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Information processing in the plasma membrane BENJAMIN MACHTA, Lewis Sigler Institute, Princeton University — The plasma membrane is a 2D liquid where information from the world is received and processed. Motivated by the recent discovery that these membranes seem to be tuned close to a 2D liquid-liquid critical point, we set out to understand the different channels through which membrane bound proteins can communicate with each other. Diffusing proteins can carry out reactions when they come in contact with each other. Near criticality, proteins can also exert long-ranged critical Casimir forces on one another by coupling to the local composition order parameter. By modulating the growth and breakdown of the rigid cytoskeleton, they can direct forces on even more distant regions. In addition, proteins can control the release and production of second messengers that diffuse either through the bulk, or in the plane of the membrane itself. By making simple models for these processes we bound functional measures for them as communication channels. These include information theoretic measures of bandwidth, as well as physical measures of energetic efficiency and speed. Our results will likely prove useful in understanding functional reasons underlying the clustering and collective behavior often seen in experiments.

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