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Elastic constants of lipid membranes are not constant: Possible medical consequences.

Content

Most efforts concerning the elastic properties of membranes have focused on minimizing the free energy by varying the shape and geometry of a membrane. Here, I will focus on the finding that the elastic constants are not constant but are thermodynamics susceptibilities that can be controlled by variation of the intensive variables, e.g., temperature, pressure, pH, ionic strength or membrane composition, which may lead to changes in the magnitude of the compression modulus and other moduli by more than an order of magnitude. This important fact has found surprisingly little attention.

Elastic "constants" also matter in the hydrodynamic theory of sound propagation in membranes. We have shown in the past that the dependence of the lateral compressibility on temperature and lateral pressure allow for the propagation of electromechanical solitons in cylindrical membranes that closely resemble nerve pulses. The excitation of such solitons strongly depends on the intensive variables and may hold an explanation of so different phenomena as anesthesia, the treatment of certain mental conditions by lithium, or the inhibition of essential tremor by alcohol.

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