Structure and Interaction of PAMAM Dendrimers and Model Lipid Membranes

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Abstract

Liposomes and recently dendrimers represent two major class of components widely employed for the development of efficient drug delivery systems. While liposomes are traditionally long recognized as excellent research models of biomembranes[1], dendrimer based carrier systems revealed a versatile tool in a wide range of biochemical applications due to their biocompatibility and their highly controllable features[2]. Encapsulation of chemical species in dendrimers interior or conjugation into their surface groups allow the development of new prototypes that can function as targeting, detecting or imaging agents, while drug delivery applications revealed dendrimers efficiency for the transfer of genetic material into cells. The development of controlled release systems based on liposomes/dendrimer complexes seems promising[3], as it is possible to increase the therapeutic index of the incorporated drug or reduce its cytotoxicity[4]. The study of the structure and interaction of Polyamidoamine (PAMAM) dendrimers during their entrapment and partitioning within model lipid membranes indicated that electrostatic interaction is the crucial parameter that influence the membrane stability in water solution, while incorporation of the PAMAM dendrimers in bilayers produces a progressive instability which depend on dendrimers concentration and surface charge. More specifically scattering experiments indicate that guest dendrimers are segregated in different compartments of the same lipid nanocarrier, while the modeling of the interdendrimer interaction provides substantial insight into the fundamental mechanisms of dendrimer-lipids interaction in solution. The finding of the obtained results outline how the control of specific system parameters can be exploited to preserve the releasing efficiency at the target site.

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