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Modeling pore formation in lipid membranes via Janus nanoparticles ALEXANDER ALEXEEV, Georgia Institute of Technology, WILLIAM E. USPAL, MIT, ANNA C. BALAZS, University of Pittsburgh — Phospholipid membranes, which separate the cytoplasm from the extracellular environment in biological cells, embed a large diversity of proteins. Some proteins form pores for the free transport of small molecules and ions across the membrane. Here, we use coarse grained numerical simulations to design a synthetic membrane, where pores can be formed "on demand." Specifically, we use dissipative particle dynamics to probe the interaction between bilayer membranes and nanoparticles. The particles are nanoscopic Janus beads that comprise both hydrophobic and hydrophilic portions. We demonstrate that when the membrane is ruptured due to an external stress, these nanoparticles diffuse to the free edge of the membrane and form stable pores, which persist after the stress is released. Pore size depends on the architecture and concentration of the nanoparticles. Once a pore is formed, a small increase in membrane tension readily reopens the pore allowing rapid transport through the membrane.

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