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## **The role of AGC3 kinases and calmodulins in plant growth responses to abiotic signals**

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## Stellingen (Propositions)

Behorende bij het proefschrift

### The role of AGC3 kinases and calmodulins in plant growth responses to abiotic signals

1. TCH3 sequesters PID and WAG2 from the plasma membrane to the cytoplasm by interacting with these protein kinases.

*This thesis*

2.  $\text{Ca}^{2+}$ -dependent and TCH3-mediated PID internalization accelerates the root gravitropic response by enhancing the asymmetric auxin distribution in the root tip.

*This thesis*

3. An overlapping amphipathic alpha helix and IQ-like motif in the PID insertion domain mediate both calmodulin binding and plasma membrane association of this protein kinase.

*This thesis*

4. Reversible PIN1 phosphorylation by the AGC3 kinases PID and WAG2 is important for maintaining spiral phyllotaxis in *Arabidopsis*.

*This thesis*

5. Elevated  $[\text{Ca}^{2+}]_{\text{cyt}}$  could be the central signal in the initial induction of *TCH3* expression by many different signals, including auxin and touch.

*Braam and Davis. (1990) Cell 60, 357-364.*

*Braam. (1992) Proc.Natl.Acad.Sci. 89, 3213-3216.*

*Lee et al. (2005) New Phytol. 165, 429-444.*

*Nakagawa et al. (2007) Proc.Natl.Acad.Sci. 104, 3639-3644.*

6. The two antagonistic effects of auxin on PID activity, on the one hand the enhancement of *PID* expression and on the other the TCH3-mediated repression of the enzymatic activity of the kinase, illustrate the complex control of auxin on its own transport.

*Benjamins et al., (2003) Plant Physiol, 132, 1623-1630.*

*Benjamins et al. (2001) Development, 128, 4057.*

*Galvan Ampudia (2009) Thesis, Leiden University.*

7. The observed chemical instability of the natural auxin IAA under normal experimental conditions underlines the important role of auxin biosynthesis in the action of this plant hormone.

*Paciorek et al. (2005) Nature 435, 1251-1256.*

8. In view of the role of Auxin Binding Protein1 as apoplastic auxin receptor, it is striking that its action has not yet been linked to auxin-induced cell wall acidification or calcium signaling.

*Robert et al. (2010) Cell, 143, 111-121.*

*Effendi et al. (2011) Plant J, 65, 282-294.*

*Tromas et al. (2013) Nature Commun, 4, 2496.*

*Xu et al. (2014) Science, 343, 1025-1028.*

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