PLANT CELL BIOLOGY

New receptors for ABA

> “…PYR1 and PYLs are at the apex of a negative regulatory pathway that controls ABA signalling…”

The identities of the receptors for abscisic acid (ABA) — a plant hormone that inhibits growth and regulates plant stress responses — have been elusive. Many factors have been proposed to be ABA receptors, but their ability to bind to ABA and to regulate diverse ABA responses has not been unequivocally confirmed. Two studies in *Science* now provide new important insights.

Park *et al.* identified *PYRABACTIN RESISTANCE 1* (*PYR1*) in a chemical genetic screen using pyrabactin, a selective ABA agonist that inhibits only some of the pathways that are regulated by ABA. *PYR1* encodes one of the 14 members of the START family of proteins, which share a conserved hydrophobic ligand-binding pocket. Triple and quadruple *pyr1* and *pyr1-like* (*pyl*) mutants are insensitive to ABA *in vivo*, but expression of *PYR1* or *PYL4* reverts the phenotype. These results suggest that PYR1 and PYLs are functionally redundant and mediate multiple ABA responses *in vivo*.

Ma *et al.* independently identified the same 14 member protein family (and named it RCAR, for regulatory component of ABA receptor) in a yeast two-hybrid screen for plant proteins that interact with ABI2 — one of the 9 redundant type 2C protein phosphatases (PP2Cs) that negatively regulate ABA signalling. A single amino acid mutation in ABI1 or in its structural homologue ABI2 abolishes the interaction with RCAR1 (PYL9) and confers dominant insensitivity to ABA. Furthermore, RCAR1 and related proteins bind ABA and block the phosphatase activity of PP2Cs in an ABA-dependent manner *in vivo*. The ABA affinity of the RCAR1–ABI2 protein complex is much higher than that of RCAR1, which is consistent with a heteromeric receptor complex. Transgenic plants that express high levels of RCAR1 are hypersensitive to ABA, and reducing the expression of RCAR1 by RNA interference counteracts the ABA response.

Using biochemical and genetic approaches, Park *et al.* found that ABA promotes interaction of PYR1 with group A PP2Cs. This interaction also leads to the inhibition of the enzymatic activity of PP2Cs. Notably, these findings also identify the first known regulators of PP2Cs. In light of these results, both teams conclude that PYR1, PYLs and RCARs form, in combinations with different PP2Cs, a large family of ABA receptors.

Park *et al.* propose that PYR1 and PYLs are at the apex of a negative regulatory pathway that controls ABA signalling by inhibiting PP2Cs. The redundancy in this family of co-receptors has been an obstacle to their identification as factors that are necessary for ABA responses. The use of a synthetic ABA agonist has proven to be a powerful approach for bypassing genetic redundancy and has provided insights into the long-sought identity of the ABA receptors. Given the crucial role of ABA signalling for plant drought and stress tolerance, pyrabactin promises to have important future applications.

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ORIGINAL RESEARCH PAPERS Park, S.-Y. *et al.* Abscisic acid inhibits type 2C protein phosphatases via the PYR/PYL family of START proteins. *Science* 30 Apr 2009 (doi:10.1126/science.1173041) | Ma, Y. *et al.* Regulators of PP2C phosphatase activity function as abscisic acid sensors. *Science* 30 Apr 2009 (doi:10.1126/science.1172408)