Discovering Novel Photosynthetic Functions Using the Green Alga *Chlamydomonas reinhardtii*

Arthur R. Grossman[1*], Tyler Wittkopp[1,2], Rick Kim[1,2] and Shai Saroussi[1]

[1]Carnegie Institution for Science, Department of Plant Biology, Stanford, CA 94305, USA.
[2]Department of Biology, Stanford University, USA (arthurg@stanford.edu)

*email: agrossman@carnegiescience.edu

Identifying novel components involved in the function, biogenesis and regulation of photosynthetic processes will improve our understanding of this energy generating process and provide us with the knowledge needed to engineer plants and algae for increased photosynthetic efficiency, higher agricultural yields and greater tolerance to adverse environmental conditions. Our studies of photosynthetic processes are being guided by an inventory of proteins designated the GreenCut, which is a set of approximately 600 nuclear-encoded proteins that is conserved among photosynthetic organisms belonging to the Green Lineage (Viridiplantae), but is either not present or very poorly conserved in heterotrophic (non-photosynthetic) organisms. While many previously characterized proteins required for the utilization of light energy are included in the GreenCut, the precise functions of approximately half of the GreenCut proteins are not known, although several may have catalytic roles required in photosynthesis (electron transport, carbon fixation) or be critical for the regulation of photosynthetic processes and the biogenesis of chloroplasts. Using biochemical, biophysical and molecular assays, we have characterized photosynthetic processes in several *Chlamydomonas reinhardtii* mutants that are null for specific GreenCut proteins, including *cgl71* and *cpld49*, which are altered in photosystem I and cytochrome b_6f activities, respectively. We have also initiated work on some GreenCut proteins that may be important for sustaining photosynthetic processes under suboptimal nutrient conditions. The mechanistic, regulatory and evolutionary implications of our results will be discussed.

Keywords: photosynthesis, insertional mutants, GreenCut