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Electrogenic metals in epidermis and the synchronous operation of membrane ATPases

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The homeostasis of electrogenic metals (K, Na, and Ca) in epidermal cells can be studied using a derivative of epidermis (hair). This approach was used in the present study to confirm the close relationship between electrogenic metals (EM) and cell bioenergetics and find evidence for possible attributability of EM homeostasis to the phenomena of self-organized criticality (SC). The above assumption is based on the following well-known facts: Generation and maintenance of electrochemical potential of the cell at the expense of permanent and multi-directional EM traffic across the plasma membrane; Participation of sodium ions (Na⁺) in cellular energy exchanges as a convertible 'energy currency', complementary to adenosine triphosphate (ATP); Failure of the hypothesis of normal distribution of quantitative spectrometry data of metals contained in epidermis derivatives (hair). Using mathematical statistics, we have analyzed the results of atomic emission spectrometry of hair samples for Na, K, and Ca content, which were obtained at the Center for Biotic Medicine (Moscow) from 10297 healthy subjects (5160 males and 5137 females) aged 2 to 85. Our previous studies have found that the results of quantitative spectrometry of EM in epidermal cells (hair) from healthy individuals and the liquidators of the chernobyl accident (chronic oxidative/nitrosative stress) are conjugated. The nature of this conjugation, like many intimate mechanisms of the metal-ligand homeostasis in the epidermis, remains unsolved. The results led to the following conclusions: Normal functioning of membrane Na⁺/K⁺-ATPases suggests synchronous (critical) nature of transmembrane traffic for EM. The synchronous operation of membrane ATPases is confirmed by the positive K-Na relation (Pearson) and signs of self-organized criticality (SC) according to the data of mathematical analysis and the obtained results point to the probable attributability of EM homeostasis in epidermis to SC-phenomena.

Biography

V I Petukhov currently works in the field of psychology in the Vladimir State University, Russia.

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