

T20: Snf1-related protein kinase 1 is needed for growth in a normal day-night light cycle

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The yeast Snf1 kinase and its animal homolog, the AMP-activated protein kinase play important roles in regulating the metabolism (Celenza & Carlson, 1986; Hardie *et al.*, 1998; Milan *et al.*, 2000). Thus, they are thought to function as energy gauges that help the cell to adapt to low energy conditions by turning off energy-consuming processes and mobilizing energy reserves. There are several Snf1-related kinases in plants (Halford & Hardie, 1998), but the closest plant homologue of Snf1 is Snf1-related protein kinase 1 (SnRK1).

We have previously cloned two SnRK1-encoding genes in *Physcomitrella*, which we named *PpSNF1a* and *PpSNF1b*. We have found that a knockout of either gene reduces the Snf1-like protein kinase activity in protonemal tissue, while a double knockout eliminates all such activity. We conclude from this that PpSnf1a and PpSnf1b are the only two SnRK1 enzymes that are expressed in protonemata. Interestingly, while either single knockout has no detectable phenotype except for the reduced kinase activity, the double knockout mutant has several pronounced phenotypes. These phenotypes include developmental abnormalities, premature senescence and altered sensitivities to plant hormones. Remarkably, the mutant is also unable to grow in a normal day-night light cycle, and can only grow in continuous light. Our interpretations of these findings will be discussed.

- Celenza, J.L. & M. Carlson. 1986. A yeast gene that is essential for release from glucose repression encodes a protein kinase. *Science* 233, 1175 - 1180.
- Hardie, D. G., D. Carling & M. Carlson. 1998. The AMP-activated/SNF1 protein kinase subfamily: metabolic sensors of the eukaryotic cell? *Annual Review of Biochemistry* 67, 821-855.
- Milan, D. *et al.* 2000. A Mutation in an AMP-activated Protein Kinase γ Subunit is Associated with Excess Glycogen in Pig Skeletal Muscle. *Science* 288, 1248 - 1251.
- Halford N. G. & D.G. Hardie. 1998. SNF1-related protein kinases: global regulators of carbon metabolism in plants? *Plant Molecular Biology* 37, 735 - 748.