Glyoxlyate cycle

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The Glyoxylate Cycle

Another Process Involving Glycolytic

Enzymes and Metabolites

- Anabolic metabolic pathway occurring in plants, and several microorganisms , **not animals**.

- Occurs in glyoxysome

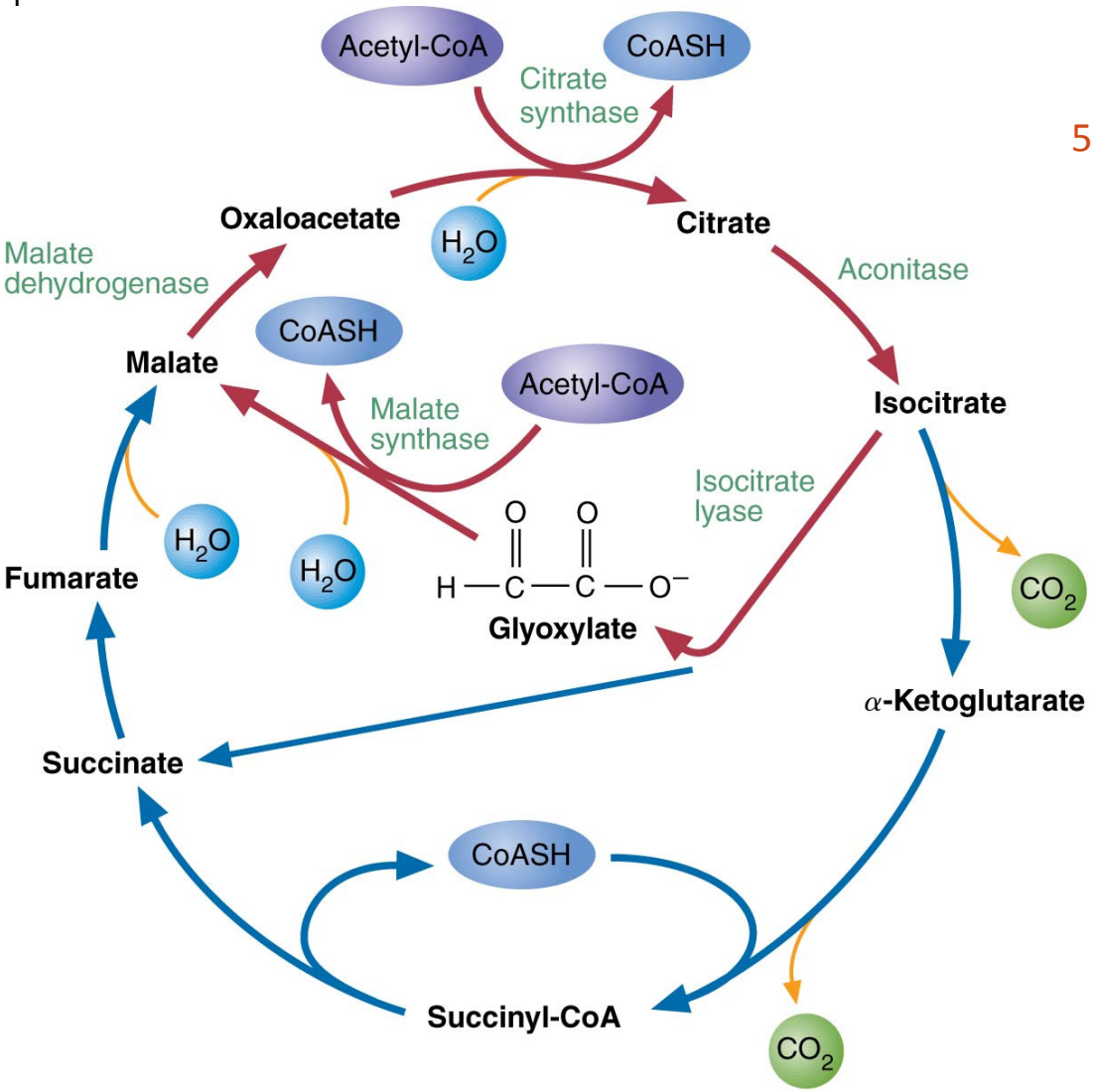
- The enzymes common to the TCA cycle and the glyoxysomes are **isoenzymes**, one specific to mitochondria and the other to glyoxysomes.

- The glyoxylate cycle allows plants to use acetyl-CoA derived from β-oxidation of fatty acids for carbohydrate synthesis (use fats for the synthesis of carbohydrates).

Animals can not do this!

Acetyl-CoA is totally oxidized to CO_2

The Glyoxylate Cycle: Demonstration of Connections to the Citric Acid Cycle



5. Succinate returns to mitochondria , where it re enters the TCA cycle and is transformed to oxaloacetate, which can again be exported (via aspartate) to the glyoxysome

6. Each turn of this cycle consumes 2 molecules of Acetyl CoA cycle and produce 1 molecule of succinate

Note that the decarboxylation reactions of the citric acid cycle are bypassed

☞ Some bateria, including *E Coli*, have the full complement of enzymes for the glyoxylate and TCA cycles in the cytosol

⇨ *E coli* can therefore grow with acetate as its sole source of carbon and energy

Summary

- Pyruvate is converted to acetyl-CoA by the action of pyruvate dehydrogenase complex, a huge enzyme complex.
- Acetyl-CoA is converted to 2 CO_2 via the eight-step citric acid cycle, generating three NADH, one $FADH_2$, and one ATP (by substrate-level phophorylation).
- Intermediates of citric acid cycle are also used as biosynthetic precursors for many other biomolecules, including fatty acids, steroids, amino acids, heme, pyrimidines, and glucose.
- Oxaloacetate can get replenished from pyruvate, via a carboxylation reaction catalyzed by the biotin-containing pyruvate carboxylase.

- The activity of pyruvate dehydrogenase complex is regulated by allosteric effectors and reversible phosphorylations.

- Net conversion of fatty acids to glucose can occur in germinating seeds, some invertebrates and some bacteria via the glycoxylate cycle, which shares three steps with the citric acid cycle but bypasses the two decarboxylation steps, converting two molecules of acetyl-CoA to one succinate.