

A “PLETHORA” of Controls

Recently, a gene network of the AP2-family of transcription factors known as PLETHORA (PLT) was determined to function as the regulators of *de novo* shoot regeneration. The important implication from this work was that regardless of the starting explant tissue (shoot- or root-derived), regeneration is controlled through two key regulatory steps: 1) regeneration competence and 2) induced shoot regeneration (Figure 1). The transcription factors PLT3, 5, and 7 coordinate both steps of this regenerative process. First, they function to trigger the reprogramming of the explant cells into a competent state for regeneration by upregulating the known root apical meristem cell maintenance factors PLT1 and PLT2 (see also Figures 7.6 and 7.7). Secondly and independently, PLT3, 5, and 7 also induce CUP-SHAPED COTYLEDON2 (CUC2) expression that serves as a master regulator of shoot differentiation (Kareem et al. 2015).

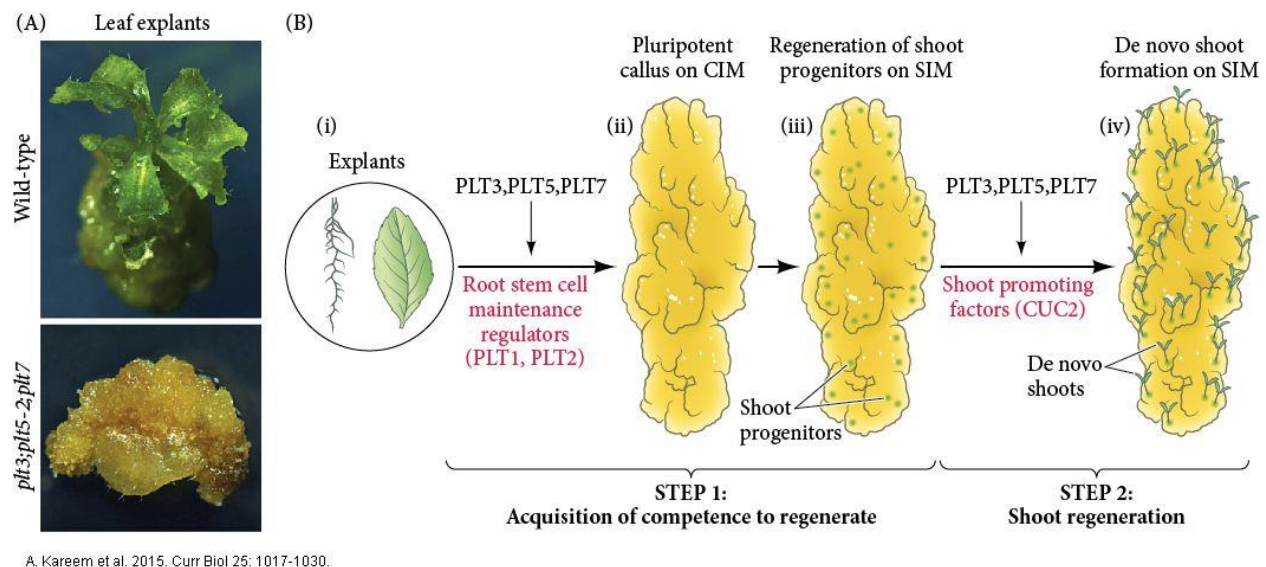


Figure 1 The PLETHORA network controls callus and shoot regeneration. (A) Leaf ex-plants with loss-of-function mutations in *plt3*, 5, and 7 fail to regenerate de novo shoot structures. (B) Schematic showing the role of PLETHORA genes in regulating both root stem cell maintenance and shoot promoting factors over the course of regeneration. CIM, callus induction medium; SIM, shoot induction medium.

Literature Cited

Kareem A., K. Durgaprasad, K. Sugimoto, Y. Du, A. J. Pulianmackal, Z. B. Trivedi, P. V. Abhayadev, V. Pinon, E. M. Meyerowitz, B. Scheres, K. Prasad. (2015) PLETHORA Genes Control Regeneration by a Two-Step Mechanism. *Curr Biol.* 25(8): 1017–1030.

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