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

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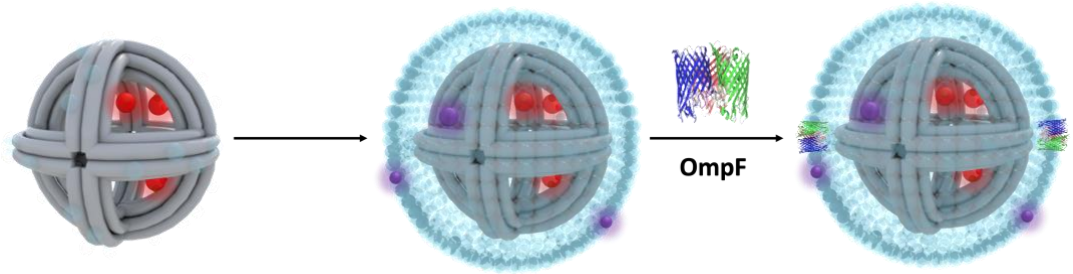
Artificial compartments are valuable tools for the study of membrane structure and mimicking cellular environment. Controlling the transport of ligands through the membrane ensures that the substrate and the reaction product can passively diffuse through the membrane. Inside cells, complex metabolic 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 enhance the efficiency of multistep processes. 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 a nanocompartment with uniform diameter of ~80 nm that is capable of locating membrane proteins. 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 sequence-specific zinc finger protein (zif268) was applied as an adaptor to stably locate the membrane protein OmpF on the DNA origami scaffold.[5] Assembly of the adaptor-fused OmpF on the DNA nanostructure and on the liposome will be described.



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