Synthetic Ion Channel with Dual Stimuli-responsiveness

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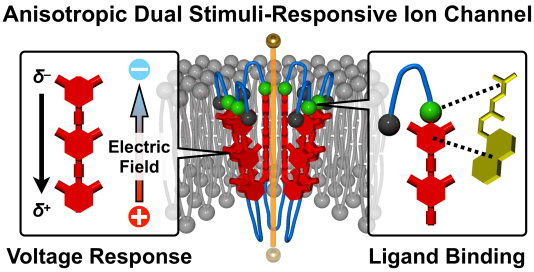
Transmembrane proteins that transport materials and transduce signals play major roles in diverse biological events. In particular, some ion channels can transport ions in a highly selective and an anisotropic manner across the biological membranes.[1] Inspired by the sophisticated structures and functions of such natural ion channels, our research group has developed a series of multiblock amphiphiles that can be incorporated into the lipid bilayer membranes and form supramolecular ion channels.[2] Strikingly, a multiblock amphiphile bearing phosphate groups showed an anisotropic ligand responsive ion transport property.[3]

In this research, we have taken another step forward to develop a synthetic ion channel with anisotropic dual stimuli-responsiveness. Such a feature is known to be important for natural ion channels (e.g. TRPM8),[4] because it enables an integration of multiple signals to realize precise functional controls. Here, we newly designed a multiblock amphiphile that possesses permanent dipole moments for voltage-responsiveness and phosphate groups for ligand bindings.[5] We expected that such a molecular design allows for anisotropic dual stimuli-responsive ion transport and bring about an important progress in the development of functional synthetic molecules.

The synthesized multiblock amphiphile was incorporated into the lipid bilayer membranes and formed a supramolecular ion channel, whose ion transport property was controllable by polarities and amplitude of applied voltage. In addition, the ion transport property was also controllable in an anisotropic manner by ligand bindings. Further details will be presented during the presentation.



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