Reverse genetic analyses of *TERMINAL EAR*-like RNA-binding protein genes in *Arabidopsis thaliana* (L.) Heynh.

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ABSTRACT

In maize, a loss-of-function mutation in a *MEI2*-like gene, *terminal ear1* (*te1*), leads to morphological defects able to be traced back to the shoot apical meristem. One *MEI2*-like gene has been identified in maize, while six have been identified in rice and nine in *Arabidopsis thaliana.* In this thesis, a programme of reverse genetic analysis has been designed to investigate if *Arabidopsis* genes most closely aligned in parsimony trees with *TE1*, *TERMINAL EAR-LIKE 1* (*TEL1*), *TERMINAL EAR-LIKE 2* (*TEL2*), perform the same function as *TE1*. The expression pattern of *TEL1* and *TEL2* genes is restricted to the Shoot Apical Meristem (SAM) and the Root Apical Meristem (RAM) suggesting these genes are important in meristem maintenance or function. Results of the molecular genetic analysis of *TEL* genes in *Arabidopsis* support models in which these genes help maintain cells in a pluripotent state. For the first part of the thesis, analysis of lines carrying single knockouts of *TEL1* and *TEL2* and double knockout lines reveals a slightly accelerated rate of organogenesis, consistent with these genes normally acting to inhibit terminal differentiation pathways. Plants grown on medium containing gibberellic acid and sucrose, at higher than normal concentrations, present a further accelerated rate of organogenesis.

As the second part of the thesis, *in situ* and promoter/reporter GUS fusion analyses indicate *TEL1* is preferentially expressed in both the root and shoot apical meristems. Deletion analysis using GFP reporter constructs show that 5' sequences are sufficient to drive quiescent centre (QC) expression in the root while additional sequences are required for central zone (CZ) expression in the SAM. Physiological studies indicate expression of *TEL1* in the root is sensitive to the hormones, auxin, gibberellic acid and zeatin, when added at physiological concentrations. To confirm the auxin effect, GFP expression is no longer visible after 12 hours of exposure to auxin transport inhibitors in plants containing GFP under the control of the *TEL1* promoter, suggesting, in common with other QC markers, that *TEL* expression is sensitive to auxin levels. Analysis of mutant plants with altered root patterning suggests QC specific expression of *TEL1* requires early acting genes, such as *PLETHORA 1* and *2*, but does not depend on later acting genes such as *SCARECROW* or *SHORTROOT*.

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