Modelling Metal Transport in Plants

A. Chavarría-Krauser[1,2]

Abstract: Ions are essential to the plant organism. For example, several fundamental molecular processes, such as gene transcription, rely on zinc as a catalytic cofactor or folding agent of proteins. Another example is magnesium, needed in photosynthesis to absorb light and hence to assimilate atmospheric carbon dioxide. Both zinc and magnesium are examples of simple ions. However, in plants other charged complex molecules are fundamental. A prominent example is the growth regulating phytohormone auxin, a weak acid which is transported as an ion.

Ions are not only essential, but can become toxic to plant cells in high concentrations. In contrast to other organisms, plants are bound all their life to a fixed location and have to cope directly with suboptimal conditions. It is therefore clear that ion transport is tightly regulated.

Transport of ions in plants affects also directly humans, in the sense that plants tend to uptake heavy metals and other toxic compounds from the soil and accumulate these in their biomass, including fruits. It is important to understand these processes to be able to avoid accumulation of toxic compounds in agricultural plants, but also to obtain a basis to use specially engineered plants to remediate polluted soils (phytoremediation).

The aim of the work presented here is to obtain models of ion transport, which connect microscopical properties given on a cellular level to macroscopical phenomena on an organismal scale. A general approach to modelling ion transport in plant cells will be proposed. It is based on the assumption that transport through a membrane can be described by reaction networks. As an concluding example a specific application to zinc transport in *A. thaliana* plants will be presented.

[1] Interdisciplinary Center for Scientific Computing, University of Heidelberg
Im Neuenheimer Feld 368, 69120 Heidelberg, Germany
andres.chavarria.krauser@iwr.uni-heidelberg.de

[2] BioQuant, University of Heidelberg
Im Neuenheimer Feld 267, 69120 Heidelberg, Germany
andres.chavarria@bioquant.uni-heidelberg.de