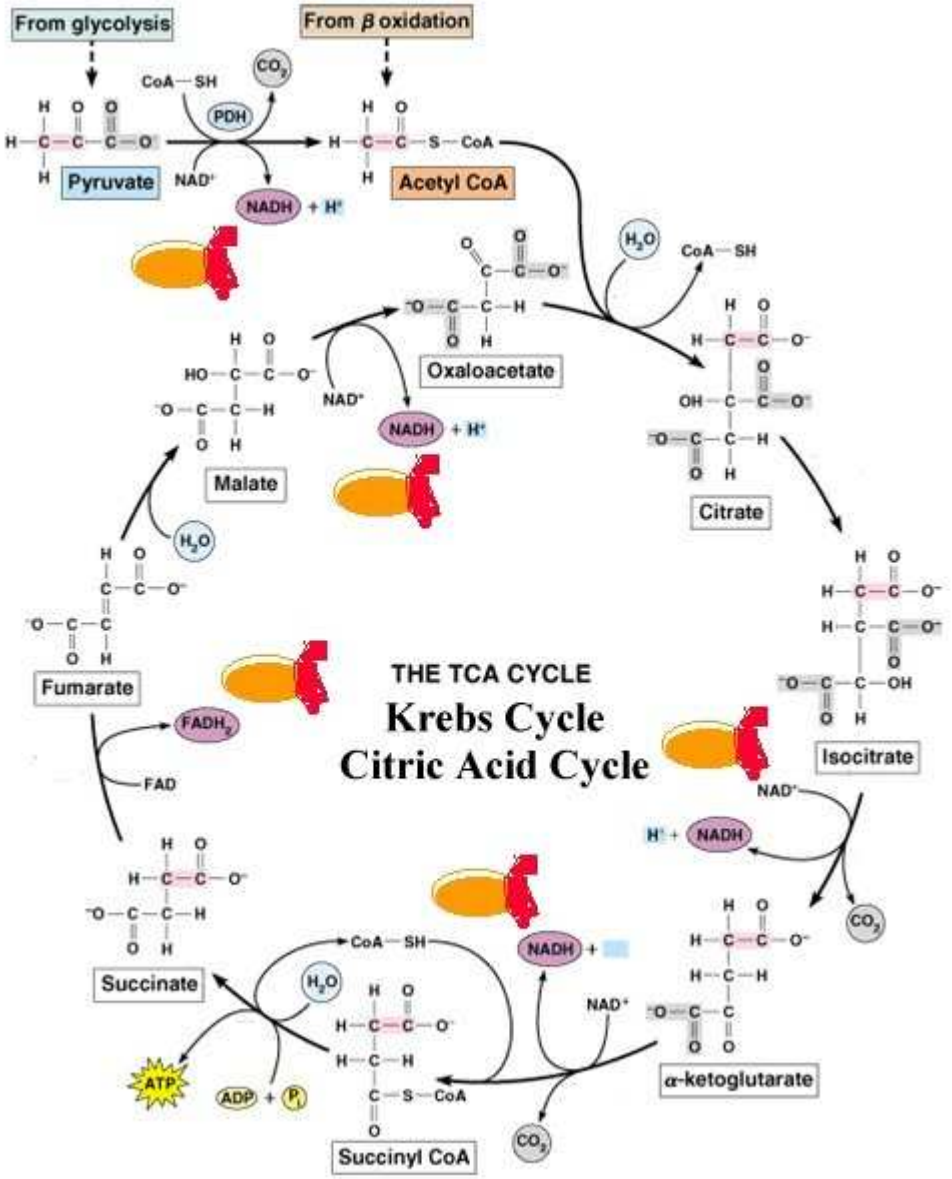
The high energy bond of sucinyl CoA breaks, and some energy is conserved as CoA is displaced by a phosphate group
The phosphate groups is transferred to GDP to form GTP and succinate
GTP donates a phosphate group to ADP to form ATP

Step 6 Succinate is oxidized to furmarate and FAD is reduced
Two hydrogens are transferred to FAD to form $FADH_2$.
The dehydrogenase that catalyzes this reaction is bound to the inner mitochondrial membrane.

Step 7 Water is added to fumarate which rearranges its chemical bonds to form malate

Step 8 Malate is oxidized and NAD^+ is reduced
A molecule of NADH is produced
Oxaloacetate is regenerated to begin the cycle again

Two turns f the Krebs cycle produce two ATPs by substrate-level phosphorylation.
However most ATP output of respiration results from oxidative phosphorylation
*Reduced coenzymes produced by the Krebs cycle (six NADH and two
*$FADH_2$ per glucose) carry high energy electrons to the electron transport chain
* The ETC couples electron flow down the chain to ATP synthesis.



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