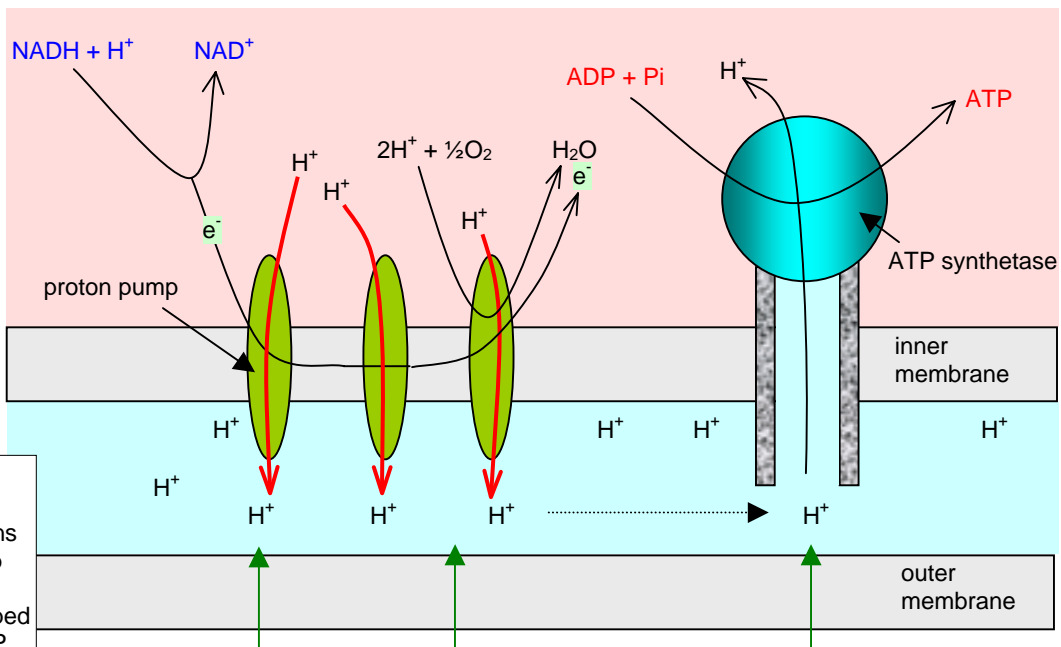
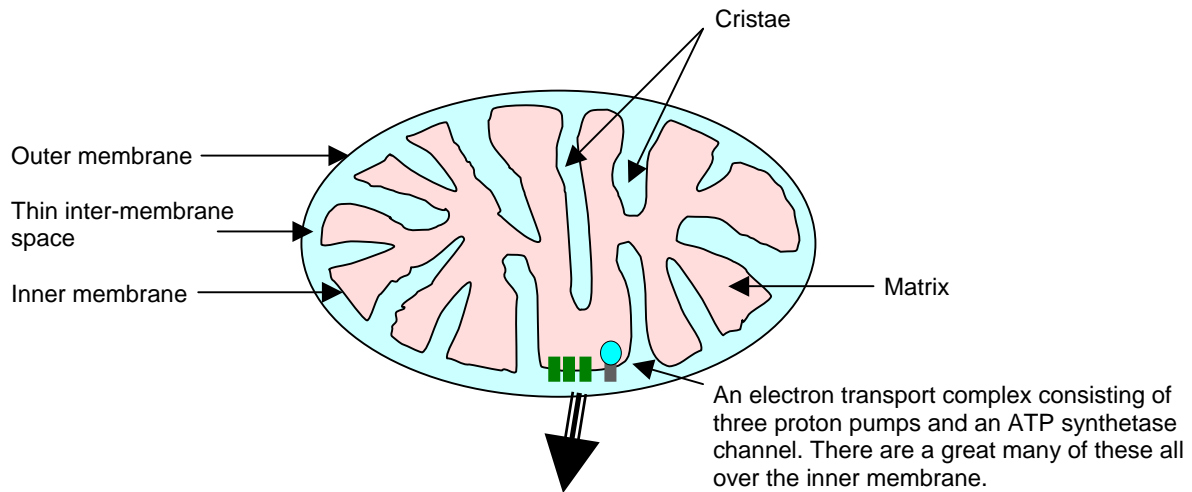


**Key points –**

- Electrons flow through a sequence of carriers that are proton pumps;
- At the final pump, cytochrome oxidase, they are added to oxygen and together with protons from the matrix form water;
- The energy from the electrons is used to pump protons from the matrix to the inter-membrane space;
- There are three linked proton pumps;
- Protons diffuse from the high concentration in the inter-membrane space back into the matrix via a channel linked to ATP synthetase;
- The energy from this proton flow is used to synthesis ATP;
- The thin inter-membrane space permits the rapid formation of a high proton concentration;
- $\text{NADH} + \text{H}^+$  releases its electrons at the first pump thus generating 3 ATP;
- $\text{FADH}_2$  releases its electrons at the second pump thus generating only 2 ATP.

**Oxidative Phosphorylation and The Chemiosmotic Theory**



Only  $\text{NADH} + \text{H}^+$  is shown.  $\text{FADH}_2$  releases its electrons at the second pump thereby resulting in fewer protons pumped and hence less ATP synthesised.

As electrons from the carriers ( $\text{NADH} + \text{H}^+$  and  $\text{FADH}_2$ ) flow through the pumps, protons are pumped into the intermembrane space creating a high concentration.

Protons diffuse down the concentration gradient through the protein channel and the ATP synthetase thereby generating ATP.