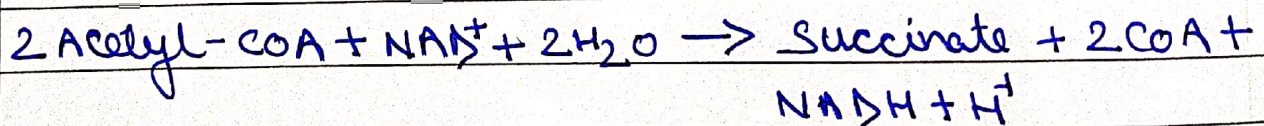


## Glyoxylate cycle [Unit - III]

- \* The plants and many microorganisms are equipped with the metabolic machinery - namely Glyoxylate cycle.
- \* This cycle converts the fats into carbohydrates.
- \* This cycle is a variation of the tricarboxylic acid cycle (TCA), is an anabolic pathway occurring in plants, bacteria, protists and fungi.
- \* The enzymes of glyoxylate cycle catalyze the net conversion of acetate to succinate or other 4-carbon intermediate of the citric acid cycle.

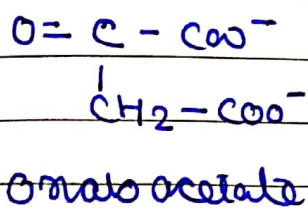
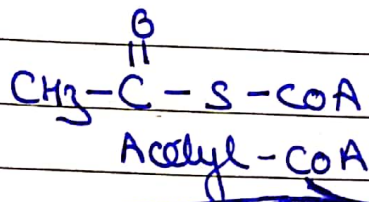


- \* The cycle occurs in glyoxysomes specialised cellular organelles, where fatty acid oxidation is also operative.
- \* In plants, the enzymes of the glyoxylate cycle are sequestered in membrane-bounded organelles called glyoxysomes, which are specialized peroxisomes.

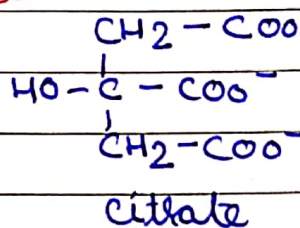
## Steps of cycle

- 1) Acetyl-CoA condenses with oxaloacetate to form citrate, and citrate is converted to isocitrate, same as in citric acid cycle.
- 2) Next step, is not the breakdown of isocitrate by isocitrate dehydrogenase but cleavage of isocitrate by isocitrate lyase, forming succinate and glyoxylate.
- 3) The glyoxylate then condenses with a second molecule of acetyl-CoA to yield malate, in this reaction is catalysed by malate synthase.
- 4) The Malate is subsequently oxidized to oxaloacetic acid (OAA), which can condense with another molecule of acetyl-CoA to start another turn of the cycle.
- 5) Each turn of the glyoxylate cycle consumes two molecules of succinate, which is then available for biosynthetic purposes.
- 6) The succinate may be converted through fumarate and malate into oxaloacetic acid, which can then be converted to phosphoenolpyruvate by PEP carboxykinase, and thus to glucose by gluconeogenesis.

- + Vertebrates do not have the enzymes specific to the glyoxylate cycle (isocitrate lyase and malate synthase) & therefore can not bring about the net synthesis of glucose from lipids.
- ▶ Glyoxysomes are not present in all plant tissues at all times.
- They develop in lipid-rich seeds during germination before the developing plant acquires the ability to make glucose by photosynthesis.
- Glyoxylate cycle enzymes, glyoxysomes contain all the enzymes needed for the degradation of the fatty acids stored in seed oil.
- ▶ Acetyl Co-A formed from lipid breakdown is converted to succinate via the glyoxylate cycle and the succinate is exported to mitochondria, where citric acid cycle enzyme transform it to malate.
- ▶ A cytosolic isozyme of malate dehydrogenase oxidize malate to oxaloacetate, a precursor for gluconeogenesis.
- ▶ Germinating seeds can therefore convert the carbon of stored lipids into glucose.

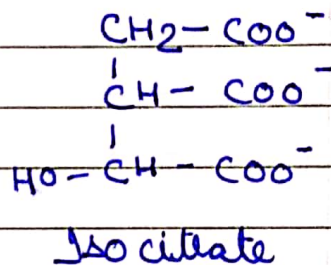


*citrate synthase*

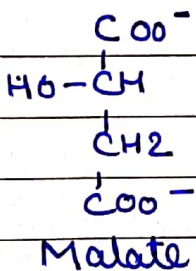


**GLYOXYLATE CYCLE**

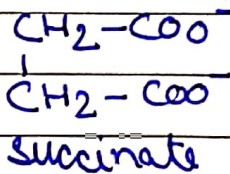
*Aconitase*



*Malate dehydrogenase*



*Isocitrate lyase*



*Malate synthase*

