

**Abscisic acid and the outer space of moss:
Analysis of genes encoding extracellular proteins in *Physcomitrella patens***

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The plant cell wall yields protection against mechanical, chemical and pathogenic influences for the cell and the whole organism. The cell wall enables and controls the exchange of water and other substances as well as the communication between cells and between individual plants. This is of specific importance for *Physcomitrella patens*, since the moss has no vascular tissue.

Ten extracellular proteins of *Physcomitrella* were identified and characterized. Signal peptides were analysed using fusion constructs and proven to be highly efficient for secretion of heterologous proteins. Expression analyses revealed that eight of the ten genes are regulated by the phytohormone abscisic acid (ABA). ABA leads to a drastic increase of cell wall thickness in *Physcomitrella*-cultures. For two genes encoding the cell wall modifying proteins PpPME1 (Pectin methylesterase) and PpXTH1 (Xyloglucan endotransglycosylase/hydrolase), knockout as well as overexpression mutants were generated. Knockout mutants of another gene encoding the extracellular protein PpFLP (fasciclin-like protein), which has no homologs in higher plants, were analysed. All mutant plants showed an aberrant phenotype compared to wildtype. The mutants were severely affected in their protoplast regeneration capacity; the chloronema cells exhibited differences in size as well as in cell wall thickness. Most of the mutants had smaller leaflets resulting in dwarfed gametophores. The ABA-sensitivity in *Pppme1*- and *Ppxth1*-mutants was altered. The results implicate that all three proteins are important for cell wall construction as well as for the development of the whole plant. In addition, PpPME1 and PpXTH1 play a role in ABA-sensitivity and PpPME1 and PpFLP were shown to be involved in chloroplast division.

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