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Life presumably arose in the primeval oceans with similar or even greater salinity than the present ocean, so the ancient cells were designed to withstand salinity. However, the immediate ancestors of land plants most likely lived in fresh, or slightly brackish, water. The fresh/brackish water origins might explain why many land plants, including some cereals, can withstand moderate salinity, but only 1 – 2 % of all the higher plant species were able to re-discover their saline origins again and survive at increased salinities close to that of seawater. From a practical side, salinity is among the major threats to agriculture, having been one of the reasons for the demise of the ancient Mesopotamian Sumer civilisation and in the present time causing huge annual economic losses of over 10 billion USD. The effects of salinity on plants include osmotic stress, disruption of membrane ion transport, direct toxicity of high cytoplasmic concentrations of sodium and chloride on cellular processes and induced oxidative stress. Ion transport is the crucial starting point that determines salinity tolerance in plants. Transport via membranes is mediated mostly by the ion channels and transporters, which ensure selective passage of specific ions. The molecular and structural diversity of these ion channels and transporters is amazing. Obtaining the detailed descriptions of distinct ion channels and transporters present in halophytes, marine algae and salt-tolerant fungi and then progressing to the cellular and the whole organism mechanisms, is one

of the logical ways to understand high salinity tolerance. Transfer of the genes from halophytes to agricultural crops is a means to increase salt tolerance of the crops. The theoretical scientific approaches involve protein chemistry, structure-function relations of membrane proteins, synthetic biology, systems biology and physiology of stress and ion homeostasis. At the time of compiling this e-book many aspects of ion transport under salinity stress are not yet well understood. The e-book has attracted researchers in ion transport and salinity tolerance. We have combined our efforts to achieve a wider, more detailed understanding of salt tolerance in plants mediated by ion transport, to understand present and future ways to modify and manipulate ion transport and salinity tolerance and also to find natural limits for the modifications.