

Electron transport Chain inhibitor

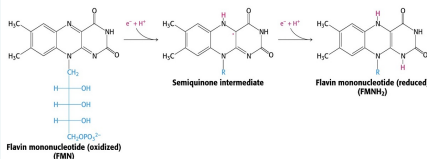
pump1	Rotenone
pump3	Antimycin
pump4	Cyanide
ATP synthase	Oligomycin
protons	uncoupling agent

Generated

Glycolysis	ATP	2
	NADH	3-5
Pyruvate metabolism	NADH	5
TCA cycle	ATP	2
	NADH	6
	FADH ₂	2

FMN/FMNH/FMNH₂

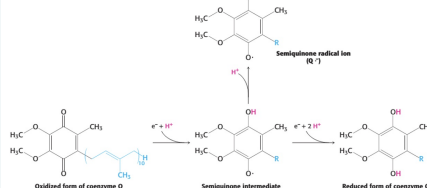
Flavin Mononucleotide (FMN): 1 or 2 e-carrier



Coenzyme Q

Coenzyme Q

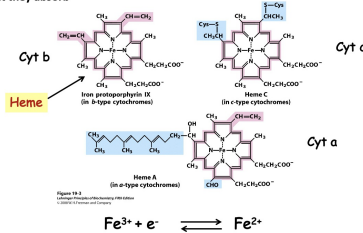
also called CoQ, Q or ubiquinone, is very hydrophobic



The highly hydrophobic tail of isoprene units helps to confine Coenzyme Q to lipid-rich areas of cells.

Prosthetic groups of cytochromes

Cytochromes are subdivided into three classes depending on what wavelengths of light they absorb



Iron-sulfur protein (Fe-S)

Iron-sulfur protein contains **iron-sulfur clusters** comprising sulfide-linked mono-, di-, or tetra iron centers in variable oxidation states.

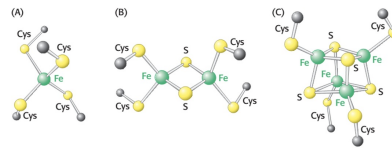


Figure 18.9 Iron-Sulfur Clusters. (A) A single iron ion bound by four cysteine residues. (B) 2Fe-2S cluster with iron ions bridged by sulfide ions. (C) 4Fe-4S cluster. Each of these clusters can undergo oxidation-reduction reactions.

Complex 1

NADH-Q Oxidoreductase

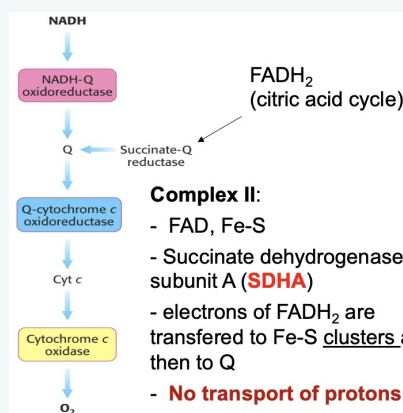
Enormous enzyme (>900 kDa), 46 polypeptides

FMN, Fe-S clusters

Steps of Electron-Transfer:

1. Binding of NADH and transfer of its electrons to FMN (prosthetic group of complex)
 2. Electrons are transferred from FMNH₂ to a series of iron-sulfur clusters (prosthetic group of complex) $\rightarrow 2Fe-2S + 4Fe-4S$ clusters
 3. Electrons are shuttled to coenzyme Q (ubiquinone)
- 2 Electrons from NADH to Coenzyme Q \rightarrow pumping 4 H⁺ from matrix to intermembrane space

Complex 2 & CoQ (entry point for electrons from FADH₂)



Complex 3

Electrons Flow from Ubiquinol (QH₂) to Cytochrome c Through Q-Cytochrome c Oxidoreductase

Cytochrome b: heme bL and heme bH

Cytochrome c1: heme c1

iron-sulfur protein: 2Fe-2S center

Function: catalyse transfer of electrons from QH₂ \rightarrow oxidized cyt c

pumps 4 H⁺ out of matrix \rightarrow intermembrane space

Coupling of electron transport from Q \rightarrow cyt c and transmembrane proton transport: Q cycle

Complex 4

Cytochrome c oxidase catalyzes the reduction of molecular oxygen to water

CuA/CuA, heme a, heme a₃, CuB

heme a₃-CuB is responsible for reduction of O₂

Oxidation of cyt c coupled to reduction of O₂ \rightarrow H₂O

Electron transfer coupled to proton pump

pumps 2 H⁺ from the matrix to intermembrane space

Flow

Flow of electrons and protons through the respiratory chain

