

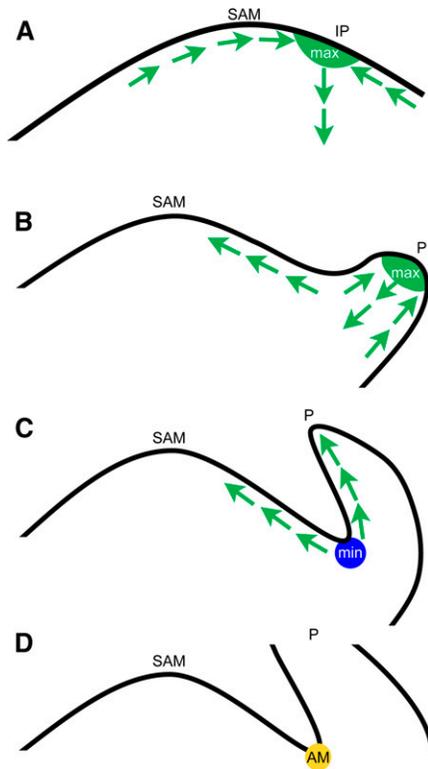
IN BRIEF

The Importance of Being Absent: Auxin Minima Are Required for Axillary Meristem Formation

Shoot branching is critical in determining plant architecture, and much of the plasticity of plant form arises from axillary buds, which exist at the base of each leaf and can remain dormant indefinitely or grow out to produce a branch. Axillary bud outgrowth is therefore important to plant responses to the environment and to agronomic characteristics including yield. As with so many other aspects of plant development, phytohormones are vital to branching: Axillary bud outgrowth is regulated by strigolactones, auxins, and cytokinins. Axillary meristem (AM) initiation has received less attention than outgrowth, but it appears to involve brassinosteroids (reviewed in Janssen et al., 2014). Now, companion papers report that localized auxin minima are needed for the formation of AMs in the shoot apex (Q. Wang et al., pages 2068–2079; Y. Wang et al., pages 2055–2067).

The two groups used reporters to visualize auxin signaling activity in the shoot apex. They both not only found high auxin levels in the shoot apical meristem and in new leaf primordia, as previously reported (reviewed in Vernoux et al., 2010), but also observed areas of low auxin in the boundary zone between the shoot apical meristem and the leaf primordia, where axils form (see figure). Using mutants and chemical treatments, both groups found that auxin efflux mediated by PINFORMED (PIN) transporters was required for the production of the localized auxin minima. Consistent with these minima being important for AM formation, both groups also found that *pin1* mutants are defective in AM formation.

They then used various strategies to manipulate auxin concentrations in incipient leaf axils. Both groups found that fewer AMs were formed when auxin biosynthesis was upregulated in *Arabidopsis thaliana* leaf axils (thereby disrupting the formation of auxin



Auxin distribution and AM formation. Auxin flux in the shoot apical meristem (SAM) leads to a local auxin maximum (green) at the site of the incipient leaf primordium ([A]; IP). As the primordium (P) grows out, auxin transport generates a local auxin minimum (blue) that promotes AM formation ([B] to [D]). (Adapted from Q. Wang et al. [2014a], Figure 7.)

minima) by targeted expression of a bacterial auxin biosynthesis gene. Consistent with this, application of exogenous auxin to leaf axils suppressed AM initiation in tomato (*Solanum lycopersicum*; Y. Wang et al., 2014). Conversely, repression of auxin signaling in *Arabidopsis* axils increased the number of

side shoots generated by the plants, suggesting that these areas of auxin unresponsiveness behaved as artificial minima and promoted AM initiation (Q. Wang et al., 2014). These complementary findings nicely demonstrate that auxin minima are central to AM formation.

Y. Wang et al. (2014) also provide evidence that the auxin minima induce a transient accumulation of cytokinin in the same region that also appears to be necessary for AM formation. Together, these two reports represent a great step forward in understanding AM initiation, an overlooked aspect of plant development, and underscore the importance of heterogeneous hormone distribution in plant patterning.

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