

Water Biology and Medicine: from aquaporins to aquaphotomics

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Water constitutes roughly 70% of the mass of our body. Water balance is one of the most important homeostatic functions. 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, thereby physiology in water balance of our body.

We have introduced a couple of new technologies in order to understand further water dynamics and biological relevance of AQP in the living system. 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. We also introduce “Aquaphotomics” approach to access water dynamics of the cells as well as AQP functions. Molecular dynamics simulation is also used to evaluate our experimental findings. Taken together, we try to understand how water molecules contribute to the complex of life phenomenon, especially self-organization under non-linear open system.