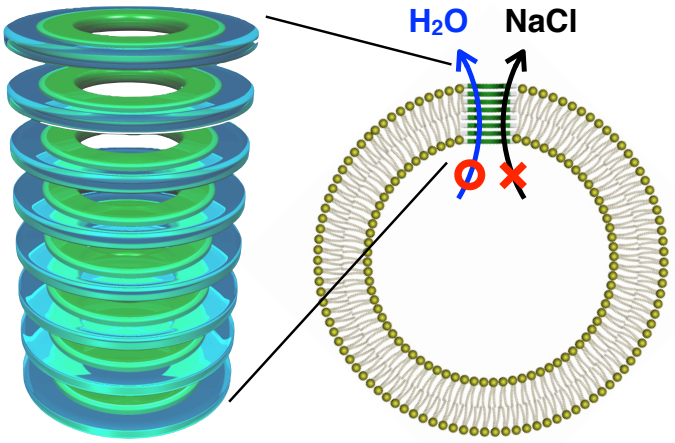
Fluorous Synthetic Channels Enabling Both Ultrafast Water Permeation and High Salt Reflection

([1]*The University of Tokyo*, [2]*JST PRESTO*, [3]*RIKEN CEMS*) ○Shuo CHEN,[1] Yoshimitsu ITOH,[1,2] Ryota HIRAHARA,[1] Takeshi KONDA,[1] Tsubasa AOKI,[1] Kohei SATO,[1] Takuzo AIDA[1,3]

Keywords: Supramolecular Polymerization; Synthetic Water Channel; Teflon-like Interior Surface

The Teflon® surface, densely covered with fluorine atoms, is superhydrophobic. Although the hydrophobic interior surface is recognized to play an essential role in the ultrafast water permeation in aquaporins,[1] no fluorous nanochannel with a Teflon-like superhydrophobic interior surface has been explored for water permeation. Recent reports showed that water clusters in the vicinity of fluorous compounds break to yield many hydroxy dangling bonds, whereas considerably fewer dangling bonds are generated with the hydrocarbon analogs.[2] This observation indicates that a nanochannel with a Teflon®-like superhydrophobic interior surface can suppress the formation of water clusters that likely diffuse more sluggishly than nonclustered water molecules. Therefore, this study was aimed at investigating water permeation through such fluorous nanochannels.

In this presentation, we show a series of fluorous oligoamide macrocycles with different interior diameters which can undergo supramolecular polymerization in phospholipid bilayer membranes to form fluorous nanochannels. The smallest-diameter nanochannel can permeate water with a flux two orders of magnitude greater than those of aquaporins or carbon nanotubes, the best reported water channels. Furthermore, it furnished a nearly perfect salt reflectance for desalination.[3]



1) P. Agre *et al.*, *J. Physiol.* **2002**, *542*, 3–16. 2) J. Robalo *et al.*, *J. Am. Chem. Soc.* **2019**, *141*, 15856–15868; S. Roy *et al.*, *J. Phys. Chem. C.* **2019**, *123*, 27012–27019. 3) Submitted.