

Citric Acid Cycle

Chapter 16 Learning Objectives

Key concepts: The use of oxygen by aerobic organisms in the oxidation of glucose yields a substantially greater amount of energy than fermentation of glucose to lactate or ethanol. Pyruvate is converted to acetyl CoA by the enzyme complex pyruvate dehydrogenase. TPP, FAD, NAD and lipoate are required cofactors. The cycle is initiated by the condensation of an oxaloacetate and acetyl CoA. Citrate is formed in this reaction with the ultimate recycling of oxaloacetate. During the TCA cycle 2 CO₂, 3 NADH, 1 FADH₂ and 1 GTP are produced. Because the citric acid cycle molecules can serve as biosynthetic starting materials, the cycle has an amphibolic nature. Like glycolysis, the TCA cycle is highly regulated ensuring that the cells energy is met as needed. There are several points within the cycle that are regulated.

By the end of the chapter you should be able to:

- 1) Know each of the steps of the TCA cycle know the reactants and the products.
- 2) Relate the citric acid cycle in the role of generating energy.
- 3) Summarize the different reactions that occur during the cycle.
- 4) Recognize the intermediates based on their nomenclature and basic structure.
- 5) Give examples of condensation, dehydration, hydration, decarboxylation, oxidation and substrate level phosphorylation.
- 6) Calculate the yield of ATP for one turn of the cycle.
- 7) Describe the net reaction for the TCA cycle.
- 8) Describe the conversion pyruvate into the cycle by either the PDH or PC.
- 9) Recognize why acetyl Co-A is an important cross-road metabolite.
- 10) Understand the reaction for the three enzyme complexes of pyruvate dehydrogenase and how it is regulated and know which vitamins or co-factors are involved in the PDH conversion of pyruvate to acetyl CoA.
- 11) Understand the mechanism of citrate synthase and understand why induced fit is important for this enzyme.
- 12) Describe the asymmetric reaction of citrate. Know which carbon is added and which carbon is lost though out the cycle.
- 13) What are the thermodynamic points for the cycle.
- 14) Understand the key features for each of the enzymes studied