# Respiratory chain and oxidative phosphorylation

## Respiration

During respiration, nutrients are oxidized, and this creates energy, which is necessary for the course of other biochemical reactions. Humans take in oxygen from atmospheric air and give off carbon dioxide. These respiratory gases are carried through the blood by iron in red blood cells. External respiration is carried out by the transfer of oxygen to the cells and thus enables the second type of respiration, internal respiration, which takes place inside the cells, where food components are broken down by reactions requiring oxygen, and this is followed by the **release of ATP** ( energy in the form of a macroergic compound – adenosine triphosphate).

### Key organelle – mitochondria

In contrast to the citrate cycle, which takes place in the mitochondrial matrix, the respiratory chain takes place in the **inner mitochondrial membrane**.

## Breathing Chain

We define it as a sequence of chemical reactions that end the energy breakdown of '*monosaccharides, amino acids, fatty acids and glycerol*. Compounds, so-called coenzymes, play a significant role in the respiratory chain. Compounds, so-called coenzymes, play a significant role in the respiratory chain. Významnou roli v dýchacím řetězci hrají sloučeniny, tzv. koenzymy. In the respiratory chain, there is a significant participation of compounds, so-called coenzymes. V dýchacím řetězci se významně podílejí sloučeniny, tzv. koenzymy.

These coenzymes are oxidized during the entire process and their conversion to oxidized forms occurs:

- Protons from reduced coenzymes are transferred to the intermembrane space (hydrogen cation pumping).
- Electrons from reduced coenzymes are transferred through the assembly of acceptors in the respiratory chain to elemental oxygen to form water:

- $4H^+$ (from matrix) + $4e^-$ + $O^2$ → 2 $H_2O$ + energy

### Respiratory chain as a process

The respiratory chain consists of **4 enzyme complexes and the enzyme ATP synthase'**. During the transfer of electrons, energy is generated, which is used by each complex to pump protons from the matrix into the intermembrane space. During the transition of protons back into the matrix, energy is generated that drives the synthesis of ATP from ADP and $P_i$. Protons spin the stem of the ATP-synthase head, and thus ATP synthesis occurs.

### Reaction of enzyme complexes

- *Complex I*: **NADH-CoQ-oxidoreductase**: NADH + $H^+$ + CoQ → $NAD^+$ + $CoQH_2$
- *Complex II*: **Succinate-CoQ-oxidoreductase**: $FADH_2$ + CoQ → FAD + $CoQH_2$
- *Complex III*: **$CoQH_2$-cytochrome-c-oxidoreductase'**: $CoQH_2$ + cyt c ($Fe^{3+}$) → CoQ + cyt c ($Fe^{2+}$) + $2H^+$
- *Complex IV*: **Cytochrome c-oxidase**: 4cyt c ($Fe^{2+}$) + $0_2$ +4$H^+$ → 4cyt c ($Fe^{3+}$) + $2H_2O$

### Related Articles

- Respiratory chain
- Adenosine triphosphate

### External links

- Respiratory chain

### Used literatury


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- Citrate cycle and respiratory chain (http://www.e-chembook.eu/cz/biochemie/krebsuv-cyklus-a-dychaci-retezec )
- Respiratory chain