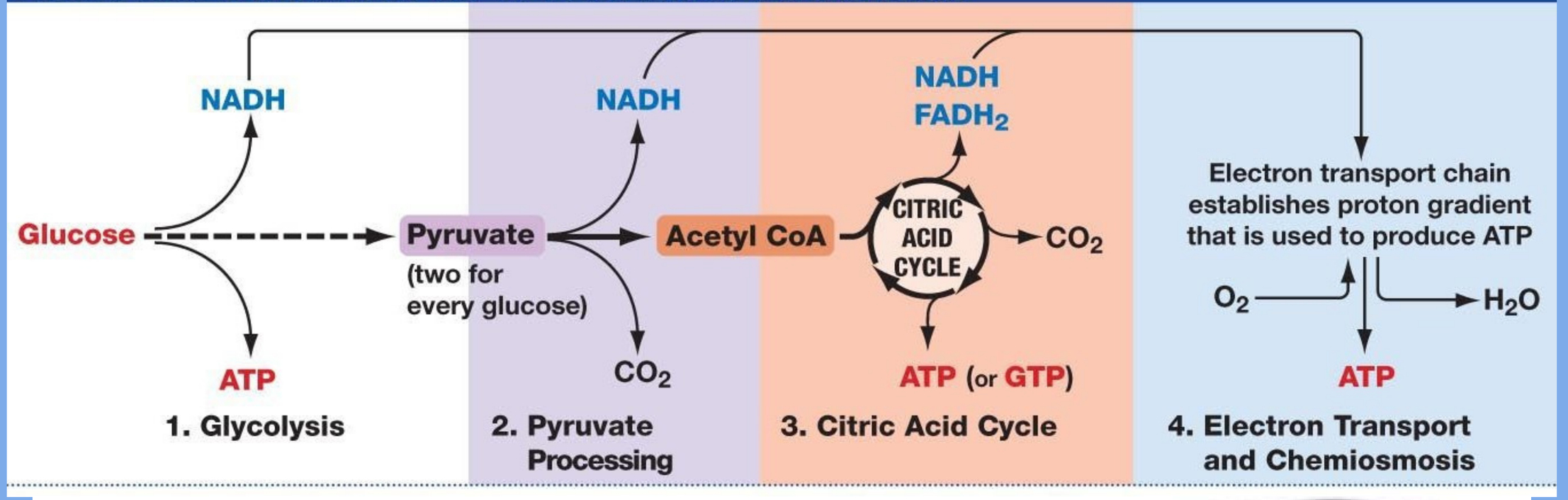
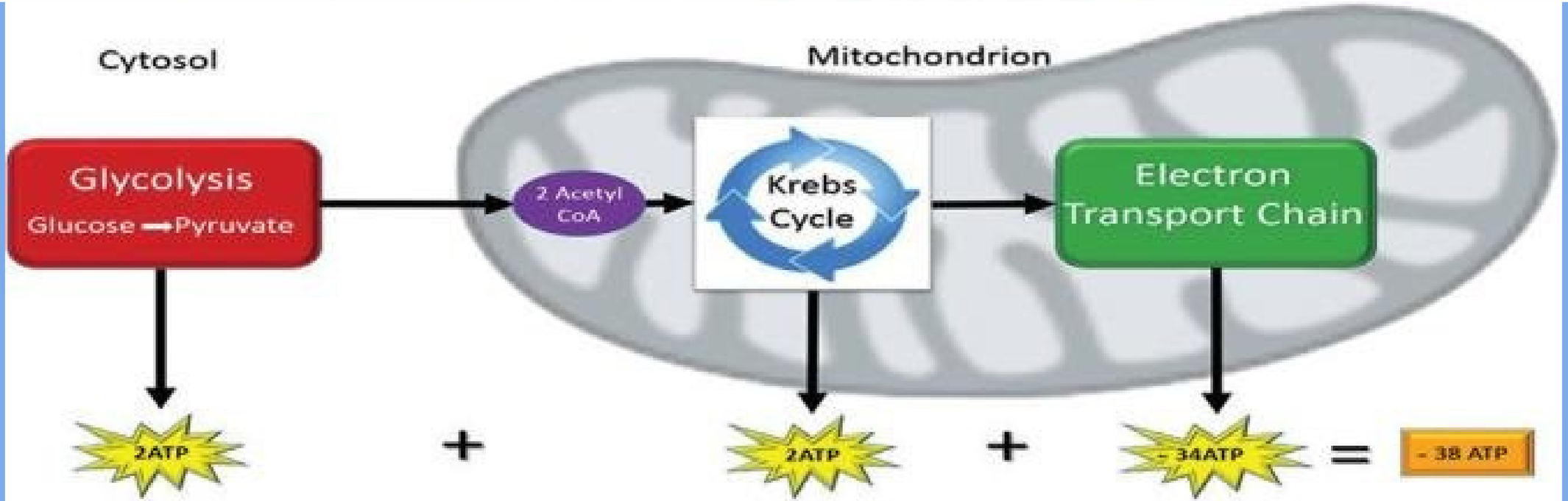
SILAPATHAR COLLEGE

Electron transport chain

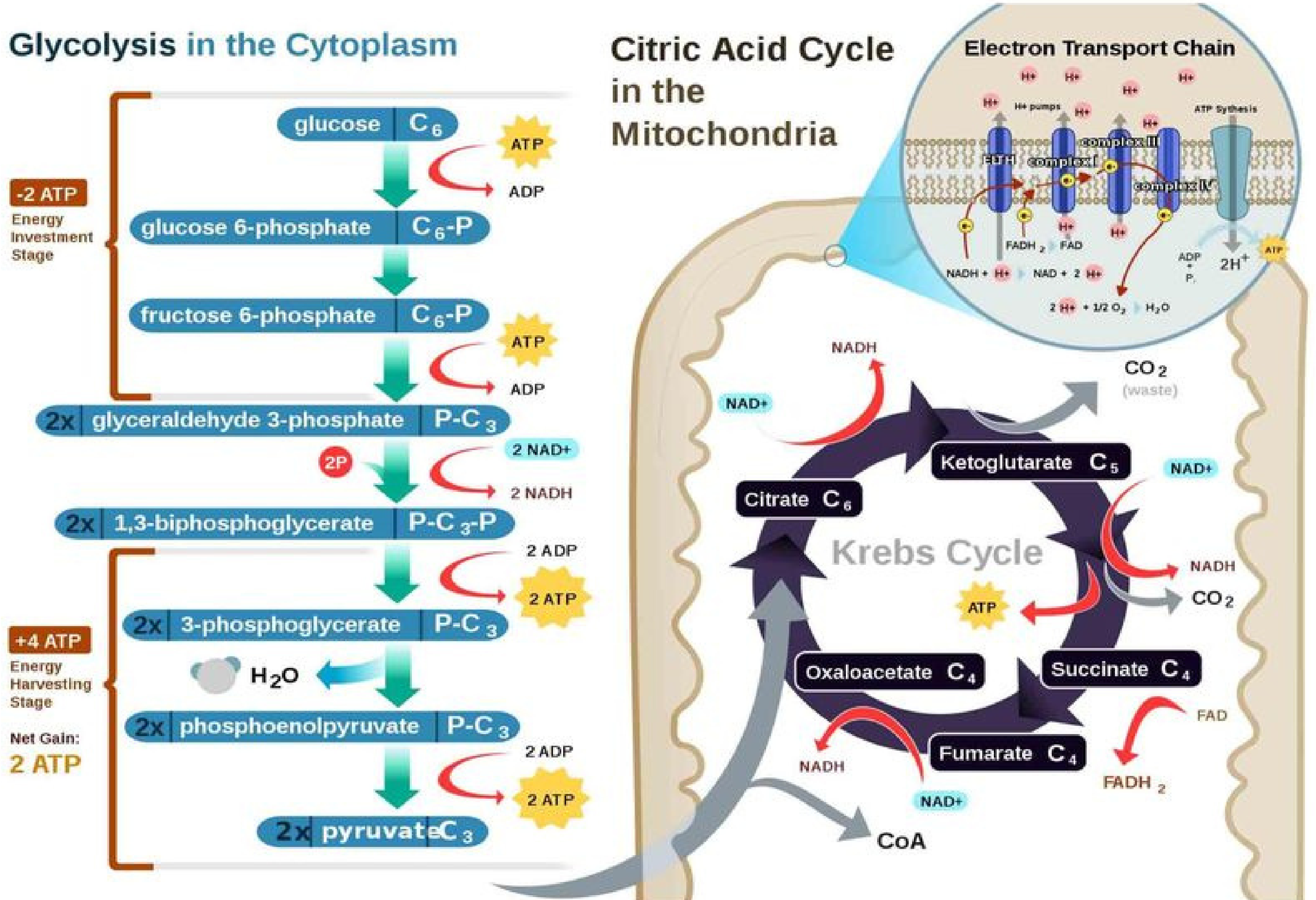
With Manash P.Dutta

PROCESS: OVERVIEW OF CELLULAR RESPIRATION

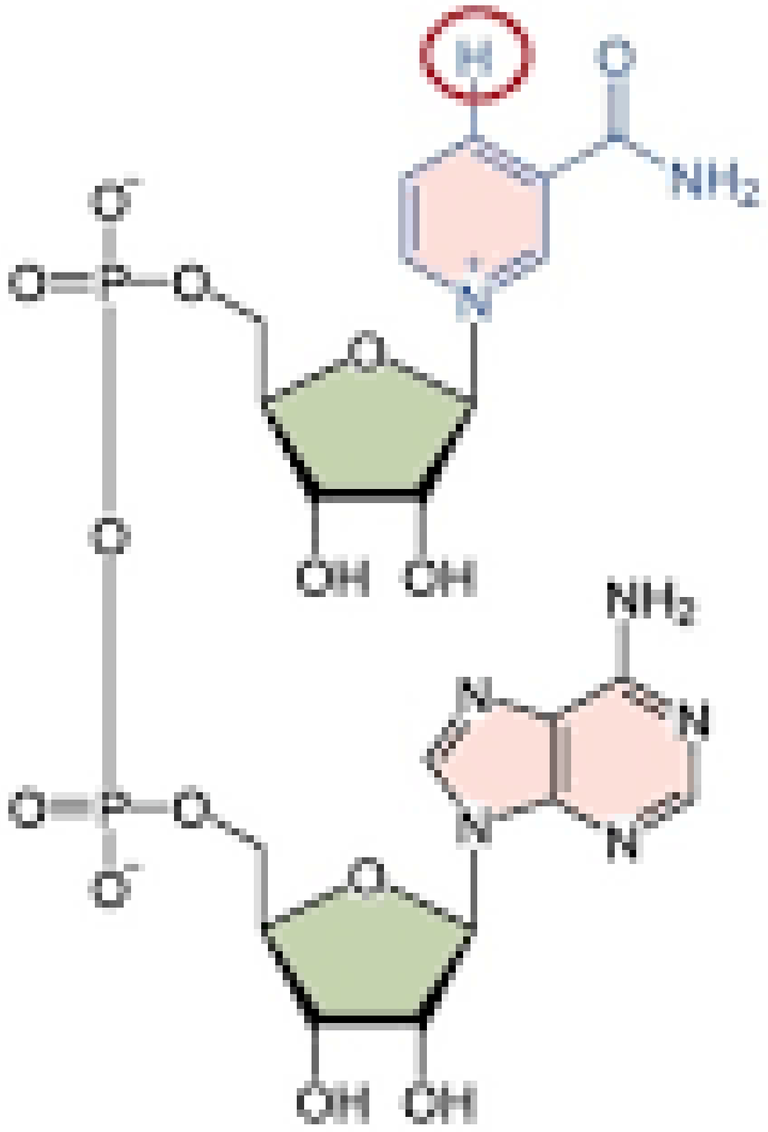
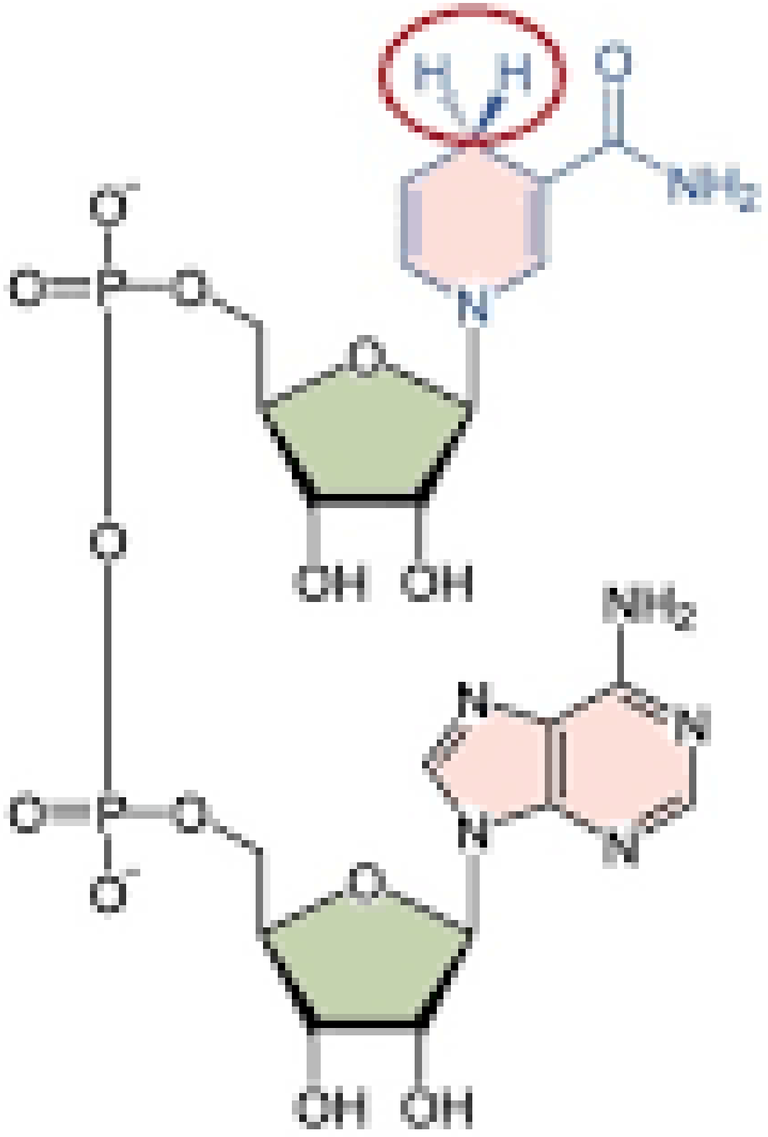


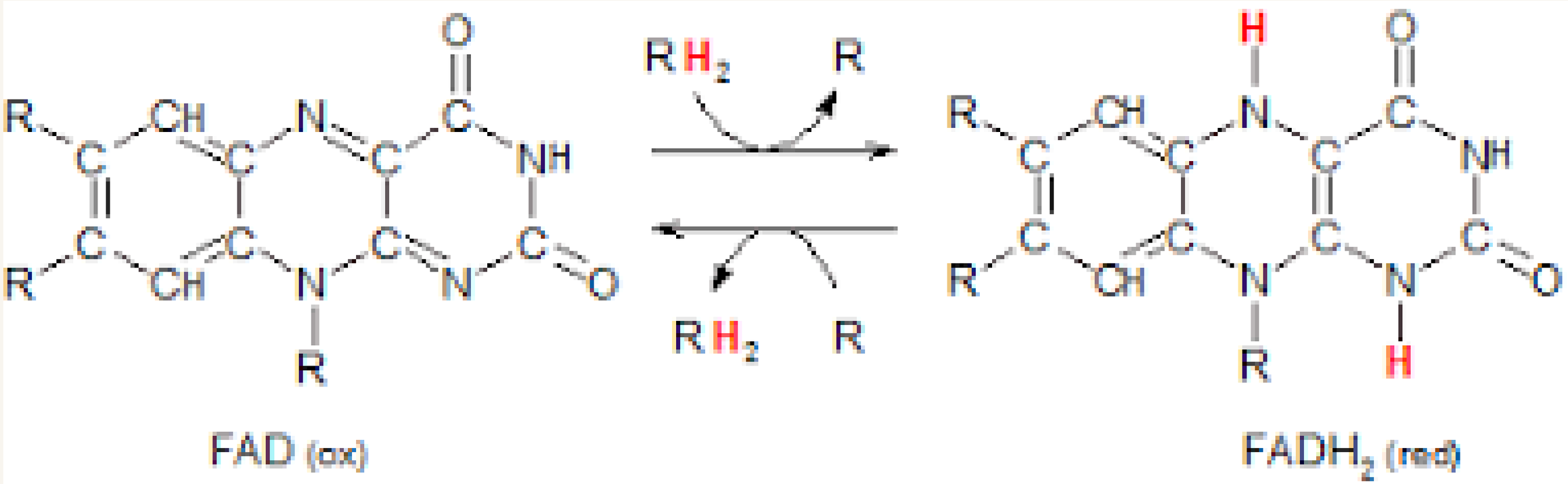


Aerobic Cellular Respiration



- All the enzyme-catalyzed steps in the oxidative degradation of carbohydrates, fats and amino acids in aerobic cells converge into electron transport and oxidative phosphorylation, the final stage of cellular respiration.
- This stage consists of the flow of electrons from organic substrates to oxygen with the simultaneous release of energy for the generation of ATP molecules.
- The energy rich carbohydrate, fatty acids, amino acids undergo a series of metabolic reactions and finally get oxidized to CO2 and H2 The reduced products of various metabolic intermediates are transferred to coenzymes NAD+ and FAD to produce, respectively, NADH and FADH2 which pass through the electron transport chain (ETC) or respiratory chain and, finally, reduce oxygen to water.
- The passage of electrons through the ETC is associated with the loss of free energy.
- A part of this free energy is utilized to generate ATP from ADP and Pi
- The mitochondria are the centers for metabolic oxidative reactions to generate reduced coenzymes (NADH and FADH2) which, in turn, are utilized in ETC to liberate energy in the form of ATP.
- For this reason, the mitochondrion is appropriately regarded as the powerhouse of the of the cell.

NAD^+	NADH
	

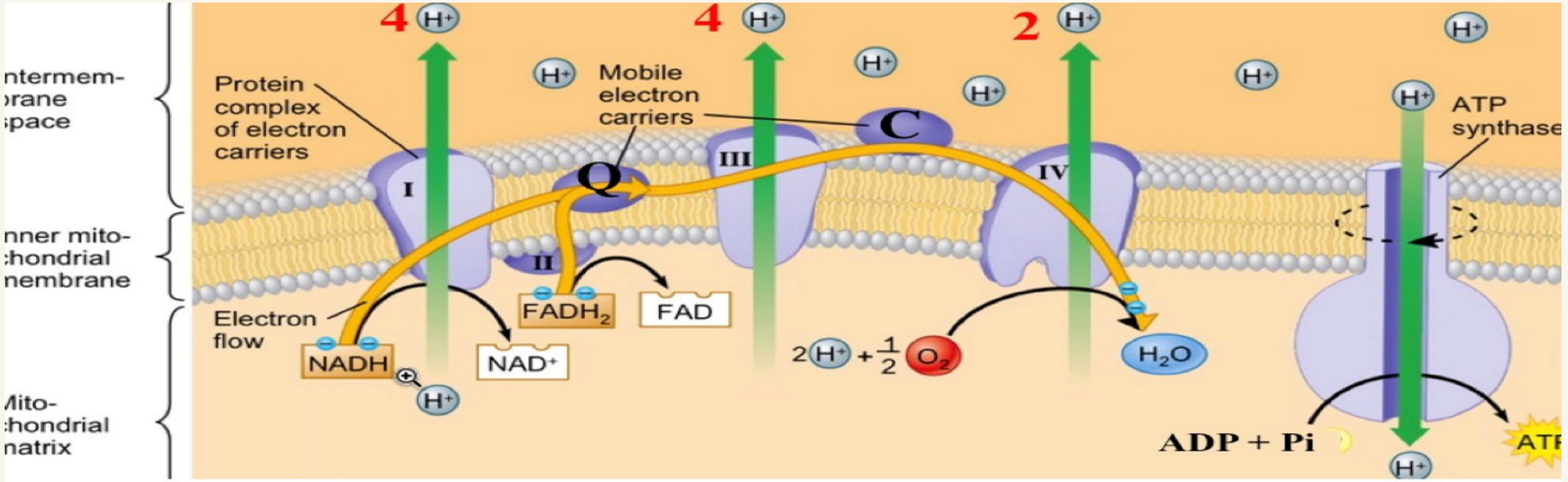

RH2
R
RH2
R
FAD (ox)
FADH2 (red)

Structural Organization of Respiratory Chain:

- The inner mitochondrial membrane has five distinct respiratory or enzyme complexes, denoted as complex I, II, III, IV & V. The complexes I-IV are carriers of electrons while complex V is responsible for ATP synthesis.

- Besides these enzyme complexes, there are certain mobile electron carriers in the respiratory chain that includes NADH, coenzyme Q, cytochrome C, and oxygen.

- The enzyme complexes (I-IV) and the mobile carriers are collectively involved in the transport of



1. **Redox of NADH+H+ at Complex I, electrons go to Complex I, four protons pumped from matrix to intermembrane space**

2. **Redox of $FADH_2$ at Complex II, Coenzyme Q picks up electrons (from Complex I and II) and transports to Complex III**

3. **Redox of Complex III, four protons pumped from matrix to intermembrane space, carrier C transports electrons to Complex IV**

4. **Redox of Complex IV, two protons pumped from matrix to intermembrane space, formation of H_20 (20% of water in body)**

5. **ATP Synthase action, pumps protons from intermembrane space to matrix, produces ATP from ADP + Pi + energy**

Complexes of ETC

There are 4 complexes involved in ETC which are as follows;

1. Complex I also known as the NADH-coenzyme Q reductase or NADH dehydrogenase.
2. Complex II also known as succinate-coenzyme Q reductase or succinate dehydrogenase.
3. Complex III also known as coenzyme Q reductase.
4. Complex IV also known as cytochrome c reductase.
5. Complex V also known as ATP synthase.

Add a subheading