Diurnal expression of the Lhcb gene in the moss Physcomitrella patens.

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Many researchers reported that Lhcb genes, encoding chlorophyll-binding proteins, from various higher plants exhibited robust oscillations with daily intervals. These rhythms are controlled by the circadian clock, a self-sustained oscillator with a period of about one day, and persist even in constant conditions such as continuous light (LL).

We investigated whether or not the Lhcb genes of the moss P. patens are also under the control of the circadian clock. First, we isolated two Lhcb genes, tentatively named as PpLhcb1 and PpLhcb4, by a screen of a P. patens genomic DNA library. The two genes clustered in a branch very close to, but distinct from, the Lhcb1 and Lhcb2 groups in higher plants in the phylogenetic tree constructed with Lhcb sequences from several plant species. Northern blotting analyses using the Lhc4 coding region as a probe revealed the expression pattern of Lhcb genes under light-dark cycle (LD), LL and continuous dark (DD) conditions. We observed very robust oscillations and damping oscillations with daily intervals under LD and DD conditions, respectively, whereas we could not observe rhythmic expression under LL condition. Some characteristics of the rhythms in LD and DD conditions suggested that the moss Lhcb genes are also under the control of the circadian clock. We fused the putative promoter region of Lhcb4 upstream of the firefly luciferase gene, and introduced this fusion DNA into the moss genome by the PEG-mediated transformation. The resulting transformants exhibited bioluminescence whose temporal profiles were consistent with the Northern data. We are now investigating light resetting properties of the damping oscillation of the Lhcb4 gene in DD.