Single-chain Heteropolymers Transport Protons Selectively and Rapidly

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Nature **2020**, 577, 216-220.

Random heteropolymers can diffuse into the interior of lipid membranes, and selectively and efficiently transport proton ions.

Membrane proteins can selectively and efficiently transport ions. Various channel structures have been fabricated using peptides, DNAs, carbon nanotubes, sequence-defined polymers and organic frameworks, which can however rival the performance of membrane proteins.

By using four-monomer-based amphiphilic random heteropolymers, we reported synthetic systems which exhibit selective transport of proton ions at an efficiency comparable to their nature counterparts. All-atom explicit solvent molecular dynamics simulations reveal that the nonpolar monomers are embedded in the interior of membranes, and the polar monomers protrude into water or at the membrane surface. The inserted random polymers promote the formation of dynamic hydrogen-bonded chains, which could aid proton ion transport across lipid membranes.

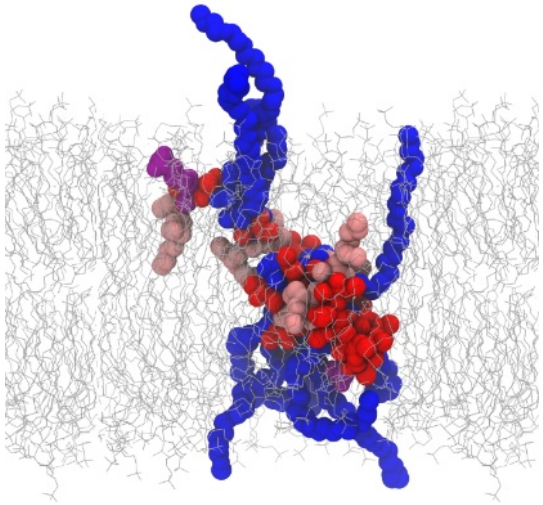

Figure 1: *Amphiphilic random heteropolymers in lipid membrane. Polar monomers are colored blue and purple; nonpolar monomers in red and pink. Lipids are colored gray.*

Support: Department of Energy (DE-FG02-08ER46539), Sherman Fairchild Foundation