A Biomimetic Ligand-Gated Ion Channel Made of DNA

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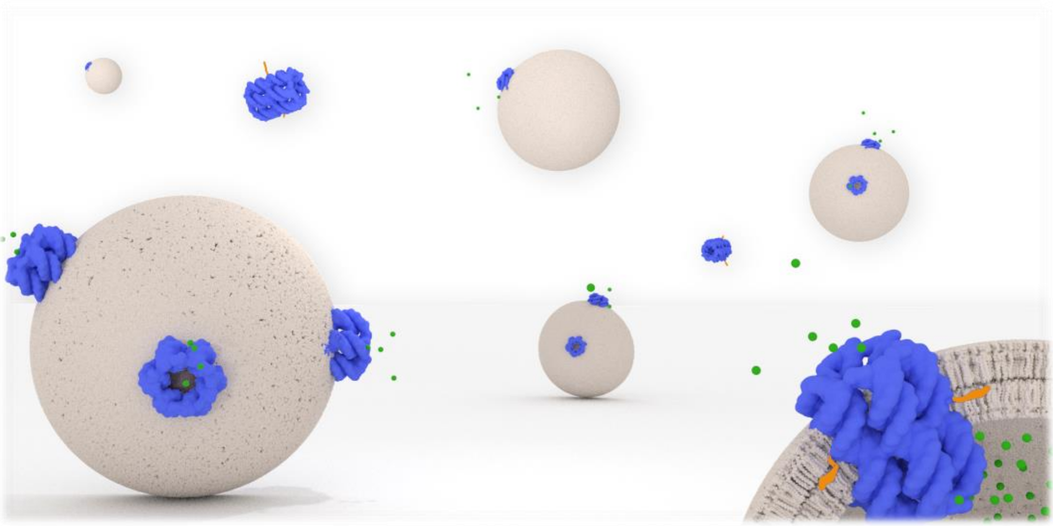
Biological nanopores are molecular gatekeepers that control transport across cell membranes. Recreating the functional principle of such systems and extending it beyond physiological ionic cargo is both scientifically exciting and technologically relevant to sensing or drug release. However, fabricating synthetic channels with a predictable structure remains a significant challenge. Here, we use DNA as a building material to create an atomistically determined molecular nanopore that can control when and which cargo is transported across a bilayer[1]. The pore is composed of seven concatenated DNA strands. The channel's design enables the control of when and which cargo is transported across a bilayer. The channel binds to a specific ligand and in response undergoes a nanomechanical change to open up the membrane-spanning lumen. The novel pore is also able to distinguish with high selectivity the transport of small-molecule cargo that differs by the presence of a positively or negatively charged group. The DNA nanodevice overcomes inherent structural limitations of classical protein-based building blocks. The pore could potentially be used for controlled-drug release, and the building of synthetic cell-like or logic ionic networks.



References:

J.R. Burns, A. Seifert, N. Fertig, S. Howorka, (2016). A biomimetic DNA-based channel for the ligand-controlled transport of charged molecular cargo across a biological membrane, Nature Nanotechnology, 11, 152-156.