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Salt Screening of Lipid Membrane Interactions Measured by Small-Angle X-ray Scattering. Horia I. Petrache, Dept. of Physics, Indiana Univ., Purdue Univ., Indianapolis, IN 46202.

Challenging accepted models of macromolecular interactions, lipid lamellar phases swell when immersed in monovalent salt solutions. Moreover, typical of a Hofmeister series, Br salts swell lipid multilayers more than Cl salts, offering an excellent opportunity to investigate long-standing questions of ionic specificity. We show experimentally that swelling is a superposition of ion-specific electrostatic repulsion, more pronounced for Br than for Cl, and non-specific weakening of the van der Waals (vdW) attraction. Negligible in low salt, weakening of vdW forces becomes significant by the time electrostatic forces vanish, resulting is a smooth monotonic swelling curve with no apparent distinction between low and high salt concentration regimes. We show that salt does not alter membrane structure or bending rigidity, eliminating the possibility that repulsive fluctuation forces change with salt. The combination of ion-specific binding and non-specific ionic screening of low-frequency fluctuations explains salt effects on lipid membrane interactions, and by extension, explains specific (Hofmeister) effects at macromolecular interfaces between low and high dielectric. By weakening vdW attractions, salt increases energy barriers to membrane contact, possibly affecting cellular communication and biological signaling.