

IN BRIEF

A Role for Plant AURORA Kinases in Formative Cell Division

Throughout plant development, new tissues and cell types arise from asymmetrical, formative divisions (reviewed in De Smet and Beeckman, 2011). Although much progress has been made in understanding how division planes are oriented in symmetrically dividing cells (reviewed in Rasmussen et al., 2011), less is known about how orientation is established during asymmetrical division. New work from **Van Damme et al. (pages 4013–4024)** describes a role for *Arabidopsis thaliana* Aurora kinases in this process.

Aurora kinases are key regulators of mitosis in animals and yeast (reviewed in Carmena et al., 2009) and have been shown to function in polarity determination during formative divisions in *Drosophila melanogaster* (Wirtz-Peitz et al., 2008). Although the *Arabidopsis* genome lacks homologs of AURORA (AUR)-interacting polarity determining proteins from other kingdoms, it encodes three AUR proteins. AUR1 and AUR2 are together referred to as the α group, whereas AUR3 makes up the β group.

In their work, Van Damme et al. examined *aur1* and *aur2* T-DNA insertion mutants, finding no obvious phenotype in the single mutants. Strong alleles were gametophyte-lethal in combination, but the authors

identified a weaker *aur1-2* allele that gave rise to a viable double mutant when combined with *aur2-2* (see figure). These plants had short internodes, which led to bushy but fertile plants. They also had slightly shorter main roots and significantly fewer lateral roots than did the wild type or the single mutants. Constructs containing AUR1 or AUR2 could rescue the double mutant, but constructs with AUR3 could not, even when driven by the functional AUR1 promoter. Thus, there is redundancy within the α group and diversification of α and β group function.

When Van Damme et al. examined the lateral root defects in the double mutant, they found that the normal pattern of 90° switches in orientation of divisions during lateral root primordium formation was altered. Instead, mutant lateral root primordia were made by random divisions, a phenotype that could be rescued by AUR1 or AUR2 expression. In a clever experiment designed to test whether this phenotype was due to defects in determination of the division plane or because AURs function at the cell plate, the authors made a construct leading to degradation of the introduced AUR1 before cytokinesis (by fusing it to the CYCLINB1;1 destruction

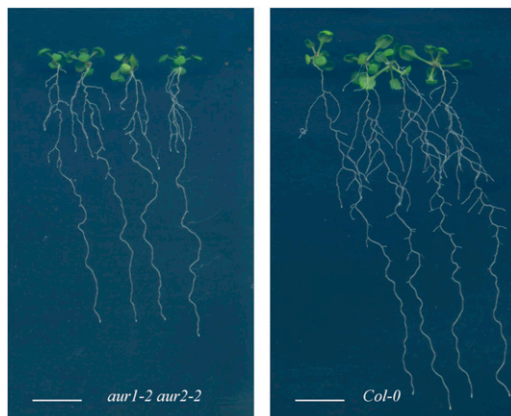
box). This construct was able to complement the double mutant phenotype, showing that high levels of α AUR function are not essential during cytokinesis and pointing to a role for α AURs in the establishment of the plane of division before cytokinesis.

The authors went on to examine other tissues and developmental stages in the double mutant, finding that AUR1 and AUR2 are likely involved in determining the orientation of the division plane in formative cell divisions throughout plant development. In their work, the authors elegantly circumvented some of the typical difficulties in studying regulators of vital processes (e.g., lethality of mutations in the genes) to provide an in-depth look at the roles of these conserved kinases in plants.

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The viable double mutant *aur1-2 aur2-2* has shorter main roots and fewer lateral roots than wild-type plants. (From Figure 1 of Van Damme et al. [2011].)