Auxin Regulation of Late Stamen Development

Pollination in self-fertilizing plants depends on the proper timing of filament elongation, anther dehiscence, and pollen maturation so that pollen grains capable of germination are deposited on the stigma surface. Auxin is known to be necessary for stamen development. For example, Cheng et al. (2006) found that stamen development is halted in the Arabidopsis auxin biosynthesis-defective mutant yuc2 yuc6. Cecchetti et al. (pages 1760–1774) now show that auxin is critical for late stages of stamen development in Arabidopsis, extending the authors’ previous work (Cecchetti et al., 2004), suggesting a role for auxin in this process in tobacco. These results allow for a detailed model of the role of auxin in late stamen development, involving the location and timing of auxin biosynthesis, transport, and perception.

The late stages of stamen development (anther dehiscence, pollen maturation, and preanthesis filament elongation) start in anthers after the end of meiosis (stage 10) and are completed at anthesis (stage 13). First, experiments involving the use the auxin-inducible marker DR5:GUS suggested that auxin accumulates in anthers at the end of meiosis. Examination of the tissue-specific expression of the auxin biosynthesis genes YUC2 and YUC6 showed that these genes are actively transcribed in anther tissues before the DR5 promoter is activated. Disruption of auxin transport into the anthers further supported the conclusion that DR5 activation was mainly due to newly synthesized auxin in anther tissues in late stamen development.

Next, the authors examined the expression of the auxin receptor genes TIR1, AFB1, AFB2, and AFB3 and found that all four are transcribed in partially overlapping developmental patterns in stamens (and pistils) at late developmental stages. Finally, Cecchetti et al. examined stamen development in the auxin perception-defective tir1 afb2 afb3 triple mutant and tir1 afb1 afb2 afb3 quadruple mutant (both of which still produce fertile flowers). The results suggest that auxin perception is required for late stamen development since the loss of auxin receptor function resulted in precocious pollen maturation and anther dehiscence (see figure) as well as reduced filament elongation. This study supports a model wherein auxin synthesized in the anthers after meiosis plays a crucial role in the regulation of late stamen development.

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Earl anther dehiscence in auxin receptor mutant flowers due to premature endothecium lignification. Wild-type and tir1 afb1 afb2 afb3 anthers at stage 10, visualized by fluorescence microscopy: lignification is absent in wild-type endothecium but abundant in the endothecium of tir1 afb1 afb2 afb3 anthers (arrowheads). T, tapetum. Bars = 20 μm.
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