Title:	Superelasticity of Plasma- and Synthetic Membranes Resulting from Coupling of Membrane Asymmetry, Curvature, and Lipid Sorting.
Authors:	Bhatia, Tripta (/jspui/browse?type=author&value=Bhatia%2C+Tripta)
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Abstract:	Biological cells are contained by a fluid lipid bilayer (plasma membrane, PM) that allows for large deformations, often exceeding 50% of the apparent initial PM area. Isolated lipids self-organize into membranes, but are prone to rupture at small (<2–4%) area strains, which limits progress for synthetic reconstitution of cellular features. Here, it is shown that by preserving PM structure and composition during isolation from cells, vesicles with cell-like elasticity can be obtained. It is found that these plasma membrane vesicles store significant area in the form of nanotubes in their lumen. These act as lipid reservoirs and are recruited by mechanical tension applied to the outer vesicle membrane. Both in experiment and theory, it is shown that a “superelastic” response emerges from the interplay of lipid domains and membrane curvature. This finding allows for bottom-up engineering of synthetic biomaterials that appear one magnitude softer and with threefold larger deformability than conventional lipid vesicles. These results open a path toward designing superelastic synthetic cells possessing the inherent mechanics of biological cells.
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