Power to the Flower

- Cell Biology
- Genetics
- Microbiology
- Biochemistry

How soil fungi and bacteria help feed plants

Turbocharging plants

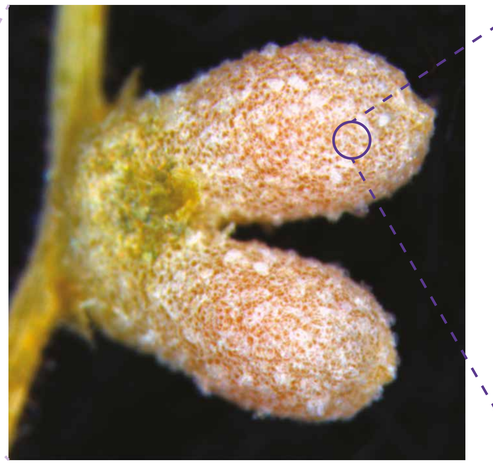
To grow and flower, plants get nutrients from microbes. These microbes live inside their roots. Plant microbe friendships date back hundreds of millions of years.

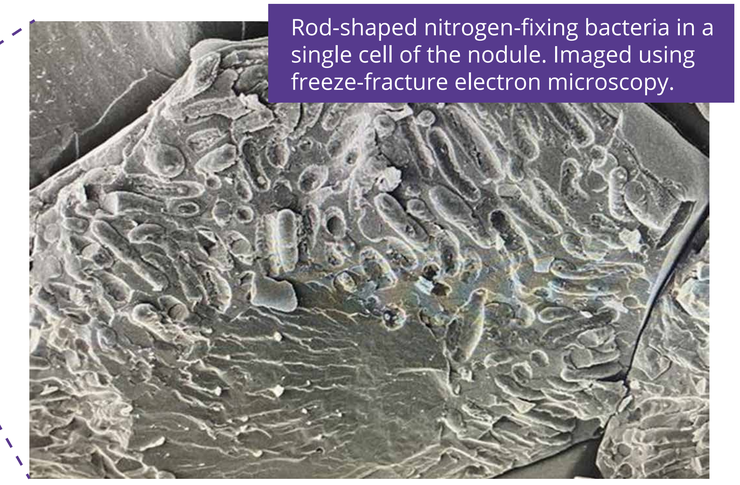
Communication across the membrane

Though these microbes live inside plant roots, they’re separated from the plant's cytoplasm by a membrane. Our research aims to understand how microbes and plants exchange nutrients and information across this interface.

Bacteria turn atmospheric nitrogen into ammonia fertiliser. Some plants, such as legumes, form dedicated organs (root nodules) to house the bacteria. —friends for 150 million years.

Next time you are in the garden, dig up a pea, bean or clover plant to have a look at the root nodules.



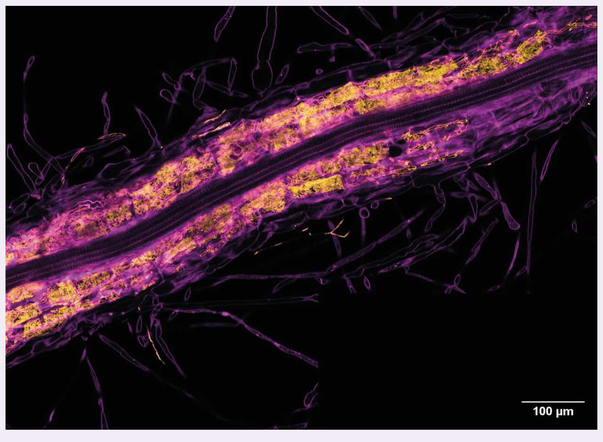


Rod-shaped nitrogen-fixing bacteria in a single cell of the nodule. Imaged using freeze-fracture electron microscopy.

Plants often reuse genes for new roles. A plant gene programme activated by bacteria grows nodules on roots. Some of the genes in this programme also function in flowers. We study how and why.

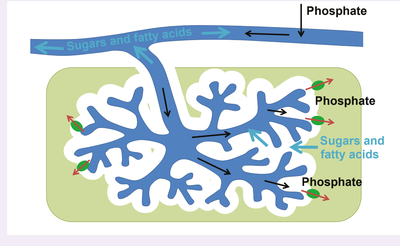
Fungi fetch phosphorus from far away in the soil and bring it to the roots—friends for >400 million years (even before flowers existed).

Revealing the fungus inside roots
These plants have been genetically modified to produce a beetroot pigment when a fungus is present. This allows us to track fungi in living roots.



Plants have a say in where beneficial fungi can live in their roots
Fungal hyphae are visualised by a yellow fluorescent protein that labels chitin in the hyphae. They only colonise specific root cell types, and do not invade the central water and nutrient transport tissues.

A highly branched fungal structure – the ‘arbuscule‘ is the heart of the mycorrhiza symbiosis. Here plant cells take up phosphate from the fungus, and give sugars and fats in return.



Images by Katharina Schiessl, Raymond Wightman, Temur Yunusov and Alex Guyon.