IMPORTANCE OF SIGNAL SORTING OF AQUAPORINS IN THE KIDNEY

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Abstract: Water transport across biological membrane is mediated by a family of water channel proteins called aquaporins (AQP). Crucial insights into the fundamental pathophysiology of water balance disorders can be understood by studying the function, localization and the molecular mechanism of regulation of AQPs. AQP1 is compartmentalized in the apical portion of the proximal tubules of kidney epithelial cells which are responsible for 70% absorption of water from the kidneys. AQP3 is located on the basolateral membrane of the principal cells of the collecting ducts where 10% water reabsorption of the kidney takes place. AQP2 is located in the intracellular vesicles of the principal cells of the kidney collecting duct. We have reported elsewhere that the differential localization of aquaporins and their associated signals in the intestinal epithelial cell system differentiating between absorption and permeability. Typically, a dileucine and tyrosine motifs control the signaling of differential localization. AQP2 has a contiguous C-terminal SLLY motif and AQP3 contains a conserved four amino acid motif YRLL in the N-terminus while AQP1 lacks these motifs. The absence of N-glycosylation sites in AQP7 indicates that sorting in kidney is controlled by other signals. N-glycosylated AQP1 targets regioselectively the areas with denser glycocalyx and AQP7 is localized to the brush border membranes with inconspicuous glycocalyx of the proximal straight tubules. Mutations in AQP2 is implicated in hereditary nephrogenic diabetes and the binding events in the periphery of signaling motifs seem to redistribute such basolateral sorting and may thus lead to the impaired functionality of the aquaporins in water transport.

Keywords: Aquaporin, kidney, basolateral membrane, apical, glycocalyx

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