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Actin driven membrane waves during lymphocyte activation

Spreading of cells involves large scale physical rearrangements of the actin cytoskeleton and cell membrane. The spreading of T and B-lymphocytes on antibody coated substrates mimics the formation of the immune synapse, a multi-protein signaling machine. As signaling events are initiated within a minute of contact, the rapid increase in contact area and clustering of receptors during early spreading are critical features of the immune response. The dynamics of the membrane and cytoskeleton during contact formation and their effect on signaling is not well understood. We have studied the morphology of the membrane, dynamics of the actin cytoskeleton and simultaneously the spatiotemporal localization of signaling clusters during the very early stages of spreading. Formation of signaling clusters was closely correlated with the movement and topography of the membrane in contact with the activating surface. Further, we observed membrane waves driven by actin polymerization originating at these signaling clusters. Actin-coupled membrane waves likely play an important role in force generation at the immune synapse, which is a topic of current investigation. Membrane deformations induced by such wavelike organization of the cytoskeleton may be a general phenomenon that underlies cell-substrate interactions and cell movements.