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RESEARCH ARTICLE

THE MEMBRANE - REDOX POTENTIALS THREE - STATE LINE SYSTEM DEPENDENT - FULL 9 STEPPED CYCLE OF PROTON CONDUCTANCE AND THE MECHANISM OF ENTRY OF PROTONS INTO ERYTHROCYTE MEMBRANE SURROUNDINGS

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ABSTRACT

The mechanism of entry of protons into erythrocyte membrane surroundings in the 8-th stage of the 9 staged closed cycle of proton conductance is needed the more detailed explanation, because cell membranes are generally impermeable to charged ions (i.e. H^+ , HCO_3^-). But should be say that during many years evolution development of organism had been formed the more appropriate way to regulate this difficulty by using the mechanism, named as exchange bicarbonate for chloride using the anion exchanger protein Band 3. During these processes have been conducted the following biological events, which may be named as "the reappearance of free protons" and may be described this pathway as "at first :the release of protons from food molecules, at second :the formation of proton gradients-ATP synthesis, heat energy formation, at third :the protonation of oxygen with formation of metabolic water within mitochondrial matrix, at fourth: the exit of ATP, carbon dioxide and metabolic water from mitochondria, at fifth :the formation of carbonic acid from metabolic water and carbon dioxide and formation of free protons and bicarbonate from carbonic acid in cytosols of all cells, plasma, at sixth: entry of bicarbonate to erythrocyte membrane surroundings ,bearing protons formed from food molecules in electron transport complexes according to principle as reutilizing of carbon dioxide to mechanism of entry of protons within the 9 staged closed cycle of proton conductance (M.Ambaga, A.Tumen-Ulzii, 2016). The basic parameters of 8-th stage of the 9 staged closed cycle of proton conductance are metabolic water, carbon dioxide, free protons and bicarbonate. Meanwhile, metabolic water and carbon dioxide have been generated in the mitochondrial matrix and the formation of free protons (reappearance of free protons) and bicarbonate (protonated oxygen) have been conducted in cytosols of all cells, plasma and erythrocyte membrane surroundings. In conducting of process of entry of protons into erythrocyte membrane surroundings within 8-th stage of the 9 staged closed cycle of proton conductance more important role is played the Protein-Band 3. Protein- Band 3 is present in the basolateral face of the various cells, including the red cells, they generate hydrogen ions and bicarbonate ions from carbon dioxide and water - a reaction catalysed by carbonic anhydrase. This is crucial for CO_2 uptake by erythrocyte membrane surroundings and conversion (by hydration catalysed by carbonic anhydrase) into a proton and a bicarbonate ion. Also, in conducting of process of entry of protons into erythrocyte membrane surroundings within 8-th stage of the 9 staged closed cycle of proton conductance more important role is played the Chloride shift (also known as the Hamburger shift or lineas phenomenon, named after Hartog Jakob Hamburger) during which occurs the exchange of bicarbonate (bearing protons, generated in mitochondrial matrix) and chloride (Cl^-) across the membrane of red blood cells. In such way, more interesting processes have been occurred in 8-th stage of proton conductance, which conditioned the following expiration of carbon dioxide and also release of oxygen from hemoglobin molecules and delivery of oxygens to all cells in the result of entry of protons into erythrocyte membrane surroundings owing to existing of 8-th stage of the 9 staged closed cycle of proton conductance.

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INTRODUCTION

About 80% of the CO_2 formed in the second stage of the 9 staged closed cycle of proton conductance is transported from cells to lungs as bicarbonate ions in the plasma and in the water phases of red cells. The catalysed protonation of CO_2 to bicarbonate by metabolic waters takes place inside erythrocyte membrane surroundings, but most of the bicarbonate thus formed must be exchanged with extracellular chloride to make

full use of the carbon dioxide transporting capacity of the blood. Chloride shift (also known as the Hamburger shift or lineas phenomenon, named after Hartog Jakob Hamburger) is a process, during which occurs the exchange of bicarbonate (HCO_3^-) and chloride (Cl^-) across the erythrocyte membrane surroundings. Continuous process of carbonic acid dissociation and outflow of bicarbonate ions would eventually lead to a change of intracellular electric potential because of lasting H^+ ions. Carbon dioxide (CO_2) is generated in the second stage of

the 9 staged closed cycle of proton conductance, it dissolves in blood plasma and inside erythrocyte membrane surroundings, where carbonic anhydrase catalyzes its protonation to carbonic acid (H_2CO_3) with participation of metabolic water, bearing free protons formed inside mitochondria matrix. Carbonic acid then spontaneously dissociates to form bicarbonate ions (HCO_3^-) and a hydrogen ion-protons (H^+). According to Haldane effect (release of CO_2 from hemoglobin during oxygenation) have been occurred the release of hydrogen ions-protons from hemoglobin and the increase of free H^+ concentration within erythrocyte membrane surroundings shifts the equilibrium towards CO_2 and water formation from bicarbonate. The subsequent decrease in intracellular bicarbonate concentration reverses chloride-bicarbonate exchange: bicarbonate moves into the cell in exchange for chloride moving out. Inward movement of bicarbonate via the Band 3 exchanger allows carbonic anhydrase to convert it to CO_2 for expiration. Continuous process of carbonic acid dissociation and outflow of bicarbonate ions would eventually lead to a change of intracellular electric potential because of lasting H^+ ions. Inflow of chloride ions maintains electrical neutrality of a cell.

RESULTS AND DISCUSSION

The basic process, which occurred within 8-th stage of 9 staged cycle of proton conductance have been needed a more detailed studies because cell membranes are generally impermeable to charged ions (i.e. H^+ , HCO_3^-). Also this stage is existed between A and B parts of closed cycle of proton conductance, serving the role of bridges between processes, which have been conducted in the mitochondrial matrix and inside erythrocyte membrane surroundings with participation of metabolic water, carbon dioxide, free protons and bicarbonate.

It should be say that during evolution development of organism had been formed the more appropriate way to ensure the entry of protons into erythrocyte membrane surroundings by using the mechanism, named as exchange bicarbonate for chloride using the anion exchanger protein B and 3. During these processes have been conducted the following biological events, which may be named as "the reappearance of free protons" and may be described this pathway as "at first: the release of protons from food molecules, at second: the formation of proton gradients-ATP synthesis, heat energy formation, at third: the protonation of oxygen with formation of metabolic water within mitochondrial matrix, at fourth: the exit of ATP, carbon dioxide and metabolic water from mitochondria, at fifth: the formation of carbonic acid from metabolic water and carbon dioxide and formation of free protons and bicarbonate from carbonic acid in cytosols of all cells, plasma, at sixth: entry of bicarbonate to erythrocyte membrane surroundings, bearing protons formed from food molecules in electron transport complexes according to principle as reutilizing of carbon dioxide to mechanism of entry of protons within the 9 staged closed cycle of proton conductance (Ambaga and Tumen-Ulzii, 2016). The formation of metabolic water and carbon dioxide have been occurred in the mitochondrial matrix and the formation of free protons (reappearance of free protons) and bicarbonate (protonated oxygen) have been occurred in cytosols of all cells, plasma and erythrocyte membrane surroundings. In conducting of process of entry of protons into erythrocyte surroundings in the 8-th stage of the 9 staged closed cycle of proton conductance more important role is played the Protein - Band 3. Protein - Band 3 is present in the basolateral face of the various cells, including the red cells, they generate hydrogen ions and bicarbonate ions from carbon dioxide and water – a reaction catalysed by carbonic anhydrase. This is crucial for CO_2 uptake by erythrocyte membrane surroundings and conversion (by hydration catalysed by carbonic anhydrase) into a proton and a



bicarbonate ion. Also, in conducting of process of entry of protons into erythrocyte membrane surroundings within 8-th stage of the 9 staged closed cycle of proton conductance more important role is played the Chloride shift (also known as the Hamburger shift or lineas phenomenon, named after Hartog Jakob Hamburger) during which occurs the exchange of bicarbonate (bearing protons, generated in mitochondrial matrix) and chloride (Cl^-) across the membrane of red blood cells. In conducting of this process more important role is played process of entry of bicarbonate bearing protons and carbon dioxide formed within mitochondrial matrix into erythrocyte membrane surroundings by mechanism as chloride shift- Humburger shift with participation of protein Band 3. These processes can be decribed as ...generate hydrogen ions protons and bicarbonate ions from carbon dioxide and water a reaction catalysed by carbonic anhydrase. This is crucial for CO_2 uptake by the erythrocyte membrane surroundings and conversion (by protonation catalysed by carbonic anhydrase) into a proton and a bicarbonate ion in the 8-th stage of the 9 staged closed cycle of proton conductance. It can be say that within 8-th stage have been occurred the very important processes, comprising a metabolic products as metabolic water and carbon dioxide formed in the mitochondrial matrix and also free protons and bicarbonate formed in cytosols, also in the plasma, also in the erythrocyte membrane surroundings. At last, protons contained in the composition of bicarbonate transferred to hemoglobin molecules forming Hb-H and conditioned the release of oxygen, meanwhile carbon dioxide contained in the composition of bicarbonate have been subjected to expiration. The biological places, where conducted above mentioned processes are cytosols of all cells, plasma and erythrocyte membrane surroundings. In the result of processes, which have been occurred in 4-6 stages of the 9 staged closed cycle of proton conductance protons released from food molecules converted to metabolic water by protonation of oxygen, electrons released from food molecules transferred to oxygen by conditioning their conversion to activated forms. In such way, more interesting processes have been occurred in 8-th stage of proton conductance, which conditioned the following expiration of carbon dioxide and also release of oxygen from hemoglobin molecules and delivery of oxygens to all cells in the result of entry of protons into erythrocyte membrane surroundings owing to existing of 8-th stage of the 9 staged closed cycle of proton conductance.

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