

# Mitochondria - Detailed Notes

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## Oxidative Phosphorylation in Mitochondria

Oxidative phosphorylation is the final stage of cellular respiration, occurring in the inner mitochondrial membrane. It involves the electron transport chain (ETC) and ATP synthase. Electrons from NADH and FADH<sub>2</sub> flow through complexes I–IV, creating a proton gradient across the inner membrane. This proton motive force drives ATP synthase (Complex V), which produces ATP from ADP and inorganic phosphate.

## Complexes of the Electron Transport Chain

### Complex I: NADH–Ubiquinone Oxidoreductase (NADH Dehydrogenase)

Largest ETC complex (~45 polypeptides, contains FMN and Fe–S clusters). Transfers electrons from NADH to coenzyme Q, pumping 4 H<sup>+</sup> into the intermembrane space.

### Complex II: Succinate–Ubiquinone Oxidoreductase (Succinate Dehydrogenase)

Part of Krebs cycle and ETC. Transfers electrons from succinate (via FADH<sub>2</sub>) to coenzyme Q. Does not pump protons.

### Coenzyme Q (Ubiquinone)

A mobile lipid-soluble electron carrier. Accepts electrons from Complex I & II and transfers them to Complex III.

### Complex III: Cytochrome bc<sub>1</sub> Complex

Transfers electrons from reduced coenzyme Q (QH<sub>2</sub>) to cytochrome c, pumping 4 H<sup>+</sup>.

### Cytochrome c

A small heme protein acting as a mobile carrier. Shuttles electrons between Complex III and IV.

### Complex IV: Cytochrome c Oxidase

Accepts electrons from cytochrome c and reduces oxygen to water. Pumps 2 H<sup>+</sup> per electron pair.

### Complex V: ATP Synthase (F<sub>0</sub>F<sub>1</sub>-ATPase)

Uses proton gradient to synthesize ATP from ADP and Pi. About 3 H<sup>+</sup> drive the synthesis of 1 ATP.

Detailed Diagram of ETC Complexes

## Electron Transport Chain (ETC) Complexes in Mitochondria

