ABSTRACT

"Plasma membrane aquaporins: a highly regulated plumbing system"

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Aquaporins are channels facilitating the movement of water and/or uncharged solutes across membranes in all kingdoms of life. Plant aquaporins constitute a large and highly divergent protein family, and members of several subfamilies are found in the plasma membrane. Recently, we characterized proteins from a new subfamily (XIP or X Intrinsic proteins) found in *Solanaceae* but absent from Arabidopsis and monocots and showed that they facilitate the transport of many uncharged substrates. Besides this new aquaporin subfamily, the most studied plant plasma membrane aquaporins are the PIPs (Plasma membrane Intrinsic Proteins) that control cellular water movement in many different physiological processes. Using molecular and biophysical approaches, we showed that the expression and activity of the PIPs are regulated in *Zea mays* roots and leaves according to the developmental stages, day/night cycle and in response to short-term osmotic stress. Beyond the initial regulatory step of controlling gene and protein expression, different mechanisms have been reported to regulate the traffic and gating of PIPs. Maize aquaporins belonging to PIP1 and PIP2 groups formed hetero-oligomers to regulate the traffic of ZmPIP1 from the endoplasmic reticulum to the plasma membrane. In addition, a conserved cysteine residue located in an extra-cytosolic loop is involved in a disulfide bridge formation between two monomers forming a dimer. The delivery of ZmPIP2s to the plasma membrane involves also interaction with the syntaxin SYP121. Altogether the data point toward a complex and highly integrated regulation of PIP trafficking and activity in the maintenance of cellular water homeostasis.