At the Interface: Glycoproteins, Glycolipids, and WAK-mediated Signaling are Required for Plant-Microbial Symbiosis in Medicago truncatula

William Moore[1,2*] (wmoore@lbl.gov), Candace Chan[1], Oge Nnadi, [1] Paul Hussey[1], Nathan Hillson[1], and **Henrik Scheller**[1,2]

[1]Joint BioEnergy Institute, Lawrence Berkeley National Laboratory, Emeryville, CA
[2]Department of Plant & Microbial Biology, University of California, Berkeley

In nature plants interact with beneficial root associated bacteria and fungi that aid in nutrient uptake and promote plant growth and resilience. Here we use Medicago truncatula as a model plant to investigate the role of the plant cell surface in beneficial plant-microbe interactions with arbuscular mycorrhizal fungi (AMF) and nitrogen-fixing Sinorhizobium. The plant cell surface plays a key role in symbiosis by forming a specialized plant-microbial interface composed of plant-derived membranes, cell wall polysaccharides, and protein complexes, through which nutrients and information are bi-directionally exchanged[1,2]. It has previously been reported in the literature through the use of glycan-directed monoclonal antibodies that arabinogalactan proteins (AGPs) aggregate at the symbiotic interface in a variety of plant-microbe mutualisms, however, the identity of the genes encoding these glycoproteins has remained unknown[3-6]. Here we report the discovery of several AGP encoding genes in *M. truncatula* that are specifically expressed during symbiosis with either AMF or *Sinorhizobium meliloti*. Functional studies using RNAi-mediated knockdown of specific AGPs result in drastic symbiotic phenotypes, including poor mycorrhizal colonization and impaired nitrogen fixation in *Sinorhizobum* infected root nodules. In parallel, we have identified a wall-associated kinase (WAK)-like receptor and a glycosyltransferase enzyme involved in sphingolipid biosynthesis that are also required for symbioses. Our data indicate that glycopeptides, glycolipids, and WAK mediate signaling at the cell surface is necessary for establishing and maintaining symbiosis in *M. truncatula*.

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