Investigations into the mechanistic role of *Chlamydomonas* RLS1 in photosynthetic acclimation using an *RLS1* genomic mutant and RNAi knockdown

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Abstract:

Photoacclimation is a universal response in photosynthetic organisms where light harvesting capacity and downstream energy utilizing pathways are adjusted in response to light intensity (and other environmental changes) in an attempt to maintain a balance between these dependent processes. This ultimately reduces photo-oxidative damage and/or limits growth and enhances survival. Long-term photoacclimation inevitably involves changes in the abundance and activity of chloroplast-localized proteins, which often requires changes in gene expression. The expression of nucleus-encoded, photosynthetic genes in response to light intensity is well described, though the specific mechanism initiating these changes as a result of the energy imbalance is unknown. *RLS1* is the closest homologue of *regA* (the gene responsible for somatic cell differentiation in *Volvox carteri*) in *Chlamydomonas reinhardtii*. While the function of RLS1 is unknown, the gene is expressed in conditions known to induce acclimation responses, such as an extended dark incubation, and both phosphate and sulphur deprivation. Since all of these conditions lead to a down-regulation of photosynthesis, we hypothesized that RLS1 could have a role in photoacclimation. Here we use an *RLS1* genomic mutant and RNAi knockdown to test whether RLS1 is a central regulator of photoacclimation in *Chlamydomonas*. The mutant/knockdown and wild-type strains were grown under different light intensities to determine if a lack of RLS1 activity affects growth rate, chlorophyll content, photosynthetic activity, and general photoacclimation capacity. These studies contribute to our understanding of the acclimation mechanism in photosynthetic organisms as well as the evolution of somatic cell differentiation in volvocine green algae.