



PhD in Toulouse, France, financed by the SPE department of INRAE and the Occitanie region

Connecting Abiotic Stress Tolerance and symbiotic signalling in LEgumes (CASTLE)

Keywords: plant symbiosis, abiotic stress responses, redox signalling, molecular and cellular biology.

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Background

The Rhizobium-legume (RL) symbiosis is a highly beneficial plant-microbe interaction that allows crops to grow without the addition of nitrogen fertiliser. Like all plant-microorganism interactions, the RL symbiosis can be affected by multiple environmental stresses, which need to be better understood in order to propose strategies for optimal symbiotic nitrogen fixation in the context of climate change. Drought, salinity, osmotic stress and increased temperatures are major stresses in agriculture and have significant negative effects on symbiosis, although the mechanisms involved are poorly understood. Our recent data suggest important connections between responses to abiotic stresses and the early stages of symbiotic signalling.

PhD project

The objective of this thesis is to understand specificities and overlaps between abiotic stress response mechanisms and symbiotic signalling pathways in *Medicago truncatula*. To this end, we will use genetic, cell biology and transcriptomic approaches to study the roles played by *M. truncatula* components controlling symbiosis and/or cellular redox state. These include the receptor protein MtNFP (Nod Factor Perception) and MtrBOH (Respiratory Oxidative Burst Homolog) proteins. Plant mutants will be studied for the ability to establish the LR symbiosis in the presence of salt, osmotic or temperature stress, changes in redox state will be measured, and gene expression analysis performed. We will also use the genomic resources available in *M. truncatula*, and exploit particular ecotypes with contrasting tolerance to salt stress or drought. Thus, we aim to identify key genes in abiotic and symbiotic signalling whose biological functions will be assessed by deregulating their expression in different genetic and physiological contexts. The PhD student will join a research group studying other aspects of symbiotic signalling and other plant-microbe interactions. We are also studying MtNFP to understand how it has a role in plant immunity as well.

The long-term aim of the work is to propose strategies for optimal symbiotic nitrogen fixation under unfavourable environmental conditions.

Profile

The PhD student should have a **good background** in **plant biology**, **plant molecular genetics** and **plant physiology**. An experience of **plant phenotyping** and/or **microscopy** would be an advantage. A **good knowledge of statistics is necessary**, as well as a **good level of English**.

How to apply?

Send a **CV** (including previous experiences and technical skills), a **copy of your Master degree** and/or **Engineer degree** if already available (including final marks and ranks) and **names of at least two scientists** (with contact details) to Nicolas Pauly (Nicolas.PAULY@univ-cotedazur.fr) and Clare Gough (clare.gough@inrae.fr) before the **17th July 2022**.