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Empowering Communities...*

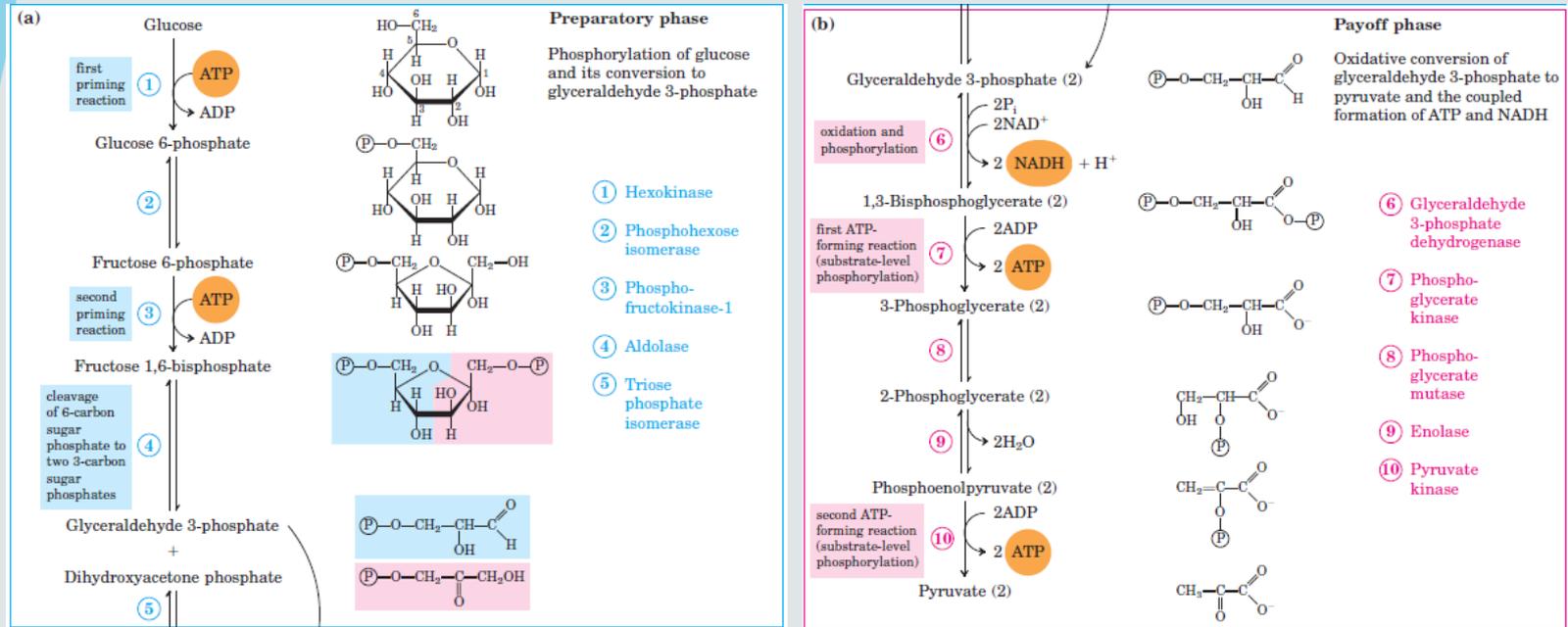
TOPIC-8: METABOLISM OF CARBOHYDRATES



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GLYCOLYSIS



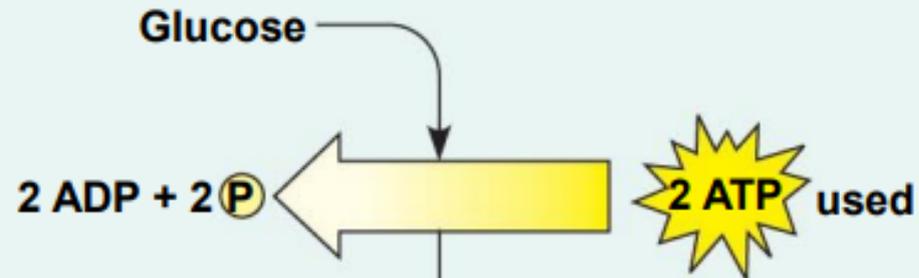


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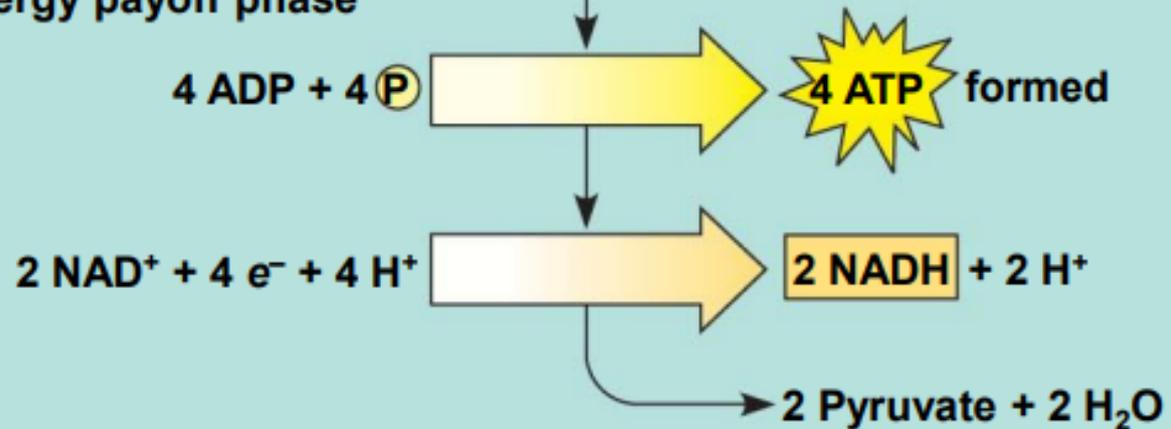
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GLYCOLYSIS

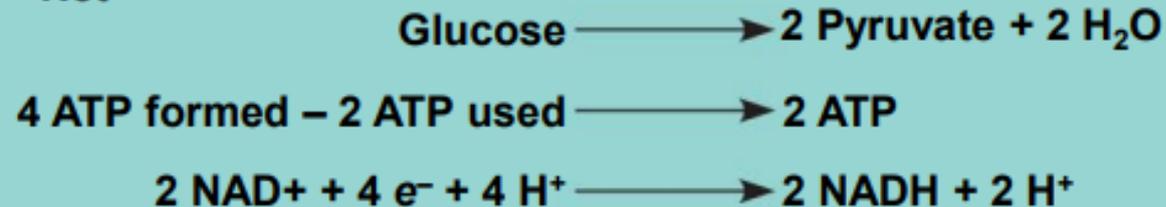
Energy investment phase



Energy payoff phase



Net



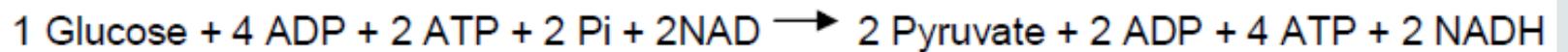


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GLYCOLYSIS

Overall Reaction Sequence



Balanced Reaction





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PENTOSE PHOSPHATE PATHWAY

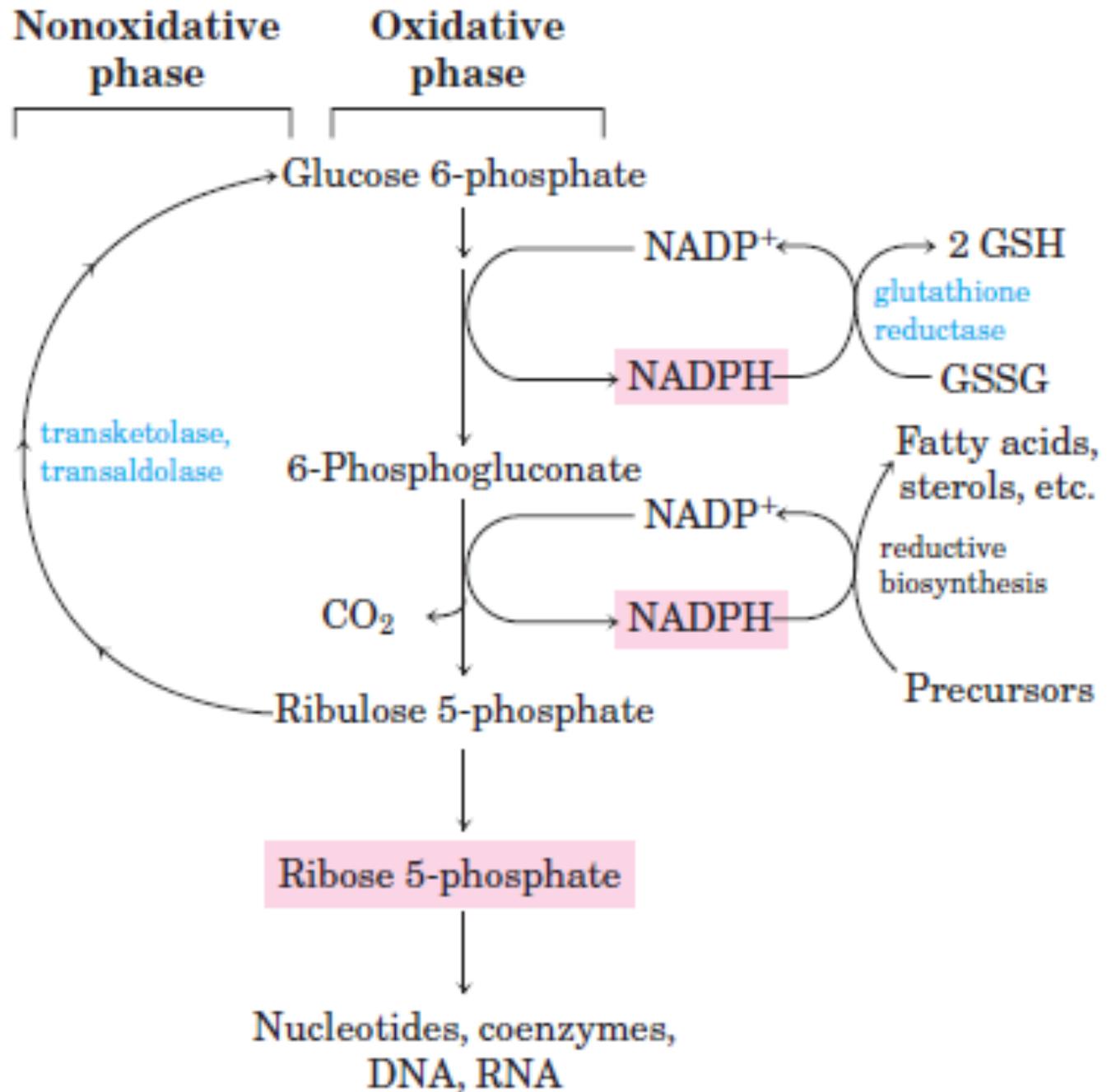
- ❖ The first phase of the **pentose phosphate pathway** consists of two oxidations that convert glucose 6-phosphate to ribulose 5-phosphate and reduce NADP^+ to NADPH. The second phase comprises non-oxidative steps that convert pentose phosphates to glucose 6-phosphate, which begins the cycle again.
- ❖ Entry of glucose-6-phosphate either into glycolysis or into the pentose phosphate pathway is largely determined by the relative concentrations of NADP and NADPH.



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PENTOSE PHOSPHATE PATHWAY





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SIGNIFICANCE OF PENTOSE PHOSPHATE PATHWAY

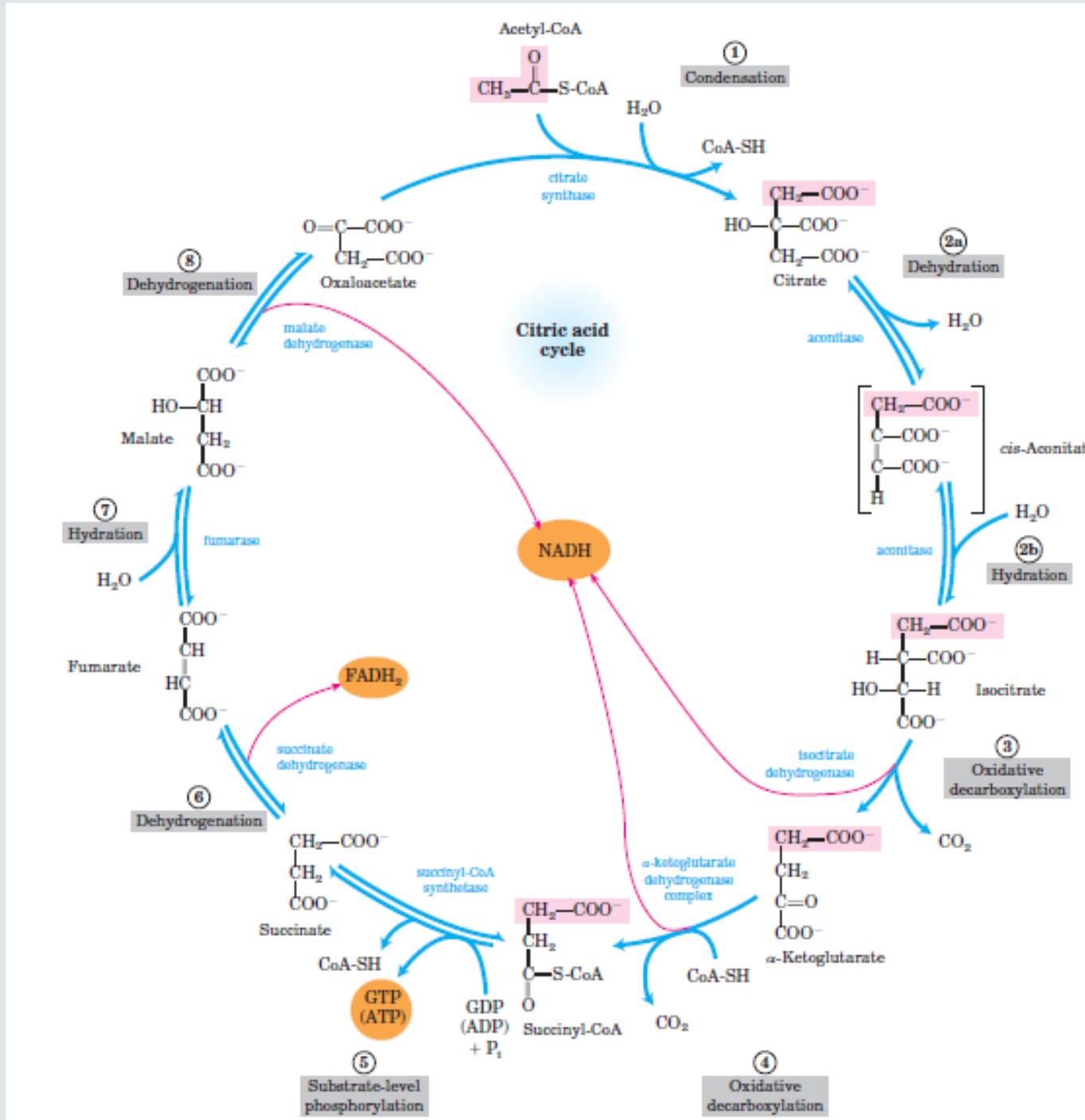
- The Product of two oxidative steps is NADPH, and this NADPH is thought to drive reductive steps associated with various biosynthetic reactions that occur in the cytosol such as **lipid biosynthesis** and **nitrogen assimilation**.
- Some of the reducing power generated by this pathway may **contribute to cellular energy metabolism**; that is, electrons from NADPH may end up reducing O₂ and generating ATP.
- The pathway produces ribose 5 phosphate, a precursor of the ribose and deoxyribose needed in the **synthesis of RNA and DNA** respectively.
- Another intermediate in this pathway, the four carbon erythrose – 4 – phosphate, combines with PEP in the initial reaction that **produces plant phenolic compounds** including the aromatic amino acids and the precursors of lignin, flavonoids and phytoalexins.
- During the early stages of greening, before leaf tissues become fully photoautotrophic, the oxidative pentose phosphate pathway is thought to be involved in generating **Calvin Cycle intermediates**.



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CITRIC ACID CYCLE





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CITRIC ACID CYCLE

The citric acid cycle is **amphibolic** in nature.

The citric acid cycle (Krebs cycle, TCA cycle) is a nearly **universal central catabolic pathway** in which compounds derived from the breakdown of carbohydrates, fats, and proteins are oxidized to CO_2 , with most of the energy of oxidation temporarily held in the electron carriers FADH_2 and NADH . During aerobic metabolism, these electrons are transferred to O_2 and the energy of electron flow is trapped as ATP.



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SIGNIFICANCE OF CITRIC ACID CYCLE

In the four oxidation steps four pairs of H^+ ions and four pairs of electrons are removed from the intermediates of the cycle. Three of these pairs of H^+ ions and electrons are utilized in the reduction of pyridine nucleotides (NAD). The one remaining pair of H^+ ions and electrons is taken up in the reduction of the FAD prosthetic group of succinic dehydrogenase.

The NADH and FADH produced by the reactions of the Krebs cycle represent reducing power that can be harnessed in the presence of oxygen to produce ATP. The production of ATP is accomplished by a series of oxidation-reduction reactions involving chemicals that comprise the electron transport system (ETS). The ETS is intimately associated with the mitochondrial membranes and the Krebs cycle apparatus.



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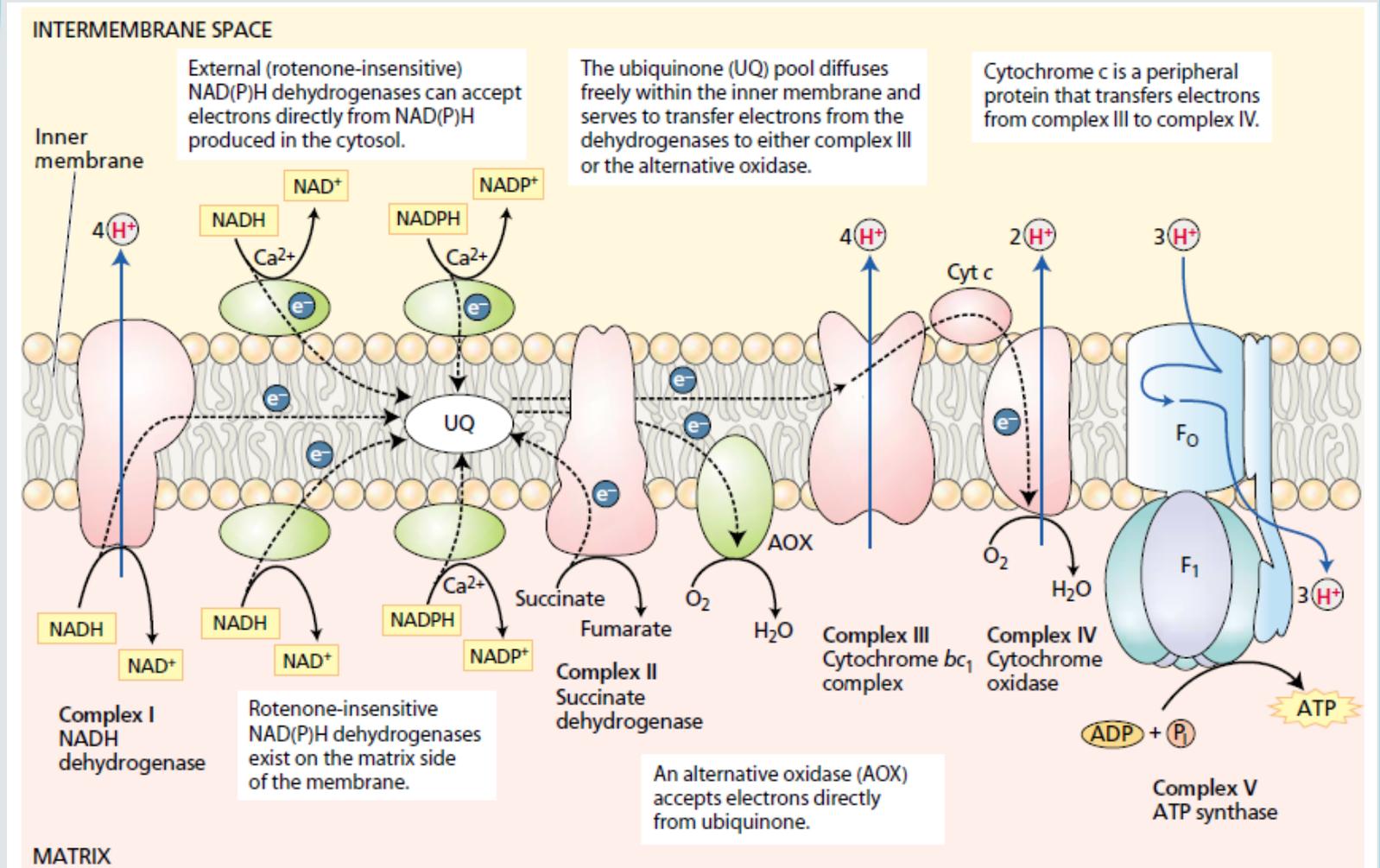
- ❖ **Substrate level phosphorylation** involves the enzyme catalyzed transfer of inorganic phosphate from a molecule to ADP to form ATP.
- ❖ The synthesis of ATP via ETS with oxygen as terminal electron acceptor, is known as **oxidative phosphorylation** and it takes place in mitochondria.



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ELECTRON TRANSPORT CHAIN





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ATP SYNTHASE/COMPLEX V

F₁ is a peripheral membrane protein complex that is composed of at least 5 different subunits and contains the catalytic site for converting ADP and Pi to ATP. This complex is attached to the matrix side of the inner membrane. F_o is an integral membrane protein complex through which protons cross inner membrane. The passage of protons through the channel is coupled to the catalytic cycle of F₁ component of ATP synthase, allowing ongoing synthesis of ATP. For each ATP synthesized, 3 H⁺ pass through the F_o from intermembrane space to the matrix down the electrochemical proton gradient.