Plants are sessile organisms and cannot avoid unfavorable environmental conditions. They have to adapt to changes in order to survive. Plants have to take into account different constituents of their environment, both biotic, including pathogens, herbivores and competition from other plants, and abiotic ones, ranging from changing temperature, presence of toxic compounds in the soil (salt, heavy metals), limitations in water availability (drought and salt stress) and last but not least too little or excess light. Plants have sophisticated biochemical mechanisms to sense and respond to environmental stimuli. Elucidating those mechanisms is important for the understanding of plant function. It is also a key factor for sustaining or improving crop productivity in the changing environment.

One of the major problems faced by agriculture is limited water availability for plants, arising from drought or presence of excess salt in the soil (often as a result of crop production, i.e. irrigation). Plants respond to those challenges by e.g. reducing transpiration, increased synthesis of osmoprotective substances and transporting Na^+ ions outside of the cytoplasm. Although we still do not know for sure how stress signal is sensed at molecular level, we know that it leads to rapid activation of protein kinases belonging to SNF1-related kinases (SnRKs) families. The kinases then phosphorylate their substrates and modify plant metabolism to enable acclimation to stress.

In my previous project I examined relations between osmotic stress signaling and light-activated processes in plant cells, including light induced chloroplast movements. I found that Plastid Movement Impaired 1, an important protein playing a role in chloroplast position establishing it the cell, is phosphorylated *in vitro* by SnRK2s. Surprisingly, I also observed that PMI1 can act as an inhibitor of SnRK2s' kinase activity. This poses interesting questions about the molecular function of PMI1 protein and its role in adaptation to environment.

This proposal is focused on PMI1 and its molecular functions. I want to examine in detail SnRK2 kinase inhibition, map its site and unravel its physiological significance. PMI1 can act as an agent tuning threshold for salt stress responses and ensuring low activity in non-stress conditions. Alternatively, PMI1 can provide tissue specific and light-dependent modulation of osmotic stress signaling pathways since it is expressed in green parts of the plant but not in roots. To see whether PMI1 plays a role of SnRK2 inhibitor and integrates light and osmotic stress signaling several biochemical, biophysical, and physiological approaches will be applied. Additionally, one of PMI1 domains can potentially bind lipids, thus influencing subcellular localization of this protein and its function. Therefore, we will study lipid binding by PMI1 and its subcellular localization in response to different factors. Last but not least we will examine the role of selected parts (and activities) of PMI1 in chloroplast movement regulation and responses to salt stress.

The project will improve our understanding of the signaling mechanism in plant cells in response to light and water deficit. Obtaining data on the dynamics of protein kinase regulation by environment will help to understand the complicated crosstalk between different signaling pathways that leads to optimal response to numerous environmental cues. It is important in the context of challenges for crop production related to climate change. Knowledge on the mechanisms of plant response will allow us to produce or select plants that will cope better with limited water supply.

Studying the lipid binding by PMI1 NT-C2 domain is also of more general interest. Proteins with domain architecture similar to PMI1 (NT-C2 domain flanked by intrinsically disordered sequences, followed by C-terminal domain specific for given protein) are present in other eukaryotes. Lipid binding by NT-C2 domain can regulate their subcellular localization and therefore be important in intracellular signal transduction in many organisms.