

Nematogens on membranes: Aggregation and morphological changes.

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Abstract:

The organelles of a biological cell have membranes with highly curved edges and tubes, as seen in the endoplasmic reticulum, the golgi and the inner membrane of mitochondria. It has been shown that macromolecules, which constitute and decorate the membrane surface, strongly influence the morphology of membranes. The standard Helfrich model for membranes, based on mean curvature energy, cannot explain the stability of such highly curved structures. Existence of anisotropic bending energy, which could arise from an in-plane orientational field on the membrane, will be the minimal requirement to explain the stability of such shapes. Planar orientational order could be intrinsic to the membrane, due to the structural properties of its constituents, or could arise as a result of membrane interactions with external agents.

We use a numerical model of the membrane, with elongated membrane inclusions possessing spontaneous directional curvatures that could be different along, and perpendicular to, the membrane's long axis. We show that, due to membrane-mediated interactions, these curvature inducing membrane-nematogens can aggregate spontaneously, even at low concentrations, and change the local shape of the membrane.