mediated interactions. The function of membrane protein lattices is influenced by membrane-
suggest direct experimental tests of how the self-assembly and biological
approach with the theory of regular lattices of polygons, we carry out a sys-
ture of membrane proteins may play a role in the biological
specifically, GUVs were synthesized using either porcine brain lipid extracts
Specifically, GUVs were synthesized using either porcine brain lipid extracts
or the more conventional, binary lipid mixtures to systematically test how
Using optical trapping coupled with force-spectroscopy and confocal microscopy, we discovered
an inverse relationship between the curvature sensing activity of the
Protein-induced lipid bilayer deformations, have been advanced as a general mechanism for long-ranged interactions be-
proteins, which result from protein-induced lipid bilayer deformations, have
be sensitive sensors of membrane curvature. One common feature of
BAR domains is a curved shape which correlates with high membrane cur-
vatures often found in cells. We focused on characterizing the FBAR domain of
in vitro, given its medical relevance to neurological diseases, using tubular membranes pulled out of Giant Unilamellar Vesicles (GUVs).
Specifically, GUVs were synthesized using either porcine brain lipid extracts or the more conventional, binary lipid mixtures to systematically test how lipid composition affects curvature sensing activity. Using optical trapping coupled with force-spectroscopy and confocal microscopy, we discovered an inverse relationship between the curvature sensing activity of the FBAR domain and its equilibrium concentration in solution. At high bulk concentrations of protein, we explicitly measured an increase in the tube’s persistence length, which can be understood as mechanical stiffening of the tube. Lastly, we used force spectroscopy to accurately test the effect of the protein on membrane relaxation dynamics in real time.

Symmetry and Stability of Membrane Protein Lattices
Osman Kahraman1, Peter D. Koch2, William S. Klug3, Christoph Haselwandter4, Poul M. Bendix5.
1Department of Physics and Astronomy, University of Southern California, Los Angeles, CA, USA, 2Department of Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Zanjan, Iran, Islamic Republic of, 3Department of Physics, Sharif University of Technology, Tehran, Iran, Islamic Republic of, 4Department of Chemistry, University of Copenhagen, Copenhagen, Denmark, 5Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark, 4University of Copenhagen, Copenhagen, Denmark.

Bin-Amphiphysin-Rvs (BAR) domains are essential components of the cellular machinery responsible for membrane deformation and were found to be sensitive sensors of membrane curvature. One common feature of BAR domains is a curved shape which correlates with high membrane curvatures often found in cells. We focused on characterizing the FBAR domain of Syndapin-1 in vitro, given its medical relevance to neurological diseases, using tubular membranes pulled out of Giant Unilamellar Vesicles (GUVs).

Effect of Protein-Induced Spontaneous Curvature on Membrane Surface Tension
Padmini Rangamani, Kranthi K. Mandadapu, George Oster.
UC Berkeley, Berkeley, CA, USA.
Adorption of proteins onto membranes can alter the local membrane curvature. This phenomenon has been observed in biological processes such as endocytosis, tubulation and vesiculation. In this letter, we show that the classical elastic model of lipid membranes cannot account for simultaneous changes in shape and membrane tension due to protein adsorption in a local region, and a viscous-elastic formulation is necessary to fully describe the system. Using the viscous-elastic model, we show that protein adsorption can not only induce curvature but also alter membrane surface stress. Using the viscous-elastic model, we show that the lipid flows to accommodate the change in membrane curvature. Finally, at the end of protein adsorption process, the system has a residual stress to balance the difference between the actual membrane curvature and the imposed curvature. Surface stress effects are local and change only in the protein patches, however, curvature changes may be non-local and remain significant for large separations between the protein patches.

Oligomerization of H-Ras on Membrane Surfaces
Chemistry, University of California, Berkeley, Berkeley, CA, USA.
Ras, a lipid-anchored small molecule GTPase, is an important signaling node in mammalian cells. Ras signaling is regulated by the dynamic nature of its subcellular localization, lateral partitioning and hierarchies of lipid and protein interactions. These observations have led, on the one hand, to the proposal that the regular arrangement of membrane proteins may play a role in the biological function of cell membranes. On the other hand, the question arises as to what are the physical mechanisms responsible for the self-assembly, symmetry, and stability of membrane protein lattices. Based on experimental observations and physical models, membrane-mediated interactions between proteins, which result from protein-induced lipid bilayer deformations, have been advanced as a general mechanism for long-ranged interactions between membrane proteins. Here we develop a computational framework for the calculation of membrane-mediated interactions in the large and complicated membrane protein lattices observed in experiments. We find that, depending on the specific shape and oligomeric state of the protein under consideration, membrane-mediated interactions can be attractive or repulsive, several kBT in strength, and depend crucially on the spatial and orientational symmetry in membrane protein lattices. Combining our approach with the theory of regular lattices of polygons, we carry out a systematic survey of the connection between the shape of membrane proteins, and the symmetry and stability of membrane protein lattices. Our results suggest direct experimental tests of how the self-assembly and biological function of membrane protein lattices is influenced by membrane-mediated interactions.