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Alternatives routes for symbiosis between legumes and Rhizobia

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Abstract: Legumes have a tremendous ecological and agronomic impact due to their ability to interact symbiotically with nitrogen-fixing bacteria, called rhizobia. A major advance in our understanding of this interaction was the discovery, in the early 1990s that it relies on the exchange of diffusible signal molecules between the two partners. Nod factors (NFs) were recognized as an essential bacterial signal to trigger the nodulation program of the host plant. For a long time, this key signal was assumed to be conserved in all nodulating rhizobia. However, we challenged in 2007 this dogma by showing that the genome of two photosynthetic *Bradyrhizobium* strains (BTai1 and ORS278) that elicit root- and stem-nodules on a particular group of Aeschynomene plants do not contain the canonical nodABC genes necessary for the synthesis of NF (Giraud et al. 2007). It was proposed that this alternative symbiotic process represents the ground state or ancient state of the rhizobium-legume symbiosis. More recently, we demonstrated that non-photosynthetic bradyrhizobia, thanks to a type 3 secretion system (T3SS), could also activate nodulation in Aeschynomene independently of NFs (Okazaki et al. 2016). Since most photosynthetic *Bradyrhizobium* strains lack this secretory machinery, we conclude that at least two different NF-independent pathways exist in legumes, a T3SS-dependent one and a T3SS-independent one. An overview on these non-conventional symbioses between bradyrhizobia and Aeschynomene, as well as, the experiments that are ongoing on both the plant and bacterial partners to progress in the understanding of the molecular mechanisms of these NF-independent processes, will be presented during this talk.

Publications:

Giraud E, Moulin L, Vallenet D, Barbe V, Cytryn E, Avarre J et al. (2007) Legumes symbioses: absence of Nod genes in photosynthetic bradyrhizobia. *Science* 316:1307-1312.

Okazaki S, Panlada T, Teulet A, Thouin J, Fardoux J, Chaintreuil C, Gully D, JArrighi JF, Furuta N, Miwa H, Yasuda M, Nouwen N, Teumroong N, Giraud E. (2016) Rhizobium-legume symbiosis in the absence of Nod factors :Two possible scenarios with or without the T3SS. *ISME J.* 10:64-74.