

PROJECT TITLE

Novel root architecture mutants in Arabidopsis

CONSORTIUM

P 1	Michael Djordjevic		
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SUMMARY OF THE REPORT

id: 158

acronym: NRAMA

title: Novel root architecture mutants in Arabidopsis

Root system architecture (RSA) influences the effectiveness of resources acquisition from soils but the genetic networks that control RSA remain largely unclear. We used rhizoboxes, and X-ray Computed Tomography at the Hounsfield facility in Nottingham to demonstrate that Arabidopsis and Medicago CEP (C-TERMINALLY ENCODED PEPTIDE)-CEP RECEPTOR signalling controls RSA and the gravitropic set-point angle (GSA) of lateral roots (LRs). We showed that soil-grown Arabidopsis and Medicago CEP receptor mutants have a narrower RSA, which results from a steeper LR GSA and this is clearly imaged using X-ray Computed Tomography for *Medicago*. Grafting shows that CEPR1 in the shoot controls GSA via a systemic mechanism. Concordantly, CEP peptides increased GSA in wild type but not *cepr1* mutants when examined using plate grown plants.

These studies were augmented by auxin transport measurements and hormone quantification studies in Arabidopsis and Medicago. CEP receptor mutants exhibited an increase in rootward auxin transport and elevated shoot auxin levels. Consistently, the application of auxin to wild-type shoots induced a steeper GSA and auxin transport inhibitors counteracted the CEP receptor mutant's steep GSA phenotype. Collectively, the results indicate that CEP-CEP receptor-dependent signalling outputs in Arabidopsis and Medicago control overall RSA, and the GSA of lateral roots as well as shoot auxin levels and rootward auxin transport. Although further studies are required to determine how CEP-CEPR1 signalling controls auxin levels and if this is causal to the changes in RSA, it is possible that manipulating CEP signalling strength or CEP receptor downstream targets may provide a means to alter RSA.

These studies led to a manuscript being published where the EPPN grant was gratefully acknowledged. Several figures and supplementary information including videos highlight the results obtained from using the Hounsfield facility and the collaboration with Craig Sturrock and Malcolm Bennett. The work conducted occurred during July 2019 where Prof Michael Djordjevic visited the Hounsfield facility.

Published manuscript:

Kelly Chapman, Ariel Ivanovici, Michael Taleski, Craig J. Sturrock, Jason L.P. Ng, Nadiatul A. Mohd-Radzman, Florian Frugier, Malcolm J. Bennett, Ulrike Mathesius, Michael A. Djordjevic (2020) CEP receptor signalling controls root system architecture in Arabidopsis and Medicago. *New Phytologist*. <https://doi.org/10.1111/nph.16483>