ABSTRACT

All organisms maintain a high concentration of potassium cations and a relatively low concentration of sodium cations in their cells, as higher concentrations of sodium cations are toxic to the cells of most organisms. To maintain the homeostasis of monovalent ions, cells utilize a variety of transport systems. This work describes and compares the transporters of these cations in human cells, plant cells, and the yeast *Saccharomyces cerevisiae*. To export excess Na^+ cations, all organisms use evolutionarily conserved Na^+/H^+ antiporters. The transporters responsible for the import and sufficient accumulation of K^+ cations differ between organisms. In animal/human cells, these are mainly Na^+/K^+ ATPases, in plants K^+ symporters with protons. In yeast, there are yeast- and fungi-specific transporters of the Trk type and K^+ cation symporters with protons from the Hak family. Besides transporters in the plasma membrane, transporters in organelle membranes also play a role, ensuring optimal concentrations of K^+ cations and protons and helping to sequester toxic Na^+ cations into vacuoles. Most transport systems in the membranes of intracellular organelles are antiporters that transport monovalent ions against protons. The regulation of most transporters occurs post-translationally. Among the most important regulatory mechanisms are phosphorylation and dephosphorylation by kinases and phosphatases. In the yeast *S. cerevisiae*, these primarily include the kinases Hog1 and Hrk1, which regulate the Nha1 antiporter and the Trk1 transporter respectively.