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Membranes, mechanics, and intracellular transport

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Cellular membranes are remarkable materials – self-assembled, flexible, two-dimensional fluids. Understanding how proteins manipulate membrane curvature is crucial to understanding the transport of cargo in cells, yet the mechanical activities of trafficking proteins remain poorly understood. Using an optical-trap based assay involving dynamic deformation of biomimetic membranes, we have examined the behavior of Sar1, a key component of the COPII family of transport proteins. We find that Sar1 from yeast (*S. cerevisiae*) lowers membrane rigidity by up to 100% as a function of its concentration, thereby lowering the energetic cost of membrane deformation. Human Sar1 proteins can also lower the mechanical rigidity of the membranes to which they bind. However, unlike the yeast proteins, the rigidity is not a monotonically decreasing function of concentration but rather shows increased rigidity and decreased mobility at high concentrations that implies interactions between proteins. In addition to describing this study of membrane mechanics, I'll also discuss some topics relevant to a range of biophysical investigations, such as the insights provided by imaging methods and open questions in the dynamics of multicellular systems.