ABSTRACT

Rab GTPases are small signaling molecules that play an important role in vesicle trafficking in eukaryotic cells. Correct signaling through small GTPases allows orchestration of vesicle transport among cellular organelles and also to the cell wall providing cell wall material for cell growth and elongation. Engagement of Rab GTPases in the regulation of endomembrane trafficking is one of the evolutionary conserved aspects of secretion regulation. The network of Rab GTPases interaction includes also various downstream effectors. One of them is the exocyst complex involved in vesicle docking at the plasma membrane. It is a complex composed of eight different subunits (Sec3, Sec5, Sec6, Sec8, Sec10, Sec15, Exo70 and Exo84). Exocyst was discovered as Sec4p Rab GTPase effector in yeast and also data from animal models describe the Sec15 exocyst subunit as the Rab-interacting partner, but data from plants are missing. On the other hand, numerous studies identified exocyst role in tip growth of pollen tube and root hairs, seed coat formation, cell plate and cell wall formation, hypocotyl elongation, and importantly also PIN auxin efflux carriers recycling and polar auxin transport. There are two paralogues of SEC15 in the *Arabidopsis* genome, SEC15a and SEC15b, the previous one already shown to be important for polarized pollen tube growth.

In this thesis, we first test the hypothesis of conservation of Rab-exocyst interaction in *Arabidopis thaliana*. Using *in vitro* and *in vivo* techniques, we were able to show interaction of SEC15b with RAB GTPases from the RAB-A4 subgroup. Our experimental data suggest an intriguing possibility that RAB GTPases from the RAB-A4 subgroup are not redundant in respect to interaction with exocyst.

The exocyst complex was proven to be important for hypocotyl elongation, thus we use etiolated *Arabidopsis* hypocotyl, a flexible connection between root and cotyledons, as a model system. Morphological, anatomical and cytological analyses of *Arabidopsis* mutants in several exocyst subunits, including SEC15, showed formation of a discrete region on the etiolated hypocotyl near the root-hypocotyl junction, overall morphology of which resembles the collet region. The collet region, root-hypocotyl junction, is an important transition zone between different environments. Despite its crucial importance for plant development, little is known about how this transition zone is specified. We also describe and discuss other aspects of the SEC15b mutation in *Arabidopsis* and redundancy of both SEC15 paralogues.

Homozygous *rgtb1-1* mutant plants that are defective in RAB GTPase geranylgeranylation are characteristic by short etiolated hypocotyls with irregular cell pattern and heavy starch accumulation. To address this phenomenon, we show that etiolated hypocotyls upon isoxaben treatment generally react on distortion of the cell wall expansion on saccharides-containing media by allocation of sugars in the form of starch accumulation. We also used different mutant lines that are defective in cellular transport showing very similar phenotype to wild-type plants treated with isoxaben. Moreover, we discovered that there is a switch mechanism redirecting the sink of internal sugars from the cell wall synthesis to starch accumulation.

At the end, we also shortly discuss potential of Rab GTPases as targets of biotechnologies.