

To nodulate or not nodulate: a legume's dilemma

Legume plants form endosymbiotic associations with nitrogen-fixing rhizobia, hosting them inside cells of specialized root organs called nodules. Nodules provide nutrition and protection for the rhizobia in exchange for fixed nitrogen. This relationship reduces the need for synthetic fertilizers in agriculture and is thus largely beneficial. However, ineffective nodules with little to no nitrogen fixation can form, limiting the agricultural use of legumes. These ineffective nodules pose a burden on the plant without providing benefits. Plants cannot select their symbionts based on their ability to fix nitrogen a priori, as rhizobia only fix nitrogen once they have infected the host. One strategy to minimize the infection by such cheaters is to restrict the host nodulation range. However, this approach is risky because, in nitrogen-poor soils, being too selective can exclude potentially beneficial symbionts, leading to plant starvation. In this project, we will characterize candidate genes identified to control the compatibility range of different *Lotus* species (promiscuous vs. selective) and study their regulation. We will analyze these candidates biochemically and cell biologically and determine their interplay with the host immune system. Understanding this will help develop strategies to minimize ineffective symbiosis in relevant legume crops in the future.