Motility of Vesicle-Type Artificial Tissues Formed by Salt Bridges

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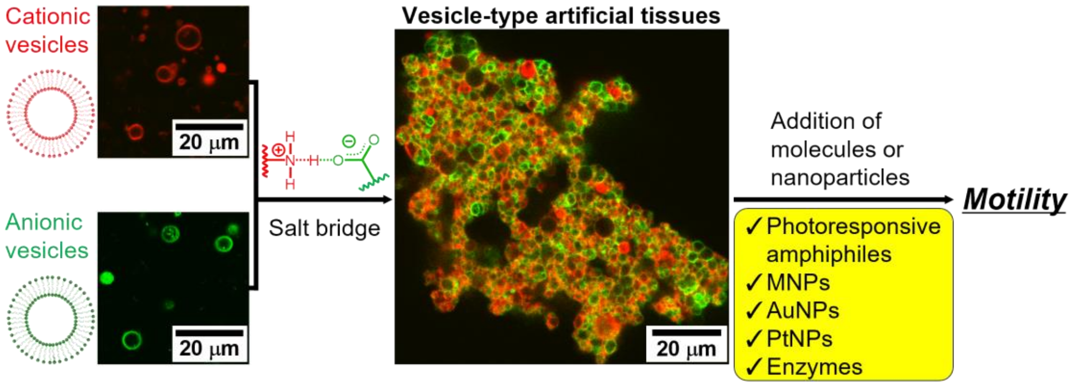
Motility is one of the characteristics in life. Reconstitution of such motility functions into synthetic cell-like entities could lead to engineering brand-new biomimetic materials which exhibit manipulation and propulsion. Nowadays, artificial cells are focused on to be engineered as colloidal materials mimicking abilities of biological cells.[1] Among them, vesicles are considered to be artificial cells because they have boundaries between inner and outer phase, which are similar to biomembranes.[2] Inspired by multicellular organisms where multiple cells assemble into tissues, assembling multiple artificial cells could induce large-scale structures considered to be artificial tissues.[3] We previously found a formation of artificial tissues comprising multiple vesicles triggered by salt bridges.[4] In this presentation, we report how to induce motility of such vesicle-type artificial tissues.

First, addition of azobenzene-containing amphiphiles induced a contraction of tissues under UV illumination. It was estimated that a deformation of each vesicle due to photoisomerization of the amphiphiles promoted close contacts between vesicles. Second, utilizing magnetic nanoparticles (MNPs) enabled us to manipulate tissues and transport large cargoes by using a magnet. Third, in the presence of gold nanoparticles (AuNPs), phototaxis of the tissues was observed due to a photothermal effect of AuNPs. Fourth, addition of platinum nanoparticles (PtNPs) or catalase caused propulsion at a vertical direction in H_2O_2 solutions, which was due to a buoyancy of oxygen bubbles generated by decomposition of H_2O_2. These results suggest a possibility of engineering biomimetic materials comprising multiple colloids with versatile motility.



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