

## **The interaction between *Lotus japonicus* and mycorrhizal fungi: a cellular and molecular analysis of signaling events**

### **Main objectives**

Identifying early steps in the interaction between *Lotus japonicus* and arbuscular mycorrhizal fungi through a cellular, genetic and molecular analysis: this will outline the role of molecular signals controlling the success of mycorrhizal interaction.

The experimental system will include mutant Lotus plants, as useful tools for dissecting the signaling pathways.

### ***I. Cell responses to AM colonization in mutant L. japonicus : definition of mycorrhizal phenotypes***

The use of model legumes capable of developing both nodules and mycorrhizas has allowed the comparison of the two symbioses and the investigation of molecular and cellular strategies developed by legumes during their interaction with microorganisms (Downie and Bonfante, 2000, Kistner and Parniske, 2002, Parniske 2004). In this field, cellular investigations characterizing the symbiotic phenotype of new mutant lines are fundamental, in association with other genetical and molecular studies. Cytological and ultrastructural observations associated to quantitative analysis allowed us to dissect the colonization process of AM fungi as a multistep process and to locate the checkpoints that allow the host plant to recognize the fungal partner as the right one (Bonfante et al., 2000; Novero et al., 2002).

We will focus on mutants developed by other partners (i.e. Partner 1, University of Munich) or by colleagues outside the network.

### ***II. Cell responses of epidermal and cortical cells during symbiosis development.***

To reach the root inner cortex and differentiate symbiotic branched structures known as arbuscules, the fungus first has to penetrate through the outer root tissues. In order to evaluate the role played by the host plant in AM infection, *in vivo* cellular dynamics within root epidermal cells has been studied using GFP-tags labelling both *Medicago truncatula* cytoskeleton and the endoplasmic reticulum (A. Genre et al. unpublished observations) . The project will be aimed to understand the responses of epidermal and cortical cells in *Lotus japonicus*. A microtubule-GFP Lotus is already available.

### ***III. Transcriptome as a response to plant-fungal signaling***

It is well known that plant cells re-organize their general structure upon fungal colonization (Bonfante 2001), a process which has been named accommodation program (Parniske, 2000). However, it is not known whether the accommodation program is already started by the plant prior to physical contact with the fungus in response to diffusible signals. To get a global idea of the responses to fungal, diffusible signals occurring in the plant root at transcriptional level, microarray analyses on plant roots treated with fungal signal substances shall be carried out. The experiments will be done in collaboration with the group of dr Uwardi (Partner 3).