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## Lipid chain saturation and the cholesterol in the phospholipid membrane affect the spectroscopic properties of lipophilic dye Nile Red

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### Abstract

We have studied the effect of composition and the phase state of phospholipid membranes on the emission spectrum, anisotropy and lifetime of a lipophilic fluorescence probe Nile Red. Fluorescence spectrum of Nile Red in membranes containing cholesterol has also been investigated in order to get insights into the influence of cholesterol on the phospholipid membranes. Maximum emission wavelength ( $\lambda_{em}$ ) of Nile Red in the fluid phase of saturated and unsaturated phospholipids was found to differ by  $\sim 10$  nm. The  $\lambda_{em}$  was also found to be independent of chain length and charge of the membrane. However, the  $\lambda_{em}$  is strongly dependent on the temperature in the gel phase. The  $\lambda_{em}$  and rotational diffusion rate decrease, whereas the anisotropy and lifetime increase markedly with increasing cholesterol concentration for saturated phospholipids, such as, dimyristoyl phosphatidylcholine (DMPC) in the liquid ordered phase. However, these spectroscopic properties do not alter significantly in case of unsaturated phospholipids, such as, dioleoyl phosphatidylcholine (DOPC) in liquid disordered phase. Interestingly, red edge excitation shift (REES) in the presence of lipid-cholesterol membranes is the direct consequence of change in rotational diffusion

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