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Lateral diffusion of saturated phosphatidylcholines in cholesterol- containing bilayers

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Abstract

A pulsed field gradient NMR was used to study lateral diffusion in the cholesterol-containing oriented bilayers of saturated (dipalmitoyl- and dimyristoyl-) phosphatidylcholines, upon their limiting hydration. Similar dependences of lateral diffusion coefficients on temperature and cholesterol concentration were observed, which agree with phase diagram showing the presence of the regions of disordered and ordered liquid-crystalline phases and a two-phase region. Under the same conditions, the lateral diffusion coefficient of dipalmitoylphosphatidylcholine is lower, which agrees qualitatively with its larger molecular weight. The comparison of data for dipalmitoylphosphatidylcholine with previous results for dipalmitoylsphingomyelin-cholesterol bilayers under the same conditions, in spite of similarity of phase diagrams, shows large (two-three times) differences in the lateral diffusion coefficient and a different profile of its dependence on cholesterol concentration. The comparison of data for dimyristoylphosphatidylcholine with previous results shows that the values of lateral diffusion coefficient and the shape of its dependence on cholesterol concentration coincide at high concentrations (>15 mol%) but differ at lower concentrations The revealed disagreement may be caused by the fact that the measurements were carried out at different water content in the system. At limiting hydration (more than 35% of water), the lateral diffusion coefficient for lipids decreases when cholesterol concentration rises, while at water content about 25% (as a result of equilibrium hydration from vapors) the lateral diffusion coefficient of phosphatidylcholine may be independent of cholesterol concentration. This is the consequence of the denser packing of molecules in the bilayer at reduced water content, an effect that competes with the ordering effect of cholesterol. © 2007 Pleiades Publishing, Inc.

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Keywords

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