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LEAF MORPHOGENESIS

Pitcher perfect

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The leaves of plants can take on many different shapes from simple flat vaguely oval disks seen in *Arabidopsis* to the complicated horn shaped traps of the carnivorous pitcher plants. Kenji Fukushima and colleagues have studied the purple pitcher plant, *Sarracenia purpurea*, and found that changes in the orientation of cell division in the developing leaf form the basis of the creation of their lethal 'trumpets'.

The diversity of leaf structures is created by the interplay of the layers of cells lying on their adaxial and abaxial sides. These two surfaces are determined by the mutually exclusive expression of different sets of transcription factors, with cell division and growth being stimulated at the junction between these domains. If the layers grow at approximately the same rate simple flat leaves result but any disparity produces mechanical tensions that mould more exotic morphologies.

Fukishima *et al.* saw that the early development of the *S. purpurea* leaf looked no different to that of *Arabidopsis* but soon the abaxial region began to dominate restricting adaxial identity to a band on one side of the organ. In the distal part of the developing leaf this produced a hollow, but in the proximal region a ridge of adaxial tissue is maintained creating a tube. Using microscopy to inform mathematical modelling the researchers showed that although the cells forming the hollow divide longitudinally to the leaf axis, the division plane of the cells underlying the ridge is rotated through 90 degrees. This periclinal division is sufficient to create the different structures in the growing leaf and so the ornate architecture of the adult pitcher. *CS*

RNA INTERFERENCE

Avoiding self-harm

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Plants use post-transcriptional gene silencing (PTGS) to guard against the invasion of foreign genes, such as viral genomes and transgenes, but endogenous transcripts escape being silenced. By a comprehensive analysis of *Arabidopsis* mutants, Xinyan Zhang, of Peking University, and colleagues show that bidirectional cytoplasmic RNA decay pathways repress the unwanted PTGS of endogenous coding genes.

The exoribonuclease EIN5 and the SKI–exosome complex mediate cytoplasmic 5′–3′ and 3′–5′ RNA decay pathways, respectively. The researchers found that the disruption of either pathway in *ein5* or *ski2* single mutants caused the co-suppression of both exogenous transgenes and their cognate endogenous genes. Moreover, this suppression depended on the RNA-dependent RNA polymerase RDR6, an essential component of PTGS, indicating that compromising RNA decay removes a restraint on the activity of PTGS.

The double mutant, *ein5 ski2*, with compromised RNA decay, shows striking growth defects and transcriptomic changes, demonstrating the detrimental effect of unwanted PTGS acting on endogenous genes. The developmental anomalies were rescued by PTGS mutations affecting the 21- or 22-nt siRNA pathway, confirming that bidirectional cytoplasmic RNA decay pathways repress PTGS.

The researchers identified 441 siRNAs derived from coding transcript (ct-siRNAs) upregulated in *ein5 ski2* compared with the wild type. These ct-siRNAs mediate the silencing of their cognate genes and likely contribute to the detrimental effect of unrestrained PTGS. *JL*

STOMATAL DEVELOPMENT

Securing a lineage

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The structural organization needed for efficient multicellularity derives from asymmetric cell divisions during development, which create functionally diverse and spatially oriented cells and tissues. A model pathway of such symmetry breaking is the stomatal lineage in *Arabidopsis*. Juan Dong and colleagues have discovered a new mechanism in this signalling cascade, connecting the polarization of molecular players with the fate of daughter cells.

The protein BASL was previously identified as critical for establishing polarity prior to asymmetrical division in the stomatal lineage. BASL has a striking crescent-shaped subcellular localization, and mutants lacking BASL lost the ability to divide asymmetrically during stomata patterning.

The presence of MAP kinase (MAPK) docking sites helped to integrate BASL in the already known pathway controlling cellular transitions. Specifically BASL is a target of the MAPK cascade containing YODA, MKK4/5 and MPK3/6. Once phosphorylated, BASL adopts its polarized location and acts as a scaffold protein, recruiting YODA and MPK3/6 to the cortical side of the dividing cell. Thus a reinforcing feedback loop is created, inhibiting stomatal fate in one of the daughter cells.

This self-organizing loop ensures the establishment of polarity and connects polarity with cell fate. Moreover, as MAPKs have many substrates, subcellular sequestering of a whole signalling cascade could play a role in the cascade's functional specificity. *GT*

INVASIVE SPECIES

Sizing up the competition

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Genome size can serve as an indicator of species invasiveness in relatively high light environments, where weeds often have smaller genomes than native plants. An analysis of the genome size of native and invasive forest shrubs suggests that genome size can also serve as an indicator of invasiveness under more light-limited conditions.

Jason Fridley and Alaä Craddock, of Syracuse University, examined the physiology, growth characteristics and genome size of 54 species of woody shrubs and vines that grow in the deciduous forests of the eastern US. Both native and invasive plants were included in the analysis. Invasive species had smaller genomes and higher photosynthetic capacities, and exhibited more rapid summer growth, than native species. Species with smaller genomes also exhibited delayed budbreak during spring, but this trait was unrelated to invasiveness.

The researchers suggest that the small size of invasive plant genomes permits more rapid rates of cell division, and thus increased growth — relative to native plants — as temperatures rise during the growing season, putting these plants at a competitive advantage. *AA*

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