Non-invasive water flow imaging in plant roots at cellular resolution

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A key impediment to studying water-related mechanisms in plants is the inability to non-invasively image water fluxes in cells at high temporal and spatial resolution. Here, we report that Raman microspectroscopy, complemented by hydrodynamic modelling using MECHA (Couvreur et al., 2018; Pascut et al., 2021), can achieve this goal - monitoring hydrodynamics within living root tissues at cell- and sub-second-scale resolutions. Raman imaging of water-transporting xylem vessels in *Arabidopsis thaliana* mutant roots reveals faster xylem water transport in endodermal diffusion barrier mutants. Furthermore, transverse line scans across the root suggest water transported via the root xylem does not re-enter outer root tissues nor the surrounding soil when en-route to shoot tissues if endodermal diffusion barriers are intact, thereby separating 'two water worlds' (Fig. 1).

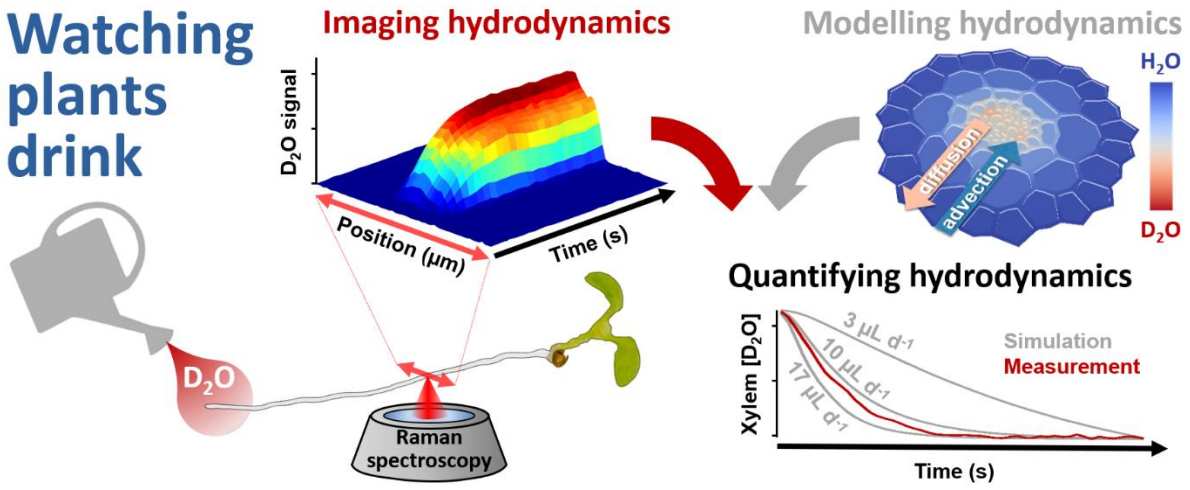

Figure 1: Graphical abstract showing the pipeline of (left) D_2O wash-in spatio-temporal dynamics data acquisition, and (right) comparison with simulated D_2O advection-diffusion during D_2O wash-out phase to estimate xylem water velocity

References

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