Modeling biomembranes with bending elasticity

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Abstract: This talk will present the modeling of coexistent phases and protein mediated morphology in biomembranes. The theory of fluid surfaces with elastic resistance to bending is applied to coexistent phase equilibria in biomembranes composed of lipid bilayers. We extend the theory of biomembranes with a classical framework for treating phase equilibria using a non-convex energy density. A simplified version of the model is used to simulate necking and budding of closed vesicles. The spontaneous curvature arising in the equilibrium theory for lipid membranes is normally assumed to be a fixed parameter. We assume it to vary with position on the membrane surface in a manner that reflects the influence of attached proteins. The associated mathematical model is used to predict equilibrium shapes of membranes in the vicinity of a nuclear pore and in the process of protein-assisted endocytosis. Some preliminary work on the coupled electromechanical fluid membrane theory will also be discussed.