

Different mechanisms of membrane destabilization studied by optical microscopy of giant vesicles: antimicrobial peptides, detergents and lipid phase transition

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Biological membranes serve as a selective barrier between the cell interior and exterior. The basic structure of the biological membrane is provided by the lipids that spontaneously form bilayers in aqueous solutions. The integrity of lipid bilayers is crucial to sustain life. There are different ways of destabilizing lipid bilayers, with subsequent opening of holes/pores. Here we use optical microscopy to observe giant lipid vesicles (~10³nm size) and to study different mechanisms of pore opening. Antimicrobial peptides are a natural defense of various animals against different microorganisms such as bacteria. The main mechanism of action of these peptides is a non-specific interaction with the lipid phase of the bacterial membrane, which eventually causes opening of pores and bacterial death. Detergents, such as SDS and Triton, are widely used to extract membrane proteins, because they solubilize the lipid bilayer and provide an interface between the hydrophobic part of membrane proteins and water. We use micropipettes to inject solutions of antimicrobial peptides and detergents in the vicinities of giant vesicles and observe vesicle morphology and dynamics under an optical microscope. Alternatively, small transient pores open at the gel-fluid transition of pure lipid vesicles. In a specific anionic lipid (DMPG), large stable pores open along the wide phase transition region of this lipid.