Year of CfP: 2008

Project No 0803-022

Project title: Computational model for electrical signaling in plants in relation to polarized patterns of development and morphogenesis, and to adaptative responses to stresses (ELEXIGNAL)

Units managing the project: BPMP (Plant Molecular Physiology and Biochemistry) (CNRS, INRA, Montpellier SupAgro, UMII) and University of Ottawa

Project leaders: Jean-Baptiste Thibaud, BPMP (thibaud(a)supagro.inra.fr), Anne-Gaëlle Rolland-Lagan Department of computer sciences, University of Ottawa (arolland(a)uottawa.ca)

Countries involved in the project: Canada, Germany

Research units from the Foundation's scientific network involved: GREEN, SYSTEM, LAMETA

Sub-thematic axes: IPB-1 (Integrative Plant Biology 1: *Genetics and genomics, plant breeding, ecophysiology*), IPB-2 (Integrative Plant Biology 2: *Plant pests and diseases, integrated crop protection, population ecology*)

Objectives:

Plant ion transport systems are well studied with respect to their role in plant mineral homeostasis and nutrition. But ion transport through cell membranes are intrinsically dependent on membrane potential and, in turn, do contribute to both the steady-state and the transients of membrane potential. Electrical signaling, which is mostly studied in animals (and especially in excitable cells) is not foreign to plants. Electrical signals do occur at both the plant cell and plant tissue levels and can even propagate at the whole plant level from one organ to another and participate in stress signaling. Electrical fields within plant tissues, in relation with the activity of ion transport systems and with propagation of electrical signals, are also believed to be involved in the control of polarized patterns of growth, development and morphogenesis. The molecular basis of these peculiar aspects of plant physiology is as yet poorly understood.

An increasing number of plant ion transport systems have been identified at the molecular level and their individual biophysical characteristics have been described in detail. Particularly, a number of voltage-dependent ion channels and other ion transport systems have been identified in plant cells which are analogous to animal counterparts responsible for electrical signaling in excitable cells. It is now important to collect quantitative data on ion transport and electrical signaling, and to use these data as a basis for developing simulation models of the control of cell membrane potential.

The aim of this project is:

- to implement and validate a mathematical model for the integration, at both the cell and tissue scales within the plant, of the individual contributions of ion transport systems to the steady-state and transients of the cell membrane potential

- to explore, describe and demonstrate the role of electrical signals in the polarization of development and morphogenesis and in stress signaling within plants (especially water and biotic stresses)

Total Agropolis Fondation funding: € 266,760 (salary for a Junior Fellow for three years, travel expenses, running costs)

Funding categorie(s): Agropolis Fondation Junior Fellowship

Project duration: 1 January 2009 – 30 June 2012

Keywords: electrical signaling – computational modelling – development – morphogenesis – stresses – ion channels