Ca^{2+} signaling at the crossroads of biotic and abiotic stress responses

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Scientific objectives

As sessile organisms, plants have elaborated sophisticated systems to perceive and to develop appropriate physiological responses to environmental changes. Among the numerous components of these signaling systems, calcium (Ca^{2+}) as a second messenger, conveys information from the initial perception of environmental changes to the final responses. A fundamental question is to understand how this single ion can integrate so many distinct signals and mediate stimulus-specific responses. The multiplicity of Ca^{2+} sensors/transducers in plants likely provides a powerful toolkit for a flexible and specific processing of the information encoded by various calcium signatures. In addition, it is becoming evident that inter-connections between Ca^{2+} -dependent pathways and other signaling systems contribute to generate specificity in the translation of Ca^{2+} signatures into appropriate responses.

Recent data from our group indicate the versatile roles of several Ca^{2+} signaling components in various stress conditions, suggesting that calcium is at the crossroads of biotic and abiotic responses. For instance, CML9, a calmodulin–like calcium sensor, acts as a negative regulator in osmotic stress tolerance and as a positive regulator in plant defence against a bacterial pathogen (*Pseudomonas syringae*). On these bases, our current project addresses the role of Ca^{2+} signaling during plant responses to abiotic stress but also to biotic stress during defense reactions to pathogen attacks, and explores the possible connections with other signaling pathways.

TULIP MTR

Current and future projects will fit with the objectives of the 3 following MTRs:

MTR1 entitled: **"*Organism - abiotic environment interactions (the scale of the sole organism*)".** In the context of this MTR, we have found that members of the calmodulin family but more generally calcium sensors and their respective targets regulate the adaptive response of plant to abiotic stresses.

MTR2 entitled "***Organism - Organism interactions (two partner interactions)*".** Within the frame of this MTR, Ca^{2+} ion and its calcium sensors control the behaviour (molecular mechanisms) of the interaction between a pathogen and its host plant.

MTR3 entitled **"*Environmental effects on organism-organism interaction*".** Since it is shown that a same calcium sensor can play dual role in both biotic and abiotic stresses, changes in environmental conditions can affect plant-microorganisms interactions through the involvement of calcium sensors. On these bases, a collaborative work recently engaged with a LIPM group evaluates the importance of calcium sensors in the control of organism-organism interaction by abiotic conditions.

ETP involved in the project: 4.5 (chercheurs/enseignants-chercheurs)