The homeodomain-leucine zipper I gene is involved in epidermal cell differentiation in the moss *Physcomitrella patens*

Keiko Sakakibara [1,2], Tomoaki Nishiyama [1], Naomi Sumikawa [1], Rumiko Kofuji [1,*], Takashi Murata [1], and Mitsuyasu Hasebe [1,2]

1 Speciation Mechanisms 2, National Institute for Basic Biology, Okazaki 444-8585, Japan
2 Department of Molecular Biomechanics, The Graduate University for Advanced Studies, Okazaki 444-8585, Japan
* Present address: Graduate School of Natural Science and Technology, Kanazawa University, Kanazawa 920-1192, Japan
Contact email: bara@nibb.ac.jp

The differentiation of epidermal cells is important for immobile plants because they are in direct contact with the biotic and abiotic environments. Rhizoids are multicellular filaments that differentiate from the epidermis, and they have similar functions to root hairs in vascular plants in that they support the plant body and are involved in the absorption of water and nutrients. Rhizoids are widely observed in green plants, including pteridophytes, bryophytes, and green algae, but their development has not been studied at the molecular level, mainly because of a lack of useful model systems. The moss *Physcomitrella patens* is a suitable plant in which to study rhizoid differentiation, since techniques for transformation and gene targeting by homologous recombination have been established in this plant during the last decade. The mechanisms underlying rhizoid differentiation in *P. patens* were examined. Two types of rhizoids with distinct differentiation patterns (basal and mid-stem rhizoids) were recognized. The differentiation of basal rhizoids from epidermal cells was induced by exogenous auxin, while that of mid-stem rhizoids required an unknown factor in addition to exogenous auxin. Once an epidermal cell is destined to become a rhizoid initial cell, the expression of the homeodomain-leucine zipper I gene *Pphb7* is initiated. The analysis of *Pphb7* disruptant lines showed that *Pphb7* function was crucial for certain activities and features of the rhizoid cell, which included the induction of pigmentation and the inhibition of chloroplast division and expansion. This is the first report on the involvement of a homeodomain-leucine zipper I gene in epidermal cell differentiation. A model for rhizoid differentiation is proposed.

Sakakibara, K., Nishiyama, T., Kato, M., Hasebe, M. 2001. Isolation of Homeodomain - Leucine Zipper Genes from the Moss *Physcomitrella patens* and the Evolution of Homeodomain-Leucine Zipper Genes in Land Plants. Mol. Biol. Evol. 18(4): 491-502.