

Patterning Membranes by Protein Self-organization

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Abstract

We report a new mechanism that the biological reactions occurring on the membrane surface can coordinate physical processes to transport and distribute the components in the membrane. The mechanism is demonstrated by the propagating Min protein waves formed by protein self-organization on the membrane surface to actively transport the lipid-anchored membrane components. The membrane component waves, that are formed in correspondence with the Min protein waves, represent transport of the components in the membrane. This is caused by the steric pressure gradient induced by the differential levels of binding and dissociation of the Min proteins in the propagating waves on the membrane surface. An intriguing implication arising from this study is that such a steric repulsion mechanism could be used to segregate the membrane components and maintain their heterogeneous distribution in the membrane, which may spatially localize specific physiological events inside a cell.