**Steps of Citric Acid Cycle**

**Step 1.** In the first step of the citric acid cycle, acetyl CoA with a four-carbon molecule, oxaloacetate, releasing the CoA forming a six-carbon molecule called citrate.

**Step 2.** In the second step, citrate is converted into its isomer, isocitrate. This is actually a two-step process, involving first the removal and then the addition of a water molecule, which is why the citric acid cycle is sometimes described as having nine steps—rather than the eight listed here.

**Step 3.** In the third step, isocitrate is oxidized and releases a molecule of carbon dioxide, leaving behind a five-carbon molecule—α-ketoglutarate. During this step, NAD+ is reduced to form NADH. The enzyme catalyzing this step, **isocitrate dehydrogenase**, is important in regulating the speed of the citric acid cycle.

**Step 4.** The fourth step is similar to the third. In this case, it’s α-ketoglutarate that’s oxidized, reducing NAD+ to NADH and releasing a molecule of carbon dioxide in the process. The remaining four-carbon molecule picks up Coenzyme A, forming the unstable compound succinyl CoA. The enzyme catalyzing this step, **α-ketoglutarate dehydrogenase**, is also important in regulation of the citric acid cycle.

**Step 5.** In step five, the CoA is replaced by a phosphate group, which is then transferred to ADP to make ATP. In some cells, GDP - guanosine diphosphate—is used instead of ADP forming GTP—guanosine triphosphate—as a product. The four-carbon molecule produced in this step is called succinate.

**Step 6.** In step six, succinate is oxidized, forming another four-carbon molecule called fumarate. In this reaction, two hydrogen atoms—with their electrons—are transferred to FAD producing FADH2​. The enzyme that carries out this step is embedded in the inner membrane of the mitochondrion, so FADH2​ can transfer its electrons directly into the electron transport chain.

**Step 7.** In step seven, water is added to the four-carbon molecule fumarate, converting it into another four-carbon molecule called malate.

**Step 8.** In the last step of the citric acid cycle, oxaloacetate—the starting four-carbon compound—is regenerated by oxidation of malate. Another molecule of NAD+ is reduced to NADH in the process.

