6.6: Glyoxylate Pathway

Succinate continues through the remaining reactions of the CAC to produce oxaloacetate. Glyoxylate combines with another acetyl-CoA (one acetyl-CoA was used to start the cycle) to create malate (catalyzed by malate synthase).

Figure 6.6.1: The Glyoxylate Cycle
Malate can, in turn, be oxidized to oxaloacetate.

It is at this point that the pathway’s contrast with the CAC is apparent. After one turn of the CAC, a single oxaloacetate is produced and it balances the single one used in the first reaction of the cycle. Thus, in the CAC, no net production of oxaloacetate is realized. By contrast, at the end of a turn of the glyoxylate cycle, two oxaloacetates are produced, starting with one. The extra oxaloacetate can then be used to make other molecules, including glucose in gluconeogenesis.

Because animals do not run the glyoxylate cycle, they cannot produce glucose from acetyl-CoA in net amounts, but plants and bacteria can. As a result, these organisms can turn acetyl-CoA from fat into glucose, while animals can’t. Bypassing the decarboxylations (and substrate level phosphorylation) has its costs, however. Each turn of the glyoxylate cycle produces one FADH and one NADH instead of the three NADHs, one $\text{FADH}_2$, and one GTP made in each turn of the CAC.

---

**Contributors**

- [Dr. Kevin Ahern](#) and [Dr. Indira Rajagopal](#) (Oregon State University)