

## The role of polycomb proteins in *Physcomitrella* gametophytic phase transition

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Development of multicellular organisms is controlled largely by transcription regulatory genes which must be temporally and spatially regulated to ensure proper differentiation of cells, tissues and organs. Polycomb group proteins (PcG) operate as part of complexes, maintaining the repressed transcriptional state of genes. These complexes affect the degree of localized chromatin condensation, and suppress homeotic gene transcription. Mutations in polycomb genes derepress the expression of homeobox transcription factor genes resulting in subsequent homeotic transformations. In *Arabidopsis*, the PcG complex contains three main protein families: WD, single zinc finger and SET domain proteins. Mutation in each of the *Arabidopsis* PcG proteins triggered improper developmental programs of the gametophyte and/or the sporophyte. For example, mutation in the WD40 protein FIE, homolog of ESC from *Drosophila*, develops endosperm without fertilization. Using the *Physcomitrella* as a model system representing early terrestrial plants, we examine PcG functional evolution. We have identified putative *Physcomitrella* PcG genes including *PpFIE*. To elucidate *PpFIE* function, we have generated knockout plants, which display a dramatic phenotype. The mutants arrest at the gametophytic bud formation and the abnormal buds continues to proliferate extensively, instead of differentiating gametophores bearing gametes. To monitor the expression pattern *in vivo* of each PcG gene throughout plant development, we are generating transgenic moss plants harboring fusion between the endogenous PcG genes and a GUS reporter. The degree of functional conservation along evolution is examined by reciprocal complementation assays presenting the Moss genes in *Arabidopsis* mutant plants and *vice versa*. The combined approach presented above demonstrates the central role of PcG during gametophytic phase transition throughout plant evolution.