



HOKKAIDO UNIVERSITY

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Abstract of Doctoral Dissertation

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Title of Doctoral Dissertation

Identification of novel factors involved in polarized cell expansion and development in the moss, *Physcomitrium patens*

(コケ植物 *Physcomitrium patens* における極性細胞の伸長と発生に關与する新規因子の同定)

Tip growth is vital for plant growth and development, yet the regulatory mechanisms governing this process remain incompletely understood. In this study, I identified Reagent F4, a novel small molecule that disrupts tip growth and polarized cell expansion in the moss, *Physcomitrium patens* protonemata. Through unbiased chemical screening, I found that Reagent F4 induces abnormal protonemal morphology, characterized by reduced cell elongation and stunted cell expansion. My analyses revealed that F4 treatment triggers actin depolymerization and disrupts apical actin foci, which are critical for initiating and maintaining tip growth. Additionally, both acute and prolonged F4 exposure led to mislocalization of ROP GTPase, a key regulator of cell polarity. Transcriptomic analyses of F4 treated protonemata show significant downregulation of genes involved in lipid asymmetry, a process essential for polarized growth. These findings establish Reagent F4 as a valuable tool to investigate the molecular mechanisms governing tip growth in *P. patens* and highlight the potential role of lipid asymmetry in coordinating cytoskeletal organization and membrane polarity.