research highlights

GRASS STOMATA DEVELOPMENT MUTE communication

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Stomata are little pores that interrupt the waxy and impermeable epidermal surface of the plant to allow gas exchange with the atmosphere. In eudicot plants, the pores are bordered by two bean-shaped guard cells and distributed evenly across leaf surfaces following strict spacing

rules. In the diverse family of grasses that includes the domesticated cereals uniquely important for human history, stomata have a more complicated structure, with two dumbbell-shaped guard cells flanked on each side by two more helper cells called subsidiary cells (SCs). In an Article published in *Science*, Dominique Bergmann from Stanford and colleagues discover the molecular mechanism behind the development of SCs, which may explain the adaptability and success of grasses.

The stomata developmental pathway in *Arabidopsis* has been extensively explored and used to study cell fate and asymmetrical division in plants. Several transcription factors in this pathway are conserved in the model grass *Brachypodium distachyon* (Bd). A genetic screen uncovered one mutant without SCs, suddenly cancelling millions of years of evolution. The affected gene is a basic helix–loop–helix transcription factor called MUTE, the orthologue of which in *Arabidopsis* controls guard mother

cell identity and so the development of guard cells.

In *Brachypodium*, MUTE plays a slightly different role. BdMUTE is very precisely expressed in future stomata and, unlike its *Arabidopsis* counterpart, diffuses to the neighbouring cells to induce the asymmetrical division that will create SCs. Switching to physiological whole plant assays, the authors show that without the SCs, the mutant stomata cannot open wide or close tightly, gas exchange is limited, and their response to changing conditions is much slower. The ultimate consequence is a lower growth rate.

Stomata manage the delicate balance between plant carbon assimilation and water loss. Manipulating stomata to get better yields is slowly becoming a realistic option to make more efficient crops. By understanding the details of their development, we may not have to wait another 300 million years for the next evolutionary innovation.

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