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Coupled diffusion processes and 2D affinities of adhesion molecules at synthetic membrane junctions CHRISTOPHER PEEL, University of Oxford, KAUSHIK CHOUDHURI, University of Michigan Medical School, EVA M. SCHMID, MATTHEW H. BAKALAR, HYOUNG SOOK ANN, DANIEL A. FLETCHER, University of California, Berkeley, CELINE JOURNOT, ANDREW TURBERFIELD, MARK WALLACE, MICHAEL DUSTIN, University of Oxford — A more complete understanding of the physically intrinsic mechanisms underlying protein mobility at cellular interfaces will provide additional insights into processes driving adhesion and organization in signalling junctions such as the immunological synapse. We observed diffusional slowing of structurally diverse binding proteins at synthetic interfaces formed by giant unilamellar vesicles (GUVs) on supported lipid bilayers (SLBs) that shows size dependence not accounted for by existing models. To model the effects of size and intermembrane spacing on interfacial reaction-diffusion processes, we describe a multistate diffusion model incorporating entropic effects of constrained binding. This can be merged with hydrodynamic theories of receptor-ligand diffusion and coupling to thermal membrane roughness. A novel synthetic membrane adhesion assay based on reversible and irreversible DNA-mediated interactions between GUVs and SLBs is used to precisely vary length, affinity, and flexibility, and also provides a platform to examine these effects on the dynamics of processes such as size-based segregation of binding and non-binding species.

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