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Guided Transport of a Transmembrane Nanochannel MEENAKSHI DUTT, OLGA KUKSENOK, ANNA BALAZS, University of Pittsburgh — Via the Dissipative Particle Dynamics approach, we design a system that allows transport of a nanochannel to a desired location by applying an external force. Each nanochannel encompasses an ABA architecture, with a hydrophobic shaft (B) with two hydrophilic ends (A). One of the hydrophilic ends of the nanochannel is functionalized with hydrophilic functional groups, or hairs. The hydrophilic hairs serve a dual role: (1) control transport across the membrane barrier when the channel diffuses freely in the membrane, and (2) enable the channel relocation to a specific membrane site. Our system comprises a transmembrane hairy nanochannel with the hairs extending into solution. In our earlier work, we demonstrated the spontaneous insertion of such a hairy nanochannel into a lipid bilayer (Nanoscale DOI: 10.1039/C0NR00578A). First, we hold a suitably functionalized pipette stationary above the membrane while the nanochannel freely diffuses within the membrane. For an optimal range of parameters, we demonstrate that the hairs find the pipette and spontaneously anchor onto it. We then show that by moving the pipette for a range of velocities, we can effectively transport the channel to any location within the membrane. This prototype system can provide guidelines for designing a number of biomimetic applications.

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