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Hydropatterning: water availability regulates lateral root branching

Emily Morris (1), Valentin Couvreur (2), Craig Sturrock (1), Xavier Draye (2), and Malcolm Bennett (1)

(1) University of Nottingham, Centre for Plant Integrative Biology, Plant Science, United Kingdom , (2) Earth and Life Institute, Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium

When plant roots are faced with a difference in water availability across the root's circumference, lateral roots preferentially initiate into the area with more water. This root developmental response is termed hydropatterning. This shows roots are able to sense, and respond to, much smaller differences in water availability than previously thought. We hypothesise that this is an adaptive strategy to optimise resource capture by ensuring roots are growing in areas of high water availability and soluble nutrients. The aim of my PhD is to characterise this response and investigate what molecular pathways are triggered by the gradient of water availability. In order to visualise root systems in soil we have used X-ray computed tomography (CT) which allows us to observe hydropatterning in artificial macropores. All species tested have shown a clear hydropatterning response, suggesting this is a conserved mechanism. In order to understand how differences in water availability across the roots radius are perceived it is important to understand how water moves across the root. We hypothesised that hydropatterning would create an asymmetrical water flow from the wet to the dry side of the root. Simulating hydropatterning in the Model of Explicit Cross-section Hydraulic Architecture (MECHA) confirmed asymmetrical water flow. Knocking out plasmodesmata related proteins in *Arabidopsis thaliana* can disrupt the hydropatterning response, suggesting water movement through the plasmodesmata is a necessity to pattern lateral root initiation. This result provides an interesting hint as to how water might be sensed during hydropatterning.