J. Chil. Chem. Soc., 61, Nº 3 (2016).

Temperature dependence of bilayer properties in liposomes and the use of fluorescent probes as a tool to elucidate the permeation mechanism of hydrophilic solutes.

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Abstract

Solute transport across lipidic membranes is a fundamental process for both living organisms and drug delivery. In order to establish the mechanism of solute passive transport through lipidic membranes, we determined the effect of temperature upon the rate of glucose transport (as hydrophilic solute model) through dipalmitoylphosphatidylcholine large unilamellar liposomes and compare the results to those obtained for a variety of fluorescent probes (pyrene, PRODAN, diphenylhexatriene, diphenylhexatriene-TMA). All these probes, independent of their localization in the liposomes, report a monotonous change in the micro-properties sensed with temperature, with **a maximum rate of change at** the main transition temperature of the bilayer. These results contrast with those obtained for the rate of glucose influx, were it is observed a clear maximum rate of intake **at** the transition temperature. These contrasting results imply that the microviscosity (common factor for used probes) is not the property of the bilayer that controls the rate off solute transport which, at least in the vicinity of the main transition temperature, is regulated by formation of transient pores, particularly at the transition temperature (T_m). This would indicate that, at least near T_m, glucose and other hydrophilic solutes diffuses through transient pores formed in the bilayer. Interestingly, the presence of these pores does not affect the fluorescence characteristics of the probes.