UMEÅ UNIVERSITET

# Effects of retrograde and light signalling on chloroplast biogenesis

## Master's Degree thesis in Plant Molecular Biology, 30 hp

**Michele Schneider**

Supervisor: Prof. Dr. Åsa Strand, Dept. of Plant Physiology, Umeå University

Dr. Tamara Hernández-Verdeja, Dept. of Plant Physiology, Umeå University

Kurskod: 5BI167

Subject: Biology or Molecular Biology

Subject area: Natural Sciences

Department: Department of Plant Physiology

University: Umeå University

## Abstract

Chloroplast biogenesis is a crucial developmental step during the transition from heterotrophic to autotrophic plant life. The greening process is controlled by retrograde and light signalling pathways which are converging at the nuclear-encoded GOLDEN2-LIKE1 and 2 transcription factors. Despite recent advances, the transcriptional regulation of *GLK1* and *GLK2* is not fully understood. Here, we offer new insights into the transcriptional control of the *GLKs* by applying a combination of gene expression analysis in transgenic Arabidopsis cell lines and Arabidopsis mutant seedlings. Furthermore, we investigated the crosstalk between GUN1-mediated retrograde signalling and the COP1-HY5 light signalling branch by testing the physiological responses of double and triple mutants under various conditions. Our results reveal that GUN1 represses *GLK1* and *GLK2* already before chloroplast development is initiated and that lifting this suppression is sufficient to induce *PhANG* expression in darkness. Thus, GUN1 plays an essential role as a suppressor of light response in the dark. Furthermore, we show that COP1 but not HY5 is a positive regulator of *GLK1* and *GLK2* expression in de-etiolated seedlings. Mutant studies suggested that HY5 and the GLKs promote chlorophyll biosynthesis in parallel pathways. Additionally, GUN1 and HY5 were shown to antagonistically regulate hypocotyl elongation in light-grown seedlings. Together, these findings provide novel insights into the complex interplay of light and retrograde signalling during chloroplast development and photomorphogenesis.