

# Membrane criticality and ion channel function

Benjamin B Machta<sup>1,2</sup>

**The plasma membrane surrounding animal cells is a two-dimensional liquid that is home to many of the complex processes that carry out biological function. Recent experiments have demonstrated that this two-dimensional liquid is close to a miscibility critical point, distinguished by emergent time and length scales much larger than individual molecules. I will talk about what this critical point means for the function of membrane bound proteins, and especially ion channels, mediating long-ranged forces, sensitive allosteric regulation and non-Markovian dynamics. I'll also give some qualitative comparisons to phase separation of proteins into coexisting three dimensional fluid phases in the cytoplasm, which has emerged as a common theme in diverse cellular processes. I will also report on our recent experimental progress demonstrating that anesthetics move membranes away from criticality, and that anesthetic reversers also reverse effects on membrane criticality. Our results suggest a picture in which membrane bound proteins are highly sensitive to the near-critical solvent properties of the membrane in which they are embedded**

<sup>1</sup>Department of Physics, Yale University. E-mail: [benjamin.machta@yale.edu](mailto:benjamin.machta@yale.edu)

<sup>2</sup>Systems Biology Institute, Yale University.