PHARM.D • YEAR 1

Medicinal Biochemistry

CHAPTER 5

Biological Oxidation

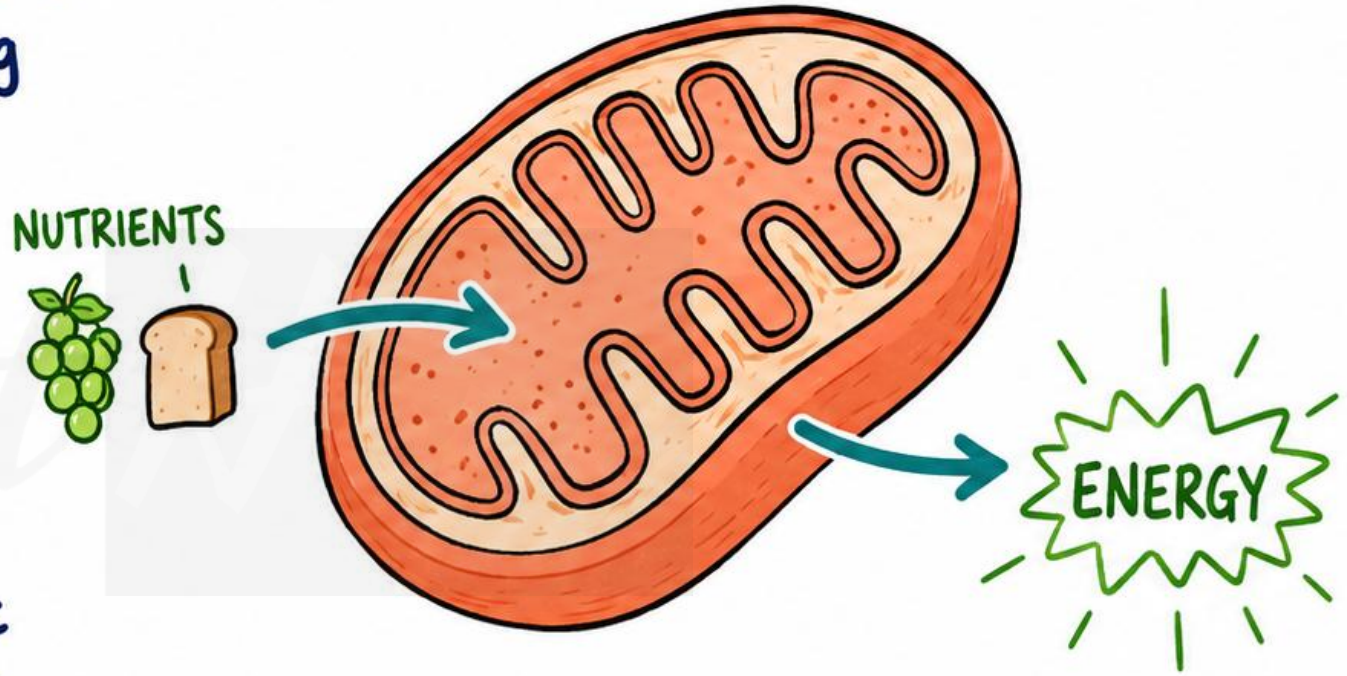
PPT CHAPTER COVER



BIOLOGICAL OXIDATION: OVERVIEW

Biological oxidation transfers electrons from nutrients to acceptors, releasing usable energy.

- Dehydrogenases remove reducing equivalents from substrates.
- NADH and reduced flavins deliver electrons toward the respiratory chain.
- Oxygen is the final acceptor in aerobic respiration; electron transfer supports ATP formation.

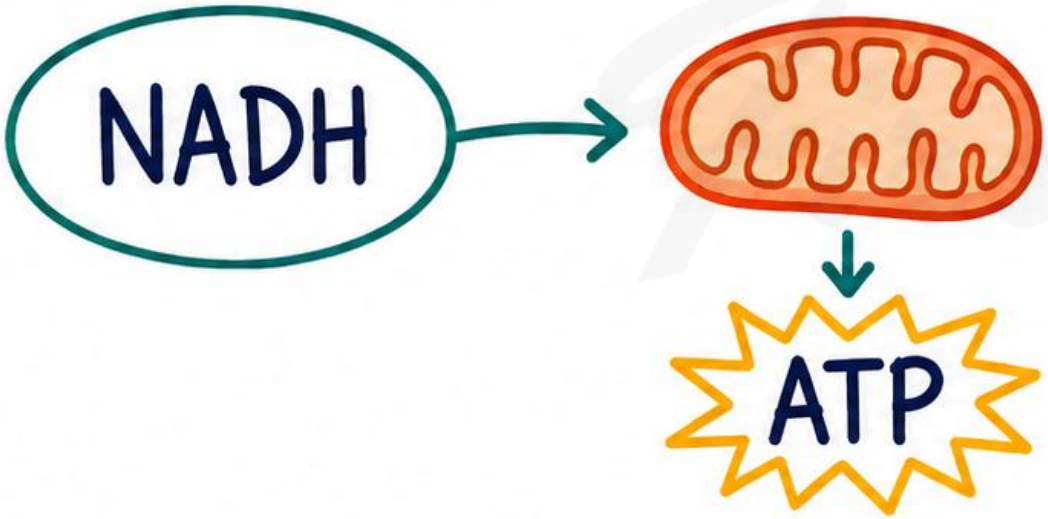


GLUCOSE + OXYGEN O_2 → CARBON DIOXIDE CO_2 + WATER + ENERGY

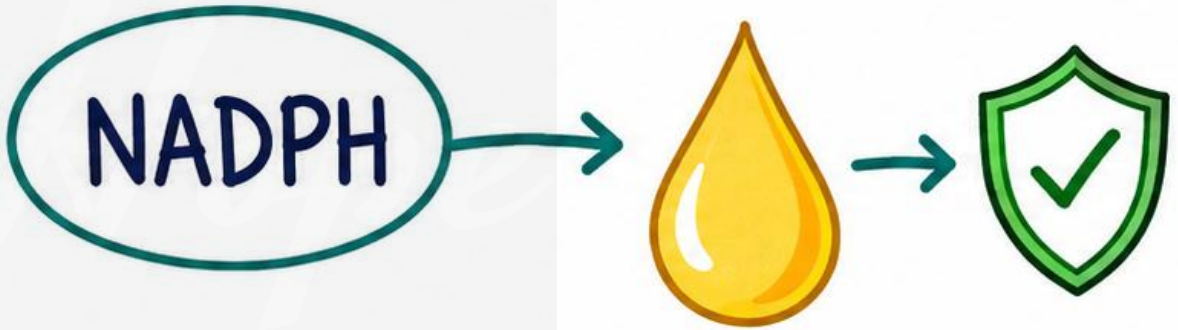
NAD^+/NADH & $NADP^+$/NADPH

Nicotinamide coenzymes are derived from niacin, vitamin B3.

$NAD^+ + 2e^- + H^+ \rightleftharpoons NADH$



$NADP^+ + 2e^- + H^+ \rightleftharpoons NADPH$

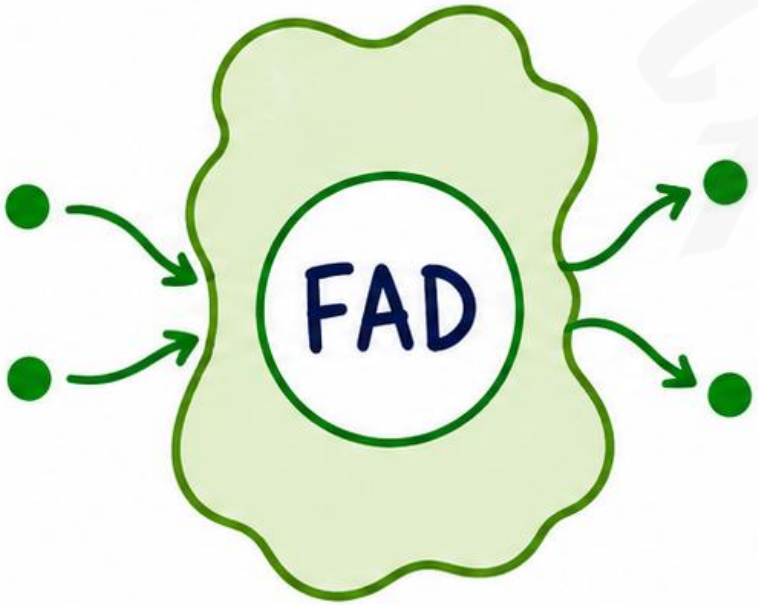


- NADH mainly carries electrons from fuel oxidation toward ATP production.
- NADPH supplies reducing power for fatty-acid synthesis and antioxidant defence.
- The extra phosphate helps enzymes distinguish the two coenzyme pools.

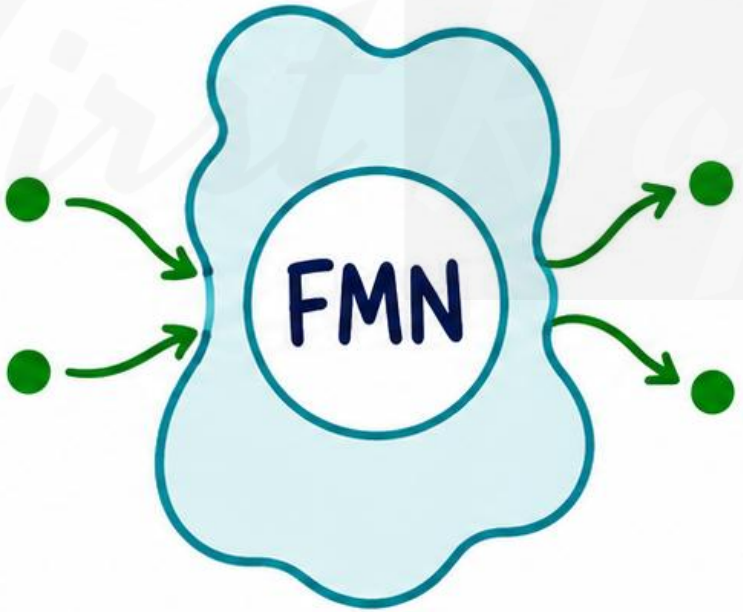
FAD & FMN ELECTRON CARRIERS

FAD and FMN are flavin coenzymes derived from riboflavin, vitamin B_2.

$$FAD + 2e^- + 2H^+ \rightleftharpoons FADH_2$$



in Complex II



in Complex I

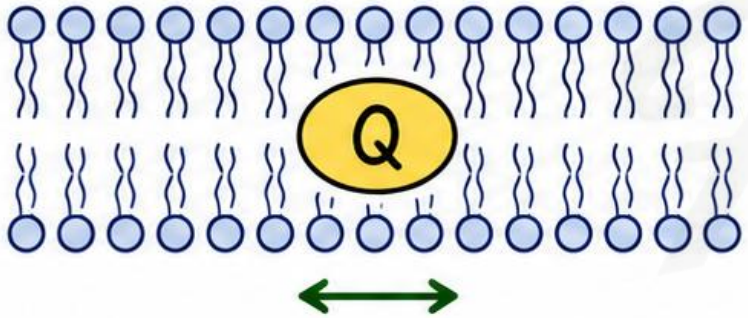
- Flavins are often tightly bound to enzymes.
- FAD accepts electrons during succinate oxidation in Complex II.
- FMN accepts electrons from NADH in Complex I.

Reduced flavins can transfer electrons one at a time.

CoQ, CYTOCHROMES & Fe-S PROTEINS

Electron carriers connect redox reactions in the respiratory chain.

CoQ / ubiquinol



Lipid-soluble; carries electrons within the inner membrane from Complexes I and II toward III.

Cytochromes



Heme iron switches between Fe^{2+} and Fe^{3+}; cytochrome c carries one electron from III to IV.

Fe-S proteins



Iron-sulfur centres transfer single electrons within Complexes I, II and III.

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