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Spatiotemporal regulation of chemical reaction kinetics of cell surface molecules by active remodeling of cortical actin BHASWATI BHATTACHARYYA, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India, ABHISHEK CHAUDHURI, KRIPA GOWRISHANKAR, Raman Research Institute, Bangalore, India, SATYAJIT MAYOR, National Centre for Biological Sciences (TIFR), Bangalore, India, MADAN RAO, Raman Research Institute and National Centre for Biological Sciences (TIFR), Bangalore, India — Cell surface proteins such as lipid tethered GPI-anchored proteins and Ras-proteins are distributed as monomers and nanoclusters on the surface of living cells. Recent work from our laboratory suggests that the spatial distribution and dynamics of formation and breakup of these nanoclusters is controlled by the active remodeling dynamics of the underlying cortical actin. To explain these observations, we propose a novel mechanism of nanoclustering, involving the transient binding to and advection along constitutively occuring "asters" of cortical actin. Here we study the consequences of such active actin based clustering, in the context of chemical reactions involving conformational changes of cell surface proteins. We find that active remodeling of cortical actin, can give rise to a dramatic increase in the reaction efficiency and output levels. In general, such actin driven clustering of membrane proteins could be a cellular mechanism to spatiotemporally regulate and amplify local chemical reaction rates, in the context of signalling and endocytosis.

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