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## **The Chara plasma membrane system : an ancestral model for plasma membrane transport in plant cells**

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## Stellingen

Propositions accompanying the thesis

### **The *Chara* plasma membrane system: an ancestral model for plasma membrane transport in plant cells**

1. The binding of the 14-3-3 protein to a phosphothreonine at the penultimate position on the R-domain of plant plasma membrane  $H^+$ -ATPases can activate the proton pump. Fusicoccin can induce the binding of the 14-3-3 protein to the R-domain even in the absence of the phosphothreonine, but the binding is less tight (Michael G Palmgren, 2001; Duby and Boutry, 2009).
2. The Zygnematophyceae, a group of mostly unbranched filamentous or single-celled organisms, have recently been shown to be most likely the closest living ancestors of land plants (Domozych et al., 2016; Delwiche and Cooper, 2015).
3. Asymmetrical (polar) localization of auxin transporters, namely the PIN-FORMED (PIN) proteins, determines the direction of auxin flow between cells, which in turn provides directional and positional information for the development of multicellular tissues by linking information at the level of individual cells to a coordinated developmental output (Viaene et al., 2014).
4. It seems likely that the plasma membrane  $H^+$ -ATPases in *Chara* cells are inactivated when the  $H^+$ / $OH^-$  channels are open; otherwise, the pH banding mechanism along the cells would be inefficient (Beilby and Casanova, 2014).
5. The phosphorylation of the plasma membrane  $H^+$ -ATPases in the hypocotyl is regulated by the phototropins, which is important for the establishment of asymmetric hypocotyl growth during phototropism (Hohm et al., 2014).
6. *Chara* plasma membrane  $H^+$ -ATPases cannot be activated by exogenous auxin (This thesis).
7. *Chara* plasma membrane  $H^+$ -ATPase CHA1 possesses an auto-inhibition domain at the C-terminal, which likely does not include 14-3-3 protein regulation (This thesis).
8. Bio-informatics studies into the green algae plasma membrane  $H^+$ -ATPases protein structure may reveal a new conserved amino-acid combination pattern among the algae which is different from the known PM  $H^+$ -ATPases from plants and yeast (This thesis).

9. The successful culture of *Chara* is a delicate balance between the growth of *Chara* and suppression of the secondary algae/fungi/bacterial growth (This thesis).
10. Doing a PhD study is like an out-door treasure hunting game.
11. Life is about BALANCE.