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# Nitrogen-fixing are polyploidy and host peptide-governed symbiotic differentiation universal characteristics of endosymbiosis in the rhizobium-legume symbiosis?.

**Mariam B Sticklen***

Department of Plant, Soil and Microbial Sciences, Michigan State University, USA

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## Perspective

Legumes may have a symbiotic relationship with nitrogen-fixing bacteria, they can grow in nitrogen-deficient soils. There is a lot of interest in applying what we've learned about this symbiosis to non-symbiotic plants. An international study group has progressed in their understanding of this complicated biological process. Microbes play a crucial role in all creatures, including plants, whether they are useful or detrimental. Plant viability depends on the ability to monitor the bacteria in the environment. The roots of a soil-growing plant, for example, are surrounded by a microbial rich environment and have evolved sophisticated surveillance mechanisms as a result.

The interaction of legume plants with rhizobia bacteria is extremely selective. Plants have previously been shown to be able to recognise certain signalling molecules produced by symbiotic rhizobia bacteria. The Nod factor signalling system, in particular, is critical for establishing the host-non host connection between legumes and rhizobia.

Invasion of the host by a suitable pathogen Rhizobium species normally cause host root cell division to produce the nodule, and subsequently both partners go through a phase of differentiation. Rhizobia generally change their morphology to create bacteroids, which are larger than free-living bacteria and have different cell walls. The bacteria are bounded by the plasmalemma of the host cell at all times during infection. The bacteria produce the enzyme nitrogenase, which causes nitrogen fixation if leghaemoglobin is present. Plants other than legumes that do not have a symbiotic relationship with rhizobia bacteria have been reported to have NFR1-type receptors. Identifying receptors involved in Nod-factor signalling could lead to novel biotechnological targets in non-symbiotic crops, allowing them to grow in nutrient-deficient environments.

The symbiosis between rhizobia soil bacteria and legumes is facultative, and it is triggered by the host plant's nitrogen deficiency. The creation of root nodules, where bacteria are converted to nitrogen-fixing bacteroids, is caused by the exchange of signal molecules between the partners. The bacteria give nitrogen supplies for plant growth in exchange for photosynthates from the host in this mutualistic symbiosis. Bacterial symbiotic fate might be reversible or irreversible depending on the host plant. The bacteria in Medic ago plants go through a host-directed multistep differentiation process that results in elongated and branched polyploidy bacteria with a permanent loss of cell division potential. Plant factors are symbiotic peptides that are particular to nodules. The cysteine-rich NCR peptides produced in infected plant cells account for about 500 of them. Endo symbionts are targeted by NCRs, and distinct sets of peptides work together to control different stages of Endo symbiont maturation. This review focuses on symbiotic plant cell development and terminal bacteroid differentiation, and it highlights the critical roles of symbiotic peptides by demonstrating one of these peptides' multi-target mechanisms.

By analysing a model legume species, Lotus japonicus, an international research team of researchers from Denmark, Italy, France, and Japan has recently uncovered the role of another LysM receptor kinase termed NRFe. The findings revealed that NFRe and NFR1 have biochemical and molecular features that are both comparable and unique. NRFe is largely expressed in cells on the surface of the roots in a specific location. NFRe has a limited signalling capacity compared to NFR1, which is limited to the outer root cell layer. When NRFe was mutated, Nod factor signalling was reduced inside the root, resulting in fewer nodules.

Plants other than legumes that do not have a symbiotic relationship with rhizobia bacteria have been reported to have NFR1-type receptors. Identifying receptors involved in Nod-factor signalling could lead to novel biotechnological targets in non-symbiotic crops, allowing them to grow in nutrient-deficient environments.

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***Correspondence to:**

Mariam B Sticklen
Department of Plant, Soil and Microbial Sciences
Michigan State University
USA
E-mail: stickle1@msu.edu