EuroSciCon

17th Edition of International Conference and Exhibition on

Pharmaceutics and Novel Drug Delivery Systems

October 04-06, 2018
Moscow, Russia

Int J Drug Dev & Res 2018, Volume 10
DOI: 10.21767/0975-9344-C1-003

The dysfunction of intracellular signaling system controlling cell hydration as a primary mechanism for cell pathology

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Cell hydration determines its functional activity via "folding-unfolding" mechanism of intracellular macro-molecules and cell surface-dependent changes of protein molecules' activity, having enzymes, receptors and ionic channels forming properties. Therefore, the metabolically controlled cell hydration is of vital importance for living cells. The facts that intracellular osmotic pressure exceeds the extracellular one and that the membrane permeability for water is much higher than for ions, the osmotically driven water influx is balanced by metabolically generated water efflux from the cell. Our data have shown that net water influx and efflux through membrane activate and inactivate inward going ionic current in membrane. Therefore, this makes the ability of metabolic compensation of osmotically driven water influx as a marker for estimation of beneficial and harmful effects of any physical and chemical factors on cells and organisms. Among the number of metabolic mechanisms involved in regulation of cell hydration, Na^+/K^+-pump has a central role, which is due to both generations of Na+ gradients on membrane, serving as energy sources for a number of secondary ionic transporters in membrane, and water efflux from the cells. Our recent study has shown that the dysfunction of Na^+/K^+-ATPase a3 isoform-dependent signaling system controlling cell hydration is the common primary mechanism for cell pathology. In may talk the suggestion on the use of a_3 isoform-dependent signaling system controlling cell hydration as a novel therapeutic target for treatment of different diseases will be discussed.

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