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Lipid interactions in the presence of ATP molecules RYAN Z. LYBARGER, BRUCE D. RAY, HORIA I. PETRACHE, IUPUI Department of Physics, Indianapolis, IN — Lipids are molecules found in biological cells containing one hydrophilic and one hydrophobic section. When immersed in water, they form multilamellar membrane structures with a regular lattice spacing (D-spacing) on the order of 5 to 15 nm. The equilibrium spacing of membranes is determined by a balance of forces that include van der Waals and electrostatics and it depends on the composition of the aqueous solution in which membranes are formed. In this work, we have used x-ray scattering and NMR spectroscopy to study how lipid interactions are modified in the presence of adenosine triphosphate (ATP) which is the molecule involved in energy transfer in biological systems. In certain environments, such as low pH, ATP has the potential to be highly charged. We find that ATP can attach to membranes and drastically increase the lattice spacing of multilamellar membrane structures. The most likely mechanism is that ATP enhances the electrostatic repulsion of neighboring membranes and at the same time it reduces their van der Waals attraction by changes in dielectric properties of the aqueous solution. Knowledge of the physical mechanism of ATP interacting with membranes can help better understand biological processes at the lipid-water interface.

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