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Role of Aquaporins in Body Fluid Homeostasis

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The movement of water across cell plasma membranes occurs in all cell types but is particularly rapid in erythrocytes, renal tubular cells. In principle, osmotic/oncotic gradients and hydrostatic pressure difference can drive water across a cell layer by transcellular or paracellular pathways. The aquaporin family of molecular water channels, which now number 10 in mammals and many more in plants and lower organism, are likely to provide a molecular pathway for water transport in some cell membranes. Several aquaporin-type water channels are expressed in kidney: AQP1 in the proximal tubule, thin descending limb of Henle, and vasa recta; AQP2, AQP3, AQP4 in the collecting duct; AQP6 in the papilla; and AQP7 in the proximal tubule. Recent studies have identified the role of aquaporins in short-term and long-term regulation of body water balance and have elucidated their critical roles in multiple water balance disorders. Moreover, recent studies of transgenic mice with gene knockouts of renal aquaporins have confirmed essential roles of aquaporins in water balance regulation.

This review will focus mainly on the role of aquaporins, especially AQP2, in water balance regulation and in the pathophysiology of water balance disorders.