



## **ABSTRACT**

"Effect of complex I mutation on mitochondria and its consequences for growth and cellular functions"

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Respiratory oxidative phosphorylation is a cornerstone of cellular metabolism allowing the development of eukaryotic and ultimately aerobic multi-cellular organisms. Being the largest of the energy-transducing complexes of the respiratory chain, Complex I is composed of 44 subunits in *Arabidopsis*. These subunits are encoded either by nuclear or mitochondrial genes; remarkably, over 20% of them are plant-specific.

We characterized an *Arabidopsis* mutant, *ndufs4*, lacking complex I, which has constitutively lowered phosphorylation efficiency. The lack of complex I has no pleiotropic effects on other respiratory components but promotes broad changes in the nuclear transcriptome governing growth and photosynthetic function. We observed large increases in organic acid and amino acid pools in the mutant, especially at night, concomitant with large increases in the cellular inorganic phosphate pools. While germination is delayed this can be rescued by application of GA, and root growth assays of seedlings show enhanced tolerance to cold, mild salt and osmotic stress. Our data suggest that the absence of complex I alters the adenylate control of cellular metabolism and provide insights into how cellular metabolism flexibly adapts to reduced phosphorylation efficiency and why this state may benefit the plant by providing moderate stress tolerance.

My future research will build on this analysis of the effects of altered phosphorylation efficiency on cellular metabolism and plant growth. A set of Arabidopsis mutants with different degrees of respiration impairment will provide a system in which the role of respiration on redox homeostasis, cellular metabolism and ROS signalling can be studied. I intend to characterize these mutants in order to understand how a respiratory defect can influence other metabolic pathways such as glycolysis, photosynthesis or photorespiration. I will moreover investigate the assembly of complex I and its functions, especially a plant-specific role in exporting CO<sub>2</sub> produced during photorespiration.