

## Identification of two genes encoding a ubiquitin-like protein, which is predominantly expressed in apical cells of the moss *Physcomitrella patens*.

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Postembryonic growth of land plants occurs from the meristem, a localized region that gives rise to all adult structures. Meristems control the continuous development of plant organs by balancing the maintenance and proliferation of stem cells, and directing their differentiation. Mosses have two types of meristems: a protonema apical cell and a gametophore apical cell. The apical cell is a single meristematic cell that is maintained through self-renewal, and gives rise to various organs. In the moss *Physcomitrella patens*, the developmental process of the apical cell is well defined at the cellular level, and gene targeting based on homologous recombination is feasible. Thus, apical cell differentiation in *P. patens* is used as a model system for studies of meristem development in land plants. To understand molecular mechanism of formation and maintenance of the apical cell, we have generated gene-trap/enhancer-trap lines to identify genes specifically expressed on the apical cell (Hiwatashi et al. 2001). Here we reported an isolation of two ubiquitin-like genes, *yh78* gene from a gene-trap line YH78 and a *yh78*-related gene, *pph27a22*, found in the *Physcomitrella* EST database. Both *yh78* (606 residues) and *pph27a22* protein (612 residues) contain two tandem repeats of a ubiquitin-like domain close to their N-terminals. The translation fusion protein with GUS reporter protein was accumulated preferentially in apical cells of both protonemata and gametophores, suggesting that these genes function in the apical cells. We carried out the disruption of *yh78* and *pph27a22* using the gene-targeting technique. Disruption of *yh78* or *pph27a22* alone did not result in any noteworthy phenotype, but double disruption of *yh78* and *pph27a22* exhibited abnormal apical cells and altered branching pattern in protonemata. The growth of protonemata of double disruptant was slower than that of wild type. Thus *yh78* and *pph27a22* genes are functionally redundant and are involved in formation and/or maintenance of the protonema apical cell. Phenotype of the gametophore apical cell of the double disruptant is under observation.

Hiwatashi, Y., Nishiyama, T., Fujita, T., and Hasebe, M. (2001). Establishment of gene- and enhancer-trap systems in the moss *Physcomitrella patens*. *Plant J.* 28: 105-116.