

Year of CfP: 2007

Project No: 07001 Completed

Project title: The role of BoIA-like proteins in iron homeostasis and iron-sulfur cluster biogenesis in <i>Arabidopsis</i>

Unit managing the project: BPMP (Plant Molecular Physiology and Biochemistry) (CNRS, INRA, SupAgro, UMII)

Project leader: Jean-François Briat (briat(a)supagro.inra.fr)

Country involved in the project: USA

Subthematic axes: IPB-1 (Integrative Plant Biology 1: *Genetics and genomics, plant breeding, ecophysiology*)

Objectives:

Iron is essential for living cells because Fe-S clusters are major protein cofactors. However, iron is potentially deleterious for the cell due to its reactivity with oxygen. Thus, iron and oxygen metabolisms required being tightly coordinated.

Recent results obtained in yeast indicate that the protein BoIA may be involved in iron homeostasis. BoIA seems to operate by interacting with glutaredoxins (Grx), proteins emerging as redox sensors in animals. These data provide a unique link between iron metabolism and oxidative stress responses.

In *Arabidopsis*, proteins containing BoIA-domain are present both in the cytosol and in the chloroplast. The plastidial one is related to the Fe-S cluster biogenesis. It interacts with the Grx-domain of an enzyme involved in sulfur assimilation, leading to hypothesize that the interaction BoIA/Grx-domains is a common feature that integrates various signals. Regarding the cytosolic BoIA protein, no characterization has been obtained so far.

Also, the host laboratory (BPMP) has isolated loss of function ferritin mutants. Ferritins are plastid proteins able to store iron under a non toxic form (ie without reactivity with oxygen), which can be remobilised accordingly to metabolism needs. These mutants are affected in iron homeostasis.

The aim of the project is to study the role of BoIA and ferritins in iron homeostasis and in the biogenesis of iron-sulfur clusters, and to decipher the interactions between iron and sulphur metabolism. This work is done in collaboration with a laboratory from the University of Colorado.

Action carried-out and results obtained:

During its stay at BPMP, E Pilon-Smits prepared tools enabling to study the cytosolic BoIA protein : mutant isolation, BoIA cDNA cloning in various expression vectors (yeast, plant). Dr Pilon-Smits has also performed physiological studies using plant ferritin mutants. In particular, she studied the response of these plants lacking ferritins to various oxidative stress (low temperature, high light, methylviologen treatment). She measured the impact of these conditions on plant biomass. She then performed a molecular physiology study using these various genetic backgrounds under these various environmental conditions (photosynthetic activity measurement, determination of the activities of various enzymes involved in Fe-S cluster biogenesis or ROS detoxification, expression study of genes regulated by iron and / or oxidative stresses).

Publication:

Karl Ravet, Brigitte Touraine, Jossia Boucherez, Jean-François Briat, Frédéric Gaymard, Françoise Cellier (Feb 2009) Ferritins control interaction between iron homeostasis and oxidative stress in *Arabidopsis*. *Plant J.* 57(3):400-412

Prospects for the future:

Studies initiated in Montpellier by Dr. E Pilon-Smits are currently continued in both the USA and the French laboratories. BoIA protein characterisation in yeast and plant mutant studies are mainly performed in Montpellier, whereas the impact of the boIA mutation on the Fe-S cluster biogenesis is under study in Dr. Pilon-Smits laboratory at Fort Collins (USA). Results from these studies should lead to a joint publication in 2009. A joint review publication on the topic is currently under writing and will be published during the first 2009 semester in Current Opinion in Plant Biology. Finally, a third year graduate student at BPMP (Karl Ravet) will join E. Pilon-Smits laboratory in 2009 as a post-doc fellow, facilitating the development of the collaboration on a longer range period.

Total Agropolis Fondation funding: € 18,830 (salary for a junior fellow)

Funding categorie(s): Agropolis Fondation Junior Fellowship

Project duration: 1 December 2007 – 31 March 2008

Keywords: *Arabidopsis* – iron – sulphur – homeostasis – ferritins