A doorman in plant cells

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Scientists at the University of Tübingen, Germany identified important signalling-protein for the stress-response of plant cells. The research group of Klaus Harter at the Centre for Plant Molecular Biology (ZMBP), University of Tübingen, Germany, identified the AHK5 as an important signalling-protein for the stress-response in plant cells.

Stomatal guard cells monitor and respond to environmental and endogenous signals such that the stomatal aperture is continually optimised for water use efficiency. A key signalling molecule produced in guard cells in response to plant hormones, light, car-bon dioxide and pathogen-derived signals is hydrogen peroxide (H_2O_2). The mecha-nisms by which H_2O_2integrates multiple signals via specific signalling pathways lead-ing to stomatal closure is not known.

Klaus Harter and his team, together with the research groups of Alfred Meixner, Insti-tute for Physical and Theoretical Chemistry, University of Tübingen, Germany and of Radhika Desikan, Imperial College London, UK identified a pathway by which H_2O_2, derived from endogenous and environmental stimuli, is sensed and transduced to ef-fect stomatal closure. Histidine kinases (HK) are part of two-component signal trans-duction systems that act to integrate environmental stimuli into a cellular response via a phosphotransfer relay mechanism. There is little known about the function of the HK AHK5 in Arabidopsis thaliana. Here we report that in addition to the predicted cyto-plasmic localisation of this protein, AHK5 also appears to co-localise to the plasma membrane. Although AHK5 is expressed at low levels in guard cells, we identify a unique role for AHK5 in stomatal signalling.

Arabidopsis mutants lacking AHK5 show reduced stomatal closure in response to H_2O_2, which is reversed by complementation with the wild type gene.

Over-expression of AHK5 results in constitutively less stomatal closure. Abiotic stimuli that generate endogenous H_2O_2, such as darkness, nitric oxide and the phytohormone ethylene, also show reduced stomatal closure in the ahk5 mutants. However, ABA caused closure, dark adaptation induced H_2O_2production and H_2O_2induced NO syn-thesis in mutants. Treatment with the bacterial pathogen associated molecular pattern (PAMP) flagellin, but not elf peptide, also exhibited reduced stomatal closure and H_2O_2generation in ahk5 mutants.

These findings identify an integral signalling function for AHK5 that acts to integrate multiple signals via H_2O_2homeostasis and is independent of ABA signalling in guard cells.

Source: Universitaet Tuebingen