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The dysfunction of cGMP-dependent Na/Ca exchange as a gate for age-related dysfunction of cellular activity

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The metabolic controlling cell hydration is a fundamental cellular parameter determining the functional activity of plasmatic membrane and intracellular macromolecules. The dysfunction of cGMP-dependent Na/Ca exchange in excitable cells has been suggested to underlie the ground of age-related cells dehydration, which leads to reducing of cell functional activity. To check this hypothesis the age-dependency of cell hydration, ouabain receptors affinity, Na/Ca exchange and +Na/+K pump activities, cAMP and cGMP intracellular contents as well as their chemo- and magneto-sensitivity of rats' brain and heart tissues were studied. The age-dependent depression of 3H-ouabain binding with high affinity receptors, the depression of Na/Ca exchange in forward mode and it's activation in reverse mode, Na/K pump dysfunction, decrease of NO- and SMF-induced elevation of intracellular cGMP content, tissue dehydration, and decrease of chemo- and magneto-sensitivity of all the mentioned cell functional parameters were observed. The reciprocal relation in development between cGMP-dependent Na/Ca exchange in forward and cAMP-dependent Na/Ca exchange in reversal mode was shown: in young animals the Na/Ca exchange functioning in forward while in old animals-in reveres mode. Taking together the data obtained in the present work with earlier data obtained on snail isolated neurons and heart muscle, allows us to consider the aging-induced decrease of cell hydration, leading to age–related dysfunctions of different catabolic and anabolic metabolic pathways in cells as the consequence of the cGMP-dependent Na/Ca exchange dysfunction.

Biography

Sinerik Ayrapetyan has completed his Ph.D and postdoctoral studies from Ukraine Academy of Sciences. He is the president of Life Sciences International Postgraduate Educational Center and head of UNESCO Chair in Life Sciences. He is the author of 7 books and 185 papers in refereed journals, and is serving as a member of Editorial Board of ISRN Biophysics, the Board of Associate Editors for the "Electromagnetic Biology and Medicine" Journal, Associate Editor for Biomedical Research of "Journal of International Dental and Medical Research". Research area: the metabolic regulation of excitable cell membrane function.

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