Salt concentration effects on the viscoelasticity of supported bilayers

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Repulsion betwen charged or zwitterionic headgroups of phospholipids is a significant determinant of the physicochemical properties of lipid bilayer membranes. It is expected that this largely electrostatic interaction is influenced by the ionic strength of the aqueous environment, and thus the salt concentration should have an effect on fundamental continuum properties of the membrane such as viscosity, stiffness and phase transition temperature. However, literature evidence is ambiguous on the question. While the effect of high salt concentrations (1-5 M) is well described, the data seem to suggest that there is no appreciable salt concentration effect in the physiologically relevant < 1M range. However, the measurements always employed very high, several mg/ml lipid concentrations. Here we report successful measurements of the phase transition temperature of supported single/few bilayer membranes of three different composition (DMPC, DMPC:cholesterol 9:1, DMPC:DMPG 4:1) based on their viscoelasticity. Comparing phase transitions of supported membranes in the presence of 100mM and 20 mM NaCl concentrations in a phosphate buffer, we identified a weak but measurable salt concentration effect, which leads to a 0.1-0.3 K shift in the phase transition temperature. The difference between the bulk measurements and our results might be explained with the better access of the solute ions to the membrane in a thin supported bilayer system.