Nodule organogenesis in Medicago truncatula requires local stage-specific auxin biosynthesis and transport

Xiao TT1,2,†, Shen D1,3,†, Müller S4,†, Liu J1, van Seters A4, Franssen H1, Bisseling T1, Kulikova O1,\*, Kohlen W1,4,\*

*E-mail of corresponding author: Wouter.kohlen@wur.nl*

*1Department of Plant Sciences, Laboratory of Molecular Biology, Cluster of Plant Developmental Biology, Wageningen University, Droevendaalsesteeg 1, 6708 PB, Wageningen, The Netherlands.*

*2Current address, College of Plant Science and Technology, Beijing Key Laboratory for Agricultural Application and New Technique, Beijing University of Agriculture, Beijing 102206, China.*

*3Current address, Max Planck Institute for Plant Breeding Research, Carl-von-Linne-Weg 10, D-50829 Cologne, Germany.*

*4Department of Plant Sciences, Laboratory of Cell and Developmental Biology, Cluster of Plant Developmental Biology, Wageningen University, Droevendaalsesteeg 1, 6708 PB, Wageningen, The Netherlands.*

The importance of auxin in plant organ development including root nodule formation is well established. Using auxin reporter constructs the spatiotemporal auxin distribution pattern during nodule development has previously been illustrated. However, our understanding of how this pattern is built-up and maintained still remains elusive.

To this end, we studied how the auxin gradient visualized by DR5 expression patterns at different stages of nodule development in Medicago truncatula (Medicago), is correlated with the spatiotemporal expression patterns of known auxin biosynthesis and auxin transport genes. In addition, we record the MtPIN10-GFP expression pattern and polar positioning on the cell plasma membranes during nodule primordium development to investigate the auxin flux. RNA interference and the application of auxin synthesis blockers were used to demonstrate the relevance of biosynthesis and transport at the initial stages of the nodulation process.

Our results show that upon rhizobium inoculation, preceding the first mitotic activity, a specific set of MtYUCs and MtPINs as well as MtLAX2 are expressed in the pericycle contributing to the creation of an auxin maximum. Overall, we demonstrate that dynamic spatiotemporal expression of both, MtYUCs and MtPINs, result in specific auxin outputs in subsequent stages of nodule primordia and nodule meristem formation.