FCS diffusion laws on two-phases lipid membranes : experimental and Monte-Carlo simulations determination of domain mean size.

Cyril Favard, Jerôme Wenger, Pierre-François Lenne*, Hervé Rigneault
Institut Fresnel, CNRS, Aix-Marseille Université, Ecole Centrale Marseille, Campus de St Jérôme, 13013 Marseille.
** Present Adress : Institut de Biologie du Développement de Marseille Luminy, CNRS UMR 6216, 13288 Marseille Cedex 9.*

Many efforts have been undertaken over the last decades to characterize the diffusion process in model and cellular lipid membranes. Amongst all the techniques developed for this purpose (Single Particle Tracking, Fluorescence Recovery After Photobleaching), fluorescence correlation spectroscopy (FCS) has proven to be a very efficient approach, especially if the analysis is extended to measurements on different spatial scales, that is referred to as FCS diffusion laws[1,2]. We will discuss the relevance of FCS diffusion laws to probe the behaviour of a pure lipid and a lipid mixture at temperatures below and above the phase transitions, both experimentally and numerically. The accuracy of the microscopic description of the lipid mixtures found here extends previous work to a more complex model where the geometry is unknown and the molecular motion are only driven by the thermodynamic parameters of the system itself. For both pure lipid and lipid mixtures multilamellar vesicles, the FCS diffusion laws recorded at different temperatures exhibit large deviations from a pure Brownian motion and reveal the existence of nanodomains. The variation of these domains mean sizes with temperature is in perfect correlation with the enthalpy fluctuation. This study highlights the advantages of FCS diffusion laws on complex lipid systems to describe their spatial structure[3].

Keywords: FCS; FCS Diffusion Laws; Monte-Carlo Numerical Simulations; Phase Separation; Domain Size Determination

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