Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Morphogenesis of protrusions from confined lipid bilayers mediated by mechanics MARINO ARROYO, Universitat Politecnica de Catalunya-BarcelonaTech, MARGARITA STAYKOVA, Princeton University, MOHAMMAD RAHIMI, Universitat Politecnica de Catalunya-BarcelonaTech, HOWARD A STONE, Princeton University — Biological membranes adopt a wide range of shapes that structure and give functionality to cells, compartmentalizing the cytosol, forming organelles, or regulating their area. The formation, stabilization, and remodeling of these structures is generally attributed to localized forces or to biochemical processes (insertion of proteins, active compositional regulation). Noting that in the crowded intra and extra-cellular environments membranes are highly constrained, we explore to what extent can mechanics explain the shape of protrusions out of confined membranes. For this purpose, we developed an in-vitro system coupling a lipid bilayer to the strain-controlled deformation of an elastic sheet (Staykova et al, PNAS 108, 2011). We show that upon contracting the elastic support, tubular or spherical protrusions grow out of the adhered membrane, which can be reversibly controlled with strain and osmolarity without resorting to localized forces or chemical alterations of the bilayer. The morphologies produced by our minimal system are ubiquitous in cells, suggesting mechanics may be a simple and generic organizing principle. We can understand most of our observations in terms of a phase diagram accounting for elasticity, adhesion, and the limited amount of area and volume available.

Marino Arroyo
Universitat Politecnica de Catalunya-BarcelonaTech

Date submitted: 11 Nov 2011 Electronic form version 1.4