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PLASMALEMMA OF PLANT CELLS IS SENSITIVE TO CLINOROTATION

Abstract

The plasmalemma is considered as one of the most dynamic supramolecular structures in a cell, which is the intermediate link between the cytoplasm and extracellular environment and involved in numerous basic cell processes. Currently the presence of functional microdomains, which became known as "lipid rafts", in the plasmalemma (Pl) of plant cells has been shown. It is supposed that rafts enriched on cholesterol and sphingolipids modulate the protein interrelation and in this way they include in many vitally important cell processes. We proposed the hypothesis of gravitational decompensation, according to which changes in the surface tension of the membrane under microgravity conditions can play the role of an inducer, the influence of which is enhanced by the heterogeneity of the membrane along its length. Sequence of events: change in the physicochemical properties of the membrane change in permeability, ion transport activity of membrane-bound enzymes, etc. reorganization of metabolism physiological responses. To test this hypothesis we studied the composition of fatty acids and sterols in Pl isolated from roots of Pisum sativum seedlings grown during 3 and 6 days under slow horizontal clinorotation and lipid rafts isolated from Pl. We showed that lipid rafts from the root Pl of pea seedlings grown in the stationary conditions and under clinorotation have the appearance of thin tapes of 80–100 nm in length and 6 –13 nm in width and also were enriched on cholesterol and saturated fatty acids. The changes in the percentage of individual saturated and unsaturated fatty acids in Pl occurred under clinorotation but the unsaturation index was similar to that in control for maintenance of the membrane normal fluidity. The percentage of cholesterol increased 7 times in lipid rafts indicates an increase in rigidity of the lipid domains in the Pl that was confirmed using a fluorescent marker of cholesterol philipine and a fluorescent dye of the lipid bilayer phase state laurdan. Since the rafts contain protein complexes necessary for the perception and transduction of external signals, and vesicular transport, a significant increase in cholesterol under clinorotation may cause the changes in membrane permeability and functions of respective proteins, that will affect cell vital activity in microgravity. This can indicate the efficiency of further studies of lipid rafts under real and simulated microgravity to better understanding the gravisensitivity/gravity dependence of both the structure and functions of the membrane and the cell metabolism as a whole.