DNA Origami as a Scaffold to Assemble Membrane Proteins on an Artificial Compartment

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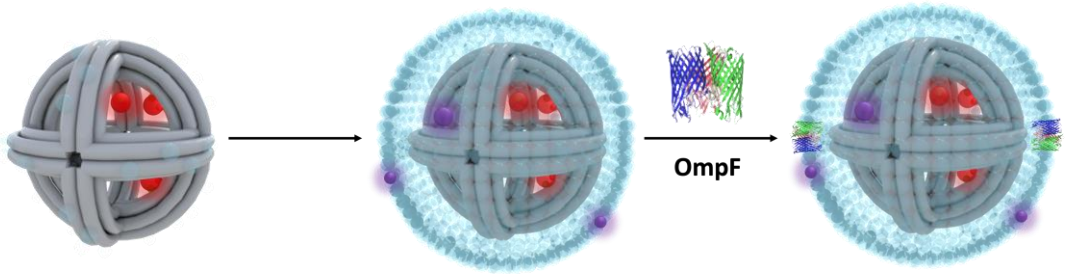
Inside cells, complex metabolic reactions are highly organized and distributed into different organelles which allows a better control over the biological processes.[1] There are some advantages in such organized systems. Because many cascade reactions suffer from incompatibilities such as cross-inhibitions by components of the reaction system. In fact, spatially arranged enzymes are observed in organelles which are believed to enhance the efficiency of multistep processes. Understanding the characteristics of these reactions is key to the development of artificial metabolic systems and biosensors. Artificial compartments are valuable tools for the study of membrane structure and mimicking cellular environment. Controlling the transport of ligands through the membrane ensures that the substrate and the reaction product can passively diffuse through the membrane. DNA origami can serve as a high-precision template for construction of confined membrane.[2] Up to now, the available membrane protein that has been successfully inserted in artificial compartments is rather limited.[3]

Here, we present a bio-inspired templating method to generate an artificial compartment with uniform diameter of ~80 nm. A spherical DNA nanostructure encapsulated by liposome was designed by following the work by Perrault et al.[4] We characterized internalized DNA origami diameters of 58.6 ± 5.5 nm and outer membrane diameters of 81.6 ± 10.1 nm from TEM images. The artificial compartment was applied as a scaffold to stably locate the bacterial membrane protein OmpF.



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