

# 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, carbon dioxide and pathogen-derived signals is hydrogen peroxide ( $H_2O_2$ ). The mechanisms by which  $H_2O_2$  integrates multiple signals via specific signalling pathways leading to stomatal closure is not known.

Klaus Harter and his team, together with the research groups of Alfred Meixner, Institute 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 effect stomatal closure. Histidine kinases (HK) are part of two-component signal transduction 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 cytoplasmic 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  $\text{H}_2\text{O}_2$ , 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  $\text{H}_2\text{O}_2$ , 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  $\text{H}_2\text{O}_2$  production and  $\text{H}_2\text{O}_2$  induced NO synthesis in mutants. Treatment with the bacterial pathogen associated molecular pattern (PAMP) flagellin, but not elf peptide, also exhibited reduced stomatal closure and  $\text{H}_2\text{O}_2$  generation in *ahk5* mutants.

These findings identify an integral signalling function for AHK5 that acts to integrate multiple signals via  $\text{H}_2\text{O}_2$  homeostasis and is independent of ABA signalling in guard cells.

Source: Universitaet Tuebingen

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