Functional characterization of full size ABCG transporters present in Medicago truncatula seeds.

Medicago truncatula is a model forage crop plant for studying legumes biology. In forage legumes, breeding efforts are primarily related to the vegetative development of the plant, although the commercial success of an agronomically superior cultivar is dependent on a reliable supply of competitively priced seed. Seeds provide food, feed, fiber and fuel. They are also an important delivery system of genetic information, which is essential for the survival of wild species in ecosystems and the production of agricultural crops. Legumes are extremely important in the development of sustainable agricultural systems. While most selections have led to seed traits favourable for agricultural consumption, such as larger seeds with higher nutritional value than the wild type, other manipulations in modern breeding sometimes led to negative traits, such as vivipary. Greater effort is needed to better understand and overcome these problems that have emerged as a consequence of crop improvement.

Among several phytohormones such as abscisic acid, gibberellins involved in signalling cascades behind seed quality cytokinins are reported to be abundant in the endosperm of developing seeds and enhance cell division in the embryo. Cytokinin has also been proposed to promote seed germination by antagonizing the effects of abscisic acid. The latter phytohormon together with gibberellins, has been considered to be the major regulator of seed dormancy induction and maintenance in both dicot and monocot crop species. To trigger specific outcomes, cytokinis have to be translocated across biological membranes and perceived, either intracellularly or extracellularly. Surprisingly, and in contrast to other hormones such as auxin or abscisic acid, our knowledge about cytokinis transporters is extremely limited and up to date, only few cytokinins transporters have been described notably belonging to the G subfamily of ATP-BINDING CASSETTE (ABC) family of transporters.

The investigation of the cytokinin transport mechanism has just begun and it provides a novel impetus for examining this hormone intercellular regulation. The transport of cytokinin is an important factor in determining the endogenous concentrations of the hormone at the site of action, and hence, it is an important process in physiological responses. With consideration of recent findings that ABC transporters may be involved in translocation of cytokinins as well as observed their organ specialization we aim at detailed studies of selected Medicago ABC transporters with a special emphasis on function of these proteins in cytokinins translocation and seed development.

Our proposal offers possibly new knowledge in membrane transporters context but importantly also seed biology which may be useful in addressing critical issues in modern agriculture. Is has also potential for translational biology and will also benefit plant breeders: establishing new selection criteria/tools based on the proper intracellular accumulation/intercellular distribution of hormones like cytokinins.

Hormone metabolism engineering has not yet been fully explored and the molecular mechanisms that regulate cytokinin transport are not fully understood. This is especially truth for crop plants. The results of this study might shed new light on ABC driven transport and functional specialization of those proteins but also cytokinin signaling. Next to these considerations we expect the results of the proposed research to have an impact on the design of new strategies for effective plant production.