



UMEÅ UNIVERSITET

Timing is everything:
**Exploring the role of the circadian clock in
plant growth and adaptation**

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Akademisk avhandling

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Abstract

Due to their sessile nature, plants must precisely time and coordinate their physiological processes with daily and seasonal changes in the environment. In this PhD thesis, I explored the interaction between an internal timekeeper, or circadian clock, and hormonal regulation, and how it may control plant growth and adaptation in the model species *Arabidopsis thaliana* (*Arabidopsis*) and hybrid aspen (*Populus tremula* x *P. tremuloides*).

Our research showed how the circadian clock component ZEITLUPE (ZTL) regulates abscisic acid (ABA)-mediated stomatal closure, indicating its central role in environmental adaptation.

We investigated the effects of manipulating gibberellin (GA) metabolism in hybrid aspen by the strategic expression of the *Arabidopsis GIBBERELLIN20-OXIDASE1* gene, using a clock-controlled promoter. This approach struck a delicate balance between enhanced growth and seasonal adaptation and showed potential for increased tree performance through biotechnological means.

Our studies on the circadian clock components *LATE ELONGATED HYPOCOTYL (LHY)* and *EARLY BIRD (EBI)* in hybrid aspen suggested their involvement in regulating GA metabolism and overall plant growth.

Taken together, these findings improve our understanding of how plants regulate growth and respond to environmental stresses and help to provide solutions for enhancing plant resilience and productivity.

Keywords

Circadian clock, plants, trees, *Arabidopsis*, hybrid aspen, growth, adaptation, gibberellin, abscisic acid

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