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Miscibility Critical Points in Plasma Membranes BENJAMIN MACHTA, SARAH VEATCH, STEFANOS PAPANIKOLAOU, JAMES P. SETHNA, Cornell University — Lipid bilayers surround all cells and are home to a host of proteins and lipids that mediate interactions between the cell and its environment. Recent experimental work has shown that simple membranes composed of three lipid components show complex phase behavior at temperatures in the physiological range. For example, two liquid phases and a gel or solid phase are seen, and a second order phase transition with Ising critical behavior can be reached at a boundary of the liquid-liquid coexistence region [1]. Surprisingly, membrane vesicles isolated from living cells can be tuned with a single parameter (temperature) to criticality [1]. This suggests that cell membranes in vivo sit near miscibility critical points, and may help explain some of the paradoxes associated with putative lipid rafts proposed in other experiments. Here we report on work mapping phase diagrams for the simple membranes utilizing NMR and microscopy data. In addition, we use canonical models of phase transitions to understand the qualitative features of the membranes. Finally we explore ideas from information theory and self organized criticality to understand how and why real cells maintain a membrane near criticality. [1] Honerkamp-Smith, Veatch, and Keller, Biochim Biophys Acta. 2008 (in press)

Benjamin Machta
Cornell University

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