

# SHORT-CHAIN CHITIN OLIGOMERS AS FUNGAL SIGNALS DURING THE ESTABLISHMENT OF THE ARBUSCULAR MYCORRHIZAL ROOT SYMBIOSIS

Arbuscular mycorrhizal (AM) associations are ancient and widespread plant symbioses playing a central role in most plant ecosystems, both by improving soil nutrient uptake and by contributing to protection against fungal pathogens. A crucial step in the establishment of these root symbioses is the reciprocal exchange of chemical signals between the AM fungus and the host plant leading to mutual recognition. Despite the importance of these beneficial associations, several features of this molecular dialogue remain to be clarified, and in particular the nature and activity of the symbiotic signals of fungal origin (termed Myc factors).

In order to facilitate their identification, we developed a rapid and sensitive biological assay based on the activation of an AM-dependent signaling pathway in roots tissues of the model legume *Medicago truncatula*. This approach led to the discovery of short-chain chitin oligomers (COs) as potential candidates for secreted AM signals. These COs are biologically active at sub-micromolar concentrations, present in exudates of a range of AM fungi, and their levels in fungal exudates are dramatically increased in response to the presence of strigolactones, host symbiotic signals secreted by the plant root. These findings provide evidence that short-chain COs of AM fungal origin are part of a molecular dialogue which sets in motion this plant-microbe association.

It now remains to determine how these COs are perceived by the host, the nature of the downstream symbiotic genes which are up-regulated during the early stages of the interaction, and the precise role(s) of CO signals in relation to the recently discovered AM fungal-secreted lipo-chitooligosaccharides, which have been shown to stimulate both lateral root development and mycorrhization levels (Maillet & al., *Nature*, 2011, 469, 58-63).

**Foreground:**  
3-D structure of a  
short-chain chitin  
oligomer

**Background:** Spores of an  
arbuscular mycorrhizal fungus