Abstract

Microtubular cytoskeleton is involved in many processes in plant cells, including cell division, growth and development. Other proteins enable its functions by modulation of its dynamics and organization and by mediation of functional and structural interaction with other cell structures. Identification of the mediating proteins and the functions of these interactions under specific conditions were the main aims of the thesis.

Membrane proteins interacting with microtubules were identified using biochemical methods. Surprisingly, the identified proteins co-sedimenting with microtubules were not members of the „classical“ microtubule associated proteins (MAPs). There were enzymes, chaperones and plant specific proteins among them. For further studies, the identified microtubule-associated heat-shock protein 90 (Hsp90_MT) was chosen. Recombinant Hsp90_MT binds directly to microtubules and tubulin dimers *in vitro*. The ATP-binding pocket is not responsible for this association. In BY-2, Hsp90_MT co-localizes with phragmoplast and cortical microtubules and is involved in microtubule recovery after their depolymerization during cold treatment. In plants, Hsp90 is involved in cell cycle progression, its inhibition causes cell-cycle arrest in G1 phase.

Based on literature search for animal proteins mediating microtubule-actin interaction, the protein CLASP from the group of recently described +TIP proteins was chosen for further investigation in plant cells. In BY-2, CLASP localizes on microtubules during the whole cell cycle. It also clearly localizes at the border edges of two adjacent cells, where it probably interacts with plasma membrane. In the cortical region, it scarcely co-localizes with actin filaments. Further, CLASP is probably involved in plant cell expansion and division.

Aluminum toxicity leads to the root growth inhibition. The primary cause of the inhibition is not known. In *Arabidopsis* plants cultivated in hydropony, the root growth inhibition occured within 2 min of Al treatment. Al inhibits endocytosis within 10 min, stabilizes cortical microtubules within the first 30 min and reduces plasma membrane fluidity. Application of the membrane fluidizer, benzyl alcohol, restored partially membrane fluidity and also partially restored root growth during the first 30 min of Al treatment. We concluded that Al-induced loss of membrane fluidity and endocytosis inhibition occurred very early during Al toxicity in plant roots and could be the earliest targets of Al treatment.