

Water Biology and Medicine: roles of aquaporins (AQP)

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Water constitutes roughly 70% of the mass of our body. There is a dynamic and precise regulation for water balance in our body: secretion such as tears or saliva and absorption in digestive tracts or kidney. Disturbance in water balance can be seen in many clinical disorders from dry syndromes to brain edema. The discovery of the water channel aquaporin (AQP) greatly expanded our understanding of the regulation of the water permeability of biological membranes.

We have introduced a couple of new technologies in order to understand further water dynamics and biological relevance of AQP in the living system. First, we introduce “Aquaphotomics” approach to access water dynamics of the cells as well as AQP functions. A nonlinear optical microscopy technique, the coherent anti-stokes Raman scattering (CARS) imaging, has been applied to directly and quantitatively imaging water transport through cell membranes or epithelial tissues. Molecular dynamics simulation is also used to evaluate our experimental findings regarding to the water permeability through AQP. Taken together, we try to understand life science better by focusing on water molecule behaviors at a microscopic level.