P14: A novel type of chloroplast stromal hexokinase is the major glucose phosphorylating enzyme in the moss *Physcomitrella patens*

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Hexokinase catalyzes the first step in the metabolism of glucose, but has also been proposed to be involved in sugar sensing and signaling both in yeast and in plants. We have cloned a hexokinase gene, *PpHXK1*, from the moss *Physcomitrella patens*. PpHxk1 is a novel type of chloroplast stromal hexokinase that differs from previously studied membrane-bound plant hexokinases. Enzyme assays on a knockout mutant revealed that PpHxk1 is the major glucose phosphorylating enzyme in *Physcomitrella*, accounting for 80% of the total activity in protonemal tissue. Sequence data suggest that most plants including *Physcomitrella* and *Arabidopsis* have both chloroplast imported hexokinases similar to PpHxk1, and traditional membrane-bound hexokinases. We propose that the two types of plant hexokinases have distinct physiological roles.

Furthermore, the *hxk1* knockout mutant is deficient in the response to intermediate levels of glucose, which in wild type moss induces the formation of caulonemal filaments that protrude from the edge of the colony. Caulonemal growth in the dark on externally supplied glucose is also severely reduced in the mutant. Our finding that PpHxk1 is important for the formation of caulonemal filaments may reflect its role as a rate-limiting enzyme in the metabolism of glucose. Based on these observations, we propose that the energy supply of the colony is one factor that contributes to regulating the transition between chloronemal and caulonemal growth.