Preface

One prerequisite for life is the ability of cells to maintain their volume, which may change in response to alterations of ambient osmolarity and nutrient supply. Thus, cells have evolved powerful mechanisms for stabilization of cell volume. These mechanisms allow fluctuations in cell hydration, which have been recognized as important signals. By these means, ambient osmolarity and activity of transport systems in the plasma membrane affect not only cell water content but also cell structure, function, and gene expression. Osmosensors and transducers exist in many cell types that couple to osmosignaling pathways, ultimately triggering functional adaptation.

Whereas in yeast and bacteria such adaptations primarily aim to stabilize cell volume, in higher organisms with stable extracellular osmolarity, cell water changes are used for metabolic regulation. Mechanotransduction plays a major role in osmosensing. Osmosensing and osmosignaling may not only maintain cell shape, water, and ionic composition of the cell, but may also be activated to adapt metabolic cell function and gene expression. Organic osmolytes are involved in counteracting osmotic stress in part by stabilizing protein structure. Disturbance of water homeostasis and osmolyte handling is pathophysiologically relevant in a variety of diseases.

We are pleased to present current knowledge in this rapidly expanding field of research. The leading experts in the areas of osmosensing and osmosignaling in bacteria, yeast, and higher organisms contributed to this volume, to all of whom we are grateful. We also would like to express our thanks to Marlies Scholtes and Cindy Minor for their excellent help.

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