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Control of Flowering

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Whilst many environmental and endogenous factors regulate when plants flowers, one of the most pivotal of these is day length. Plants can generally be divided into those which flower in response to short (SD) or long days (LD). *Arabidopsis thaliana* has long been used as a model for the analysis of flowering of LD plants. In this species the *G1* gene product activates *CO*, which then activates a downstream floral activator (*FT*) resulting in flowering under LD conditions. In the April 17 Nature, Hiyama and colleagues from The Nara Institute of Science and Technology, Japan investigated the role of the orthologues of *GI*, *CO* and *FT* - *OsGI*, *Hd1* and *Hd3a* respectively - in rice, a SD plant (*Nature* 2003, **422:**719-722). They find that the rice orthologues act differently to control flowering.

Hiyama *et al.* generated transgenic rice that overexpress *OsGI* under both SD and LD conditions. These mutants flower later than wild-type plants, suggesting that in rice *OsGI* is a suppressor of flowering, in contrast to the situation in *A. thaliana*. Comparison of mRNA levels of the downstream targets of *OsGI* - *Hd1* and *Hd3a* - showed no differences in *Hd1* mRNA levels relative to wild-type, regardless of growth conditions. In wild-type plants *Hd3a* expression is inhibited under LD conditions, and has diurnal levels under SD conditions. No *Hd3a* mRNA could be detected in the *OsGI* transgenics, however, consistent with the late-flowering phenotype. The authors suggest that under LD conditions *Hd1* expression suppresses expression of *Hd3a* in rice.

Thus, in *A. thaliana*, under LD conditions *GI* activates *FT* via *CO*, but in rice *OsGI* activates *Hd1* (the *CO* ortholog), which under LD conditions suppresses *Hd3a* (the *FT* ortholog) expression - resulting in suppression of flowering.

The authors conclude that "an important gene network for the photoperiod control of flowering is conserved between *Arabidopsis* and rice, but that the regulation of the downstream gene by an upstream regulatory gene is reversed in the two species. These findings suggest the existence of common mechanisms for the photoperiodic control of various processes in diverse plant species."

References

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