

Alkaline Phosphatase Interactions with ordered membrane domains

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GPI-anchored proteins preferentially localize in the most ordered regions of the cell plasma membrane. Acyl and alkyl chain composition of GPI-anchors determine the association with the ordered domains. This suggests that changes in the fluid and in the ordered domains lipid composition affect the interaction of GPI-anchored proteins with membrane microdomains. Atomic force microscopy (AFM) shows that the spontaneous insertion of the GPI-anchored intestinal alkaline phosphatase (BIAP) into the gel phase domains of dioleoylphosphatidylcholine / dipalmitoylphosphatidylcholine (DOPC/DPPC) and DOPC/sphingomyelin (DOPC/SM) also occurred in palmitoyloleoylphosphatidylcholine /SM (POPC/SM) gel-fluid phase separated membranes. However changes in the lipid composition of membranes had a marked effect on the bilayer topography: BIAP insertion was associated with a net transfer of phospholipids from the fluid to the gel (DOPC/DPPC) or from the gel to the fluid (POPC/SM) phases. For DOPC/SM bilayers, transfer of lipids was dependent on the homogeneity of the gel SM phase. In POPC/SM binary mixtures with the coexistence of fluid, gel and liquid ordered phases induced by cholesterol (POPC:SM:Chl, 1:1:0,35), BIAP preferentially localized in the more ordered phase, at room temperature. However, this distribution of BIAP between fluid and ordered phases was a function of temperature. How the AFM imaging of BIAP in model systems could contribute to the understanding of the behaviour of GPI-anchored proteins in biological membranes and what are the limitations of AFM in such studies will be discussed.