Synchrotron Light for Characterizing Curved Membrane Systems Mimicking Fusion Processes

M. Rappolt[1], P. Laggner[1], B. Sartori[1], H. Amenitsch[1], M. Almgren[2], and A. Yaghmur[1]

[1]Institute of Biophysics and Nanosystems Research, Graz, Austria.

[2]Department of Physical Chemistry, Uppsala University, Uppsala, Sweden

Lamellar to non-lamellar membrane transitions play an important role in cell life, e.g. in membrane fusion and fat digestion. However, due to the high complexity of biological processes a great share of research studies is dedicated to understanding the formation and stability of lipid model membrane systems, which are mimicking biomembranes in a simple manner. Using especially time-resolved synchrotron X-ray scattering techniques fundamental questions and formation pathways of theses nanostructures can be elucidated.

After a brief introduction into fusion models an overview on all lipid mesophases that are believed to take part in membrane fusion processes is given[1]. This includes to present prominent examples on the bicontinuous cubic phases, the columnar H_2 phase as well as on the rhombohedral R3m phase, which is known to "host" a stalk-like fusion intermediate. Secondly, we present two recently carried out time-resolved experiments. In the first example[2], in-situ investigations of fast structural transitions of diluted DOPG/MO vesicles into well-ordered lipidic domains at low salt concentrations are explained. The strong binding of divalent cations to the negatively charged DOPG molecules causes a rapid collapsing of the vesicles and the reorganization of the lipid molecules to form within few milliseconds the H_2 phase. The study supports the argument that the transition mechanism is based on a *leaky* fusion of the vesicles. In the second example[3], we focus on the direct transition from vesicles to cubosomes by heating an aqueous dispersion of monoelaidin (ME). The obtained results from synchrotron SAXS and Cryo-TEM suggest that the polymeric stabilizer F127 plays a significant role in membrane fusion processes. It gets incorporated in considerable amount into the lipidic nanostructure and leads to the formation of a highly swollen primitive bicontinuous cubic phase.

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