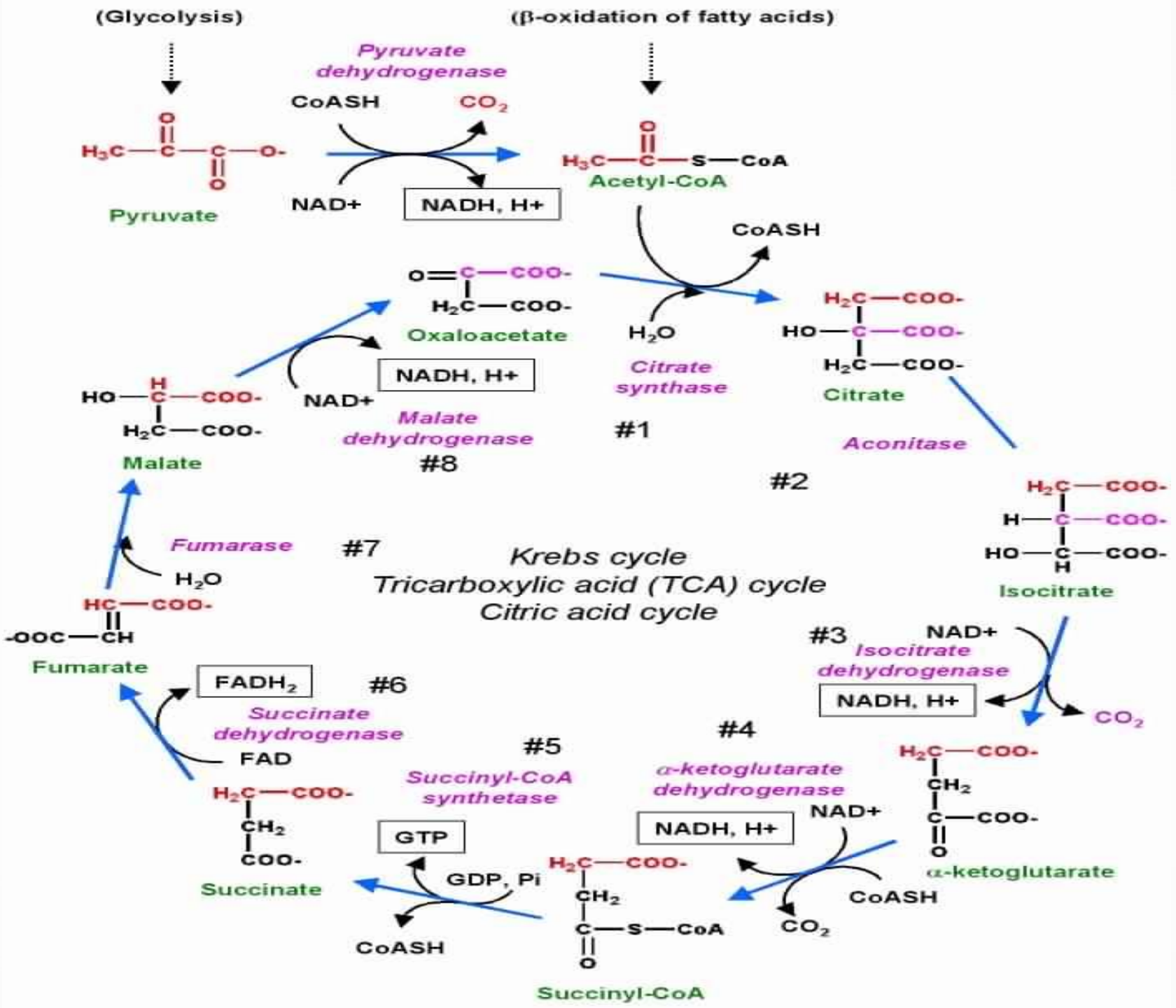
Kreb's Cycle

Introduction

- Organisms derive the majority of their energy from the Kreb's Cycle, also known as the TCA cycle.
- The Kreb's Cycle is an aerobic process consisting of eight definite steps.
- In order to enter the Kreb's Cycle pyruvate must first be converted into Acetyl-CoA by pyruvate dehydrogenase complex found in the mitochondria.

- In the presence of oxygen organisms are capable of using the Kreb's Cycle.
- The reason oxygen is required is because the NADH and [$FADH_2$] produced in the Kreb's Cycle
- They are able to be oxydized in the electron transport chain (ETC) thus replenishing the supply of NAD^+ and [FAD].


(Glycolysis)
(β-oxidation of fatty acids)
Pyruvate dehydrogenase
CoASH
CO_2
NAD+
NADH, H+
Pyruvate
Acetyl-CoA
CoASH
H_2O
Citrate synthase
#1
Citrate
Aconitase
#2
Isocitrate
#3
Isocitrate dehydrogenase
NAD+
NADH, H+
CO_2
#4
α-ketoglutarate dehydrogenase
NAD+
NADH, H+
CoASH
CO_2
α-ketoglutarate
#5
Succinyl-CoA synthetase
GTP
GDP, Pi
CoASH
Succinyl-CoA
Succinate
#6
Succinate dehydrogenase
FAD
$FADH_2$
Fumarate
#7
Fumarase
H_2O
Malate
#8
Malate dehydrogenase
NAD+
NADH, H+
Oxaloacetate
Krebs cycle
Tricarboxylic acid (TCA) cycle
Citric acid cycle

STEPS

- In order for pyruvate from glycolysis to enter the Kreb's Cycle it must first be converted into acetyl-CoA by the pyruvate dehydrogenase complex which is an oxidative process wherein NADH and CO_2 are formed.
- Another source of acetyl-CoA is beta oxidation of fatty acids.

1. 1. Acetyl-CoA enters the Kreb Cycle when it is joined to oxaloacetate by citrate synthase to produce citrate. This process requires the input of water. Oxaloacetate is the final metabolite of the Kreb Cycle and it joins again to start the cycle over again, hence the name Kreb's **Cycle**. This is known as the committed step.
2. Citrate is then converted into isocitrate by the enzyme aconitase. This is accomplished by the removal and addition of water to yield an isomer.

3. Isocitrate is converted into alpha-ketogluterate by isocitrate dehydrogenase. The byproducts of which are NADH and CO_2.

4. Apha-ketogluterate is then converted into succynl-CoA by alpha-ketogluterate dehydrogenase. NADH and CO_2 are once again produced.

5. Succynl-CoA is then converted into succinate by succynl-CoA synthetase which yields one ATP per succynl-CoA.

6. Succinate coverts into fumerate by way of the enzyme succinate dehydrogenase and [FAD] is reduced to [$FADH_2$] which is a prosthetic group of succinate dehydrogenase. Succinate dehydrogenase is a direct part of the ETC. It is also known as electron carrier II.

7. Fumerate is then converted to malate by hydration with the use of fumerase.

8. Malate is converted into oxaloacetate by malate dehydrogenase the byproducts of which are NADH.

References

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