Membrane-Spanning DNA Nanopores: Bottom-up Structures for Single-Molecule Research, Nanotechnology, and Synthetic Biology

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Replicating the biological function of membrane proteins with synthetic components is scientifically and technologically exciting. I describe the design and generation of membrane nanopores assembled from DNA. The DNA nanopores consist of a bundle of six hexagonally arranged duplexes which are interconnected by cross-overs. The negatively charged nanobarrels carry lipid anchors to facilitate the pores' insertion into the hydrophobic bilayers[1-3]. The pores facilitate the control transport of molecular cargo across the membrane; both voltage-gated[4] and ligand-gated ion-selective channels could be built[3]. Pores can also be engineered to kill cells[5]. Membrane-spanning DNA pores will open up the design of entirely new molecular devices for applications within single-molecule research, biosensing, catalysis, drug delivery, and nanofluidics[6].

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