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AtMRP5, an Arabidopsis Multidrug Resistance Related Protein, in Salt Tolerance

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The ABC (ATP-binding cassette) transporter superfamily is the largest known membrane transporter protein family and its members are capable of a multitude of transport functions. The presence of ABC proteins in plants was recently established by the cloning of several genes encoding members of this group in *Arabidpsis thaliana* and other species. Of these, the *Arabidopsis* multidrug resistance-related proteins (AtMRP) are the most extensively characterized plant ABC transporters to date. These proteins function as vacuolar sequesters of glutathionated compounds, malonylated chlophyll catabolites and glucuroindes. The plant ABC transporters are not only implicated in detoxification and ion regulation processes, but also in plant growth processes. In contrast to the studies with animal cells, there currently little known about the involvement of ABC proteins in the control of plant ion channels. Electrophysiological studies using *Vicia faba* guard cell protoplasts suggest that plants may have a sulfonylurea receptor-like protein that modulates stomatal movements and transmits the signals from sulfonylureas and potassium channel openers to potassium and/or anion channels on guard cells. However, it is not known yet what kind of molecules are responsible for these sulfonylurea-sensitive currents involved in stomatal movement. Recently, a new member of the ABC transporter superfamily of A. thaliana, *AtMRP5*, was identified and characterized. AtMRP5 promoter-GUS studies have revealed that strong AtMRP5 promoter activity is found in the vascular tissues of cotyledons and leaves, in elongation regions of the roots and in pollen and pollen tube. In the present work, we found that AtMRP5 can bind specifically to sulfonylurea when it is expressed in HEK293 cells. We also present evidence for a new role of AtMRP5 in the salt-stress response of *A. thaliana*. We used reverse genetics to identify an *A. thaliana* mutant (*atmrp5-2*) in which the AtMRP5 gene was disrupted by T-DNA insertion. In root-bending assays using MS medium supplemented with 100 mM NaCl, root growth of *atmrp5-2* was substantially inhibited in contrast to the almost normal growth of wild-type seedlings. This hypersensitive response of the *atmrp5-2*mutant was not observed during mannitol treatment. The root growth of the wild-type plant grown in MS medium supplemented with the MRP inhibitor glibenclamide and NaCl was inhibited to a very similar extent as the root growth of *atmrp5-2* grown in NaCl alone. The Na+-dependent reduction of root growth of the wild-type plant in the presence of glibenclamide was partially restored by diazoxide, a known K+ channel opener that reverses the inhibitory effects of sulfonylureas in animal cells. Moreover, the *atmrp5-2* mutant was defective in high-affinity 86Rb+ uptake. These observations suggest that AtMRP5 is a putative sulfonylurea receptor that is involved in K+homeostasis and thus also participates in the NaCl stress response. We have also found an additional putative role of AtMRP5, and will be discussed.- Supported by a grant (code PF003201-03) from PDRC of 21st Century Frontier Research Program.