Physiological relationship between vascular tissues and ER body-producing cells in Arabidopsis

Brassicaceae are one of the most important plant families for mankind as they produce both commercially important oilseeds and vegetable crops. These plants possess specific set of cells, namely ER body-producing cells, which are located in the epidermis and are involved in the plant defense against insect herbivores. ER bodies are subcellular structures that accumulate enzymes for the synthesis of the toxic metabolite. The ER body formation in these cells suggests the existence of a special system to differentiate them from the epidermal cells, which are dedicated to the plant chemical defense. It seems that ER body-producing cell's development is linked to the vasculature development, as these cells are observed in the epidermis of leaf midvein which is rich in attractive nutrients for insects.

Despite the significant role of the ER body-producing cells in the defense system in Brassicaceae plants, our understanding of their differentiation and the responsible signaling molecules inducing this process is limited. Investigating the differentiation mechanism of the ER body-producing cells and the identification of the signaling molecules will shed the light on the organization of chemical defense strategy in leaf development. To understand how ER body-producing cells differentiate, I am planning to investigate these aspects:

1. Analysis of the spatial relationship between vascular tissues and the ER body-producing cells,
2. Determining the signaling molecule responsible for the ER body-producing cells differentiation.

We already have preliminary results suggesting that the vascular tissues affect ER body-producing cell development in the epidermis. In addition, we have few candidates for the signaling molecule responsible for the differentiation of the ER body-producing cells from epidermal cells.

Based on our knowledge, the results of this project will report for the first time the influence of the vascular tissues on organization of the epidermal cell-based defense by communicating through small molecules in the leaves. Therefore**,** the applicant believes that the proposed project will have a great impact in the field of developmental, cellular, and molecular biology in plants. Interestingly, in addition to the ER bodies, Brassicaceae plants produce another type of chemical defense-related cells, namely myrosin cells that accumulate similar enzymes and are located next to the vascular tissues. Therefore, this family of plants has developed a double defensive mechanism for thorough protection against pests. The applicant's results, together with the previously reported data, have the potential to lead the agricultural and horticultural innovations by developing pest-resistant crops.