Abstract Submitted
for the MAS20 Meeting of
The American Physical Society

Protein binding to a curved and enclosed membrane with the continuum membrane model.[1] YIBEN FU, Johns Hopkins University, JEANNE STACHOWIAK, University of Texas at Austin, MARGARET JOHNSON, Johns Hopkins University — Localization of proteins to a membrane surface is an essential step in a broad range of biological processes such as clathrin-mediated endocytosis. Some proteins exhibit abilities of the curvature induction and curvature sensing. The sensing of membranes with varying curvature by inserting amphipathic helices has been characterized using both experiments and models based on elasticity theory. Here, we show that the recruitment of each domain to the membrane can influence subsequent binding events, effectively changing the 'stickiness' of the membrane. We consider the ability of both weak protein-protein interactions, and mechanical feedback of the membrane, in driving these changes in membrane stickiness. Here we use a thin-film continuum membrane model to quantify how protein insertions alter the energetics of small unilamellar vesicles of varying sizes. Our model reproduces previous experimental results showing that the energetics of interactions are stronger to smaller vesicles. We are then able to quantify how multiple insertions can produce cooperativity in the energy. Our results provide a mechanism through which recruitment of proteins to membranes can create positive feedback, increasing the probability of subsequent binding events. And this positive feedback is due to membrane mechanics rather than protein-protein interactions. Quantifying these mechanisms is critical for understanding the dynamics and control of proteins that remodel membranes through localization and self-assembly in a range of cellular processes.

[1]NIH MIRA R35GM133644

YIBEN FU
Johns Hopkins University

Date submitted: 02 Nov 2020 Electronic form version 1.4