Trees are important components of the environment and are of great value to the human economy. Their efficient growth requires precise coordination of various developmental and physiological processes, controlled by effective communication within the wood (secondary xylem). The tree functioning is regulated at different levels of its organization, including both supra- ,inter- and intracellular planes. On the intercellular level, the communication and transporting processes can occur both via the apoplasm (continuous cell walls) and the symplasm (living protoplasts connected via plasmodesmata) systems with the help of vesicular transport responsible for the continuous flow of endomembrane compartments within the particular cells. Therefore the main aim of the project is understanding the role and the function of intercellular communication pathways in trees, perform via plasmodesmata (symplasmic transport) and driven by the endomembrane system (vesicular transport) with accordance to the seasonal activity of trees during the year.

The project will be focused on the important, although still underestimated, components of wood which are the xylem parenchyma cells. Contrary to the other wood components, the xylem parenchyma are long-living elements which form three-dimensional system for the continuous intercellular transport. Therefore they maintain the integrity within the secondary xylem both over short- and long-distances. However, the precise mechanism of communication processes between these cells is still poorly understood. Consequently, to decipher new possible pathways of intercellular transport in wood and to explore the role of endocytosis and the mutual interactions between the endocytic and the symplasmic transporting pathways in the secondary xylem, an interdisciplinary approach will be undertaken. The experimental set up will include the localization of fluorescent tracers on cellular and subcellular levels with the use of high-end microscopy, anatomical methods to observe developmental changes and various techniques for sugar metabolomics. The successful completion of the project will elucidate the mechanism of intercellular transport in wood and the role of living xylem parenchyma cells for communication processes over short- and long-distances. Thanks to that the integration and proper functioning of woody plants will be better characterized and understood.