

Preface

The discovery of the water channel activity of the first plant aquaporin, γ -TIP or TIP1;1, in 1993 has significantly challenged the concepts by which plants control cell water homeostasis but also the water relations of the whole organism. In addition, it appeared rapidly that plant aquaporins or MIPs (membrane intrinsic proteins) facilitate also the membrane diffusion of an increasing amount of small solutes, such as urea, CO₂, H₂O₂, ammonium, metalloids, etc. This diversity of substrates probably evolves from the high number of aquaporin genes identified in plant genomes. Higher plant aquaporins cluster into five phylogenetic subfamilies (PIPs, plasma membrane intrinsic proteins; TIPs, tonoplast intrinsic proteins; NIPs, NOD26-like intrinsic protein; SIPs, small basic intrinsic proteins; and XIPs, X intrinsic proteins) and are present in different cell membranes.

This book integrates exciting data illustrating the various regulation mechanisms leading to active aquaporins in their target membranes and addresses the involvement of different aquaporins in many physiological processes at different cell, organ, and tissue levels and in several environmental conditions. It includes the roles and regulation of aquaporins in plant water homeostasis, but also in plant distribution of other small solutes including nitrogen, CO₂, and metalloids. There are still many more discoveries to be made in how aquaporins are regulated and how their selectivity to different solutes are controlled, particularly those that appear to have dual permeation properties. Their interaction with plant mycorrhizae and their contribution in signaling processes are also discussed. This volume, by the diversity of the aspects developed in the different chapters, illustrates the importance of the aquaporins and their regulation in controlling plant physiology and development.

Louvain-la-Neuve, Belgium
Adelaide, Australia

François Chaumont
Steve Tyerman

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Chaumont, F.; Tyerman, S.D. (Eds.)

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