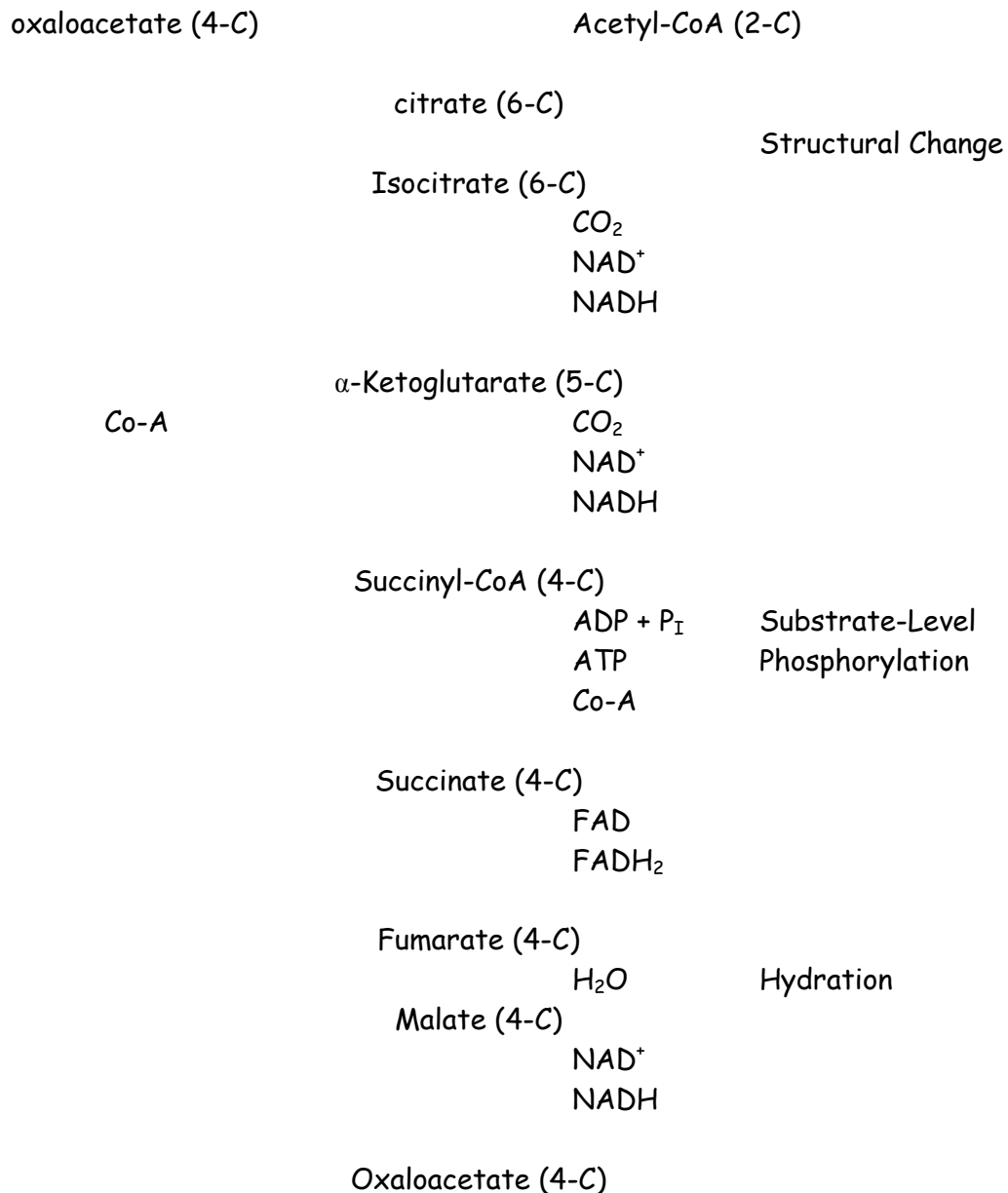


Krebs Cycle and the Electron Transport Chain

Krebs Cycle

- Note: Remember that these steps are aerobic (require oxygen)
- 2 Acetyl-CoA (2-C) is broken down to 4 molecules of carbon dioxide, 2 molecules of ATP, 6 molecules of NADH and 2 molecules of FADH₂
- It occurs in the matrix of the mitochondria (see p.102 Fig.16)

Steps of the Krebs Cycle



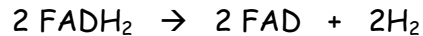
Net Production: 4 CO₂ (released by the cells)
 2ATP
 6NADH
 2FADH₂

proceed to the electron transport chain

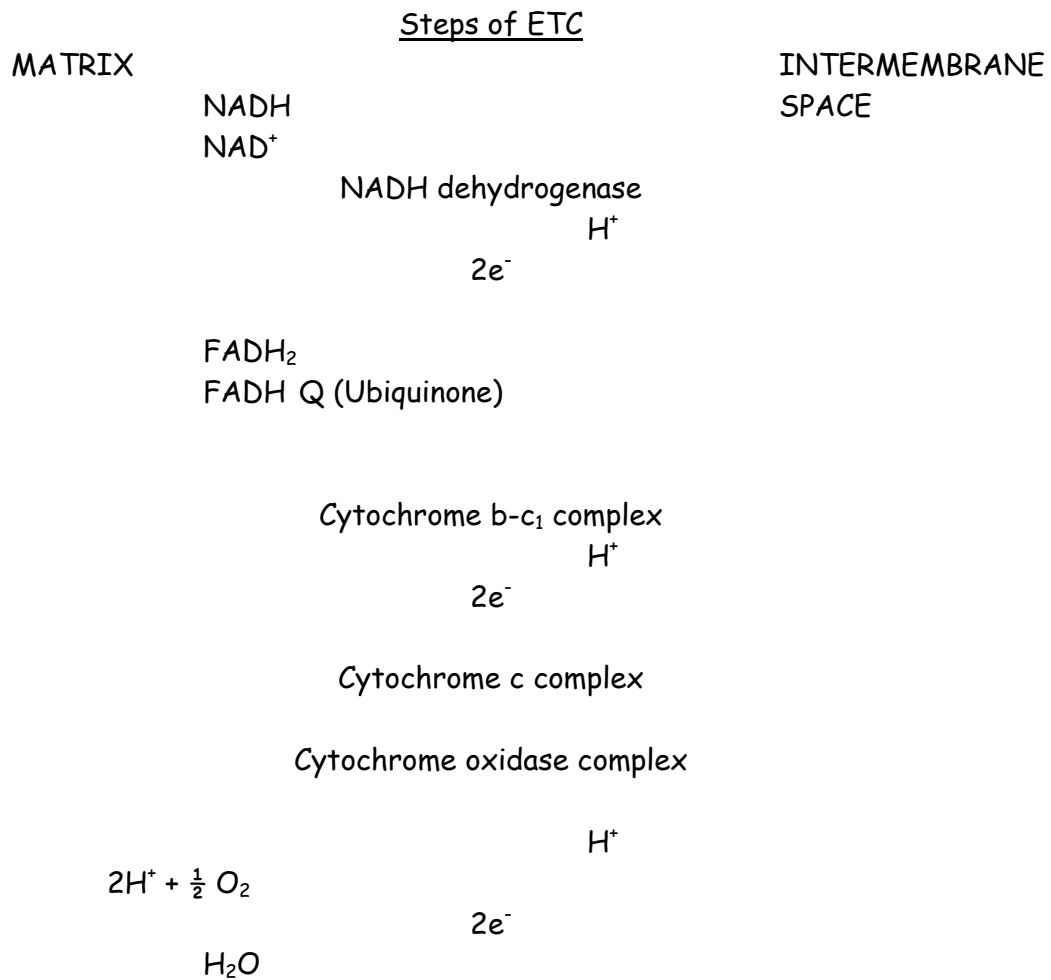
Electron Transport Phosphorylation

- The Coenzymes (NADH and FADH₂) give up H⁺ ions and electrons
- As the electrons pass through the system ATP is formed (32 molecules)
- Oxygen is the final acceptor of the H⁺ and electrons, creating a water molecule
- This occurs on the cristae of the mitochondrion

- 10 NADH (2 from glycolysis, 2 from pyruvate oxidation, 6 from Krebs cycle) and 2 FADH₂ (both from the Krebs cycle) give up hydrogen



- all the H⁺ are tossed into the outer compartment (intermembrane space) and the e⁻ are transferred through the system
- the compounds of the ETC are arranged in order of increasing electronegativity (See Fig.19, p.104)



- Since NADH passes e⁻ to the first protein complex, it pumps 3H⁺, while FADH₂ passes e⁻ to the second component, pumping 2H⁺ (Fig.20, p.105)
- This produces 3ATP per NADH molecule and 2ATP per FADH₂ molecule
- NADH from glycolysis is unable to pass through the membrane, so it transfers its electron to a glycerol phosphate shuttle that passes the electron to FAD to produce FADH₂
- End Products: 6H₂O and 32 ATP
 - 2NADH from glycolysis = 4ATP
 - NADH from Pyruvate oxidation and 6 NADH from Krebs Cycle = 24 ATP
 - 2FADH₂ from Krebs Cycle = 4ATP

Chemiosmosis

- As the H⁺ gradient increases in the intermembrane space, an electrochemical gradient is created across the cristae, causing the protons to pass through a proton channel containing an enzyme (ATP synthase)
- The energy produced is used to make ATP from ADP and P_I (Fig.21, p.106)
- The actual yield of ATP produced is 30ATP
- Some free energy is lost by the permeability of the cristae to protons and by the use of energy for exergonic reactions