

ABSTRACT FOR THE GENERAL PUBLIC

Gene Regulatory Mechanism for the Mustard Oil Bomb Defence System of ER Bodies in Brassicaceae

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Unlike animals, which can move to escape the danger, sessile plants have no choice in the environment they are planted. Therefore, plants have developed sophisticated defence systems against changes in the natural environment, which differ from the ones used by animals. An endoplasmic reticulum (ER) derived organelle, ER body, will be one of such defence systems for the protection against insects or pathogens attacks.

The ER body is a spindle-shaped organelle (~10 µm in diameter, 5 µm in width), observed in Brassicaceae plants (cabbage family plants). In a model plant of Brassicaceae, *Arabidopsis thaliana*, the epidermal cells of seedlings and roots constitutively accumulate ER bodies, whereas wounding or attacking by insect induces ER body formation *de novo* in rosette leaves. These ER bodies accumulate enzymes to produce isothiocyanates, and they constitute a so-called “mustard oil bomb”. The isothiocyanates are underlining the pungency of many Brassicaceae crops such as mustard, cabbage, and horseradish. Thus, it is suggested that plant species of this family have developed a specific mechanism of defence against pests and pathogens by developing the ER bodies, involved in the “mustard oil bomb” system.

Our previous research revealed that Brassicaceae plants developed various regulatory mechanisms for ER body formation to increase the variety of defence system. Investigating the regulatory mechanism for ER body formation in detail will further explain the sophisticated defence system of plants, and could lead to innovations in agriculture. We are planning to investigate these aspects by:

- (1) Analysis of transcription factor regulating ER body formation,
- (2) Impact of these regulatory mechanisms on defence against pathogens and herbivores

The ER is an organelle that produces secretory proteins. However, Brassicaceae plants developed a new functional organelle from the ER: the ER body, which is used to protect them against insects or pathogens. This project will reveal how Brassicaceae plants have developed a sophisticated defence system of ER bodies. The finding from the project will increase our knowledge of plant defence mechanisms, and further support the toolkit for engineering plant defence level, which could have far-reaching implications in agriculture to develop pathogen and pest-resistant plants.