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Opinion

Mini Review on Energy Transformation in Cells

János Hunyadi*
Clinical Center Department of Dermatology, University of Debrecen, Hungary

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***Corresponding authors:** János Hunyadi, Clinical Center Department of Dermatology, University of Debrecen, 4032 Debrecen, Nagyerdei krt 98, Hungary

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Opinion

Cell energy is the premise of life. Glucose and ATP are the most essential molecules serving energy for the cells.

ATP synthase

It is well known that glucose is converted to Pyruvate in the metabolic pathway of glycolysis and finally oxidized to CO_2 [1]. The free energy released in this process forms the ATP from ADP+PO_3^{3-} (Pi). ATP-synthase (Complex V) catalyse these processes. Nakamoto et al. [1] described that the binding change mechanism of ATP synthase is responsible for ATP synthesis. The enzyme changes shape and forces ADP and Pi together [1-4].

The development of eukaryotic cells

There was no O_2 in Earth's atmosphere more than three billion years ago. At that time, the possibility of the formation of life was already ensured. One of the earliest cells to produce oxygen was the cyanobacteria (blue-green algae), which evolved oxygen via photosynthesis. The appearance of O_2 in the atmosphere caused the first environmental disaster, as the ancient fermenting microorganisms did not have sufficient defence capacity against the highly destructive O_2. According to Lynn Margilus' hypothesis, an ancient cell entered into symbiosis with a cell that could defend itself against the dangerous effects of O_2. In addition, the modern cell produced an order of magnitude more energy by the High-Molecular Weight Cytochrome (HMWC) with the help of O_2. The contemporary organelle is now known as a mitochondrion [5].

The dual energy supply of eukaryotic cells

Eukaryotic cells have two genetic stocks, as mitochondria contain their own. Accordingly, our cells must have two structures to ensure energy and energy-carrier transformation. SET-AG (belonging to the ancestral cell) and SET-OP (belonging to the mitochondria). The operational activity of these structures can be determined by the amount of ATP produced. In an anoxic or hypoxic environment, the HMWC part of the mitochondria stops working. At the same time, the defence against free radicals ceases, and there is no hydrolysis of Hypoxia Inducible Factor (HIF-1) α, which will result in tissue regeneration.

Structures for energy and energy-carrier transformation, ADP, ATP production, Glucose – ATP transformation

A hypothetical structure responsible for ATP production was published recently [6-9]. Based on this hypothesis, it is proposed that glucose, NH_3, Uric Acid (UA), and $H_2PO_4^-$ will result in the formation of ATP. In addition, ribose, the part of the adenosine, CO_2, Pyruvate, and acetic acid, will be created from D-glucose molecules during the process. At the same time, protons (H^+) realize the membrane potential. Energy and energy-carrier transformations run in unique permanent structures such as Structure for Energy Transformation (SET). SETs produce ADP, Pi, and support energy for the ADP-ATP transformation. Four UA, four NH_3, 35 $H_2PO_4^-$ and eight D-glucose molecules are the-source molecules of the transformation processes realizing four ATP. SET-AG is supposed to be in the peroxisomes, while SET-OP is in the mitochondria [6].

Conclusion

Cells do not use the energy from oxidation reactions as soon as it is released. Instead, they convert it into energy-rich molecules such as ATP, which can be used throughout the cell to power metabolism and construct new cellular components. In addition, enzymes use this chemical energy to catalyse and accelerate chemical reactions within the cell that would otherwise proceed very slowly. Cells need energy to accomplish the tasks of life. Eukaryotic cells make energy-rich molecules like ATP via energy pathways, including photosynthesis, glycolysis, the citric acid cycle, and oxidative phosphorylation. Any excess energy is stored in more extensive, energy-rich molecules such as polysaccharides (starch and glycogen) and lipids.

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