SUMMARY

Growth and development of plant body is dependent on correct and effective integration of information about current deployment of its body parts, as well as on perception and transduction of inputs from environment. Multiple developmental processes within plant body are determined by specific and tightly controlled distribution of molecule with unique signaling mission within plant development – auxin. Spatial distribution of auxin is co-determined by plethora of tightly controlled processes, and the polar auxin transport plays unique role among them. PIN proteins are the plant-specific family of secondary transporters driving movement of auxin across membranes. With their frequent asymmetrical localization within cells, specific expression patterns in developing tissues and their reactiveness to external cues they secure unique, dynamic and asymmetric distribution of auxin within the plant body.

This dissertation thesis is focused on characterization of the role different PIN proteins play in determining cellular auxin homeostasis and consequent formation of auxin gradients. Controlled overexpression of PIN proteins in tobacco cells showed, that PIN4 and to some extent also PIN6, function as the direct auxin efflux carriers. In the cellular auxin transport they play the role analogous to other canonical 'long' PINs, i.e. they are rate-limiting factors in cellular auxin efflux. On the other hand, PIN5 was proved to contribute to the cellular auxin management by entirely novel mechanism: It was shown to reside in the endomembrane-system and to mediate intracellular redistribution of auxin with consequent dramatic impact on the auxin metabolic profile. The data provided first evidence for the new mechanism underlying the establishment and maintenance of auxin homeostasis on the level of a single cell. Moreover, it was shown, that PIN family can be classified, according to proteins structure, function and evolutionary history, in two major subfamilies, PIN5 was shown to belong to a newly characterized PIN subfamily of 'short' PINs. Altogether, the results summarized in this thesis contributed to the understanding of the molecular components mediating auxin homeostasis and provide classification of the family members based on structural and evolutionary relationships. Moreover, in the perspective of the reported results, together with relationships found among the proteins, we strived to make a synthesis about the role of PIN proteins in plant

development in a more general fashion and in respect to its impact on the knowledge about plant evolution.