Constitutive LHCSR expression as a strategy to increase productivity in microalgae

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Microalgae are very interesting for the production of biofuel but they need to be domesticated in order to maximize productivity. One strategy proposed in order to increase the photosynthetic efficiency is the modulation of photoprotective heat dissipation of the light absorbed. In Eukaryotic algae Non-Photochemical Quenching (NPQ) of the light absorbed has been found to be triggered by LHCSR proteins. It was reported that heat dissipation and biomass productivity are strongly related. Indeed, the *npq4* mutant, lacking the two genes coding for LHCSR3 protein, grows in a wide range of light growth conditions without suffering from photoinhibition being more productive than wild-type (Berteotti et al., JBC 2016). In order to further investigate the relation between NPQ and biomass productivity, *Chlamydomonas* mutants with a constitutive expression of LHCSR3 was generated by complementation of *npq4 lhcsr1* mutant, a genotype where LHCSR proteins are absent. Chimeric promoter, made by merging the promoter sequences of heat shock protein 70 and RuBisCo small chain 2, allows to reach a constitutive level of LHCSR3 in complemented npq*4 lhcsr1* mutant similar to WT in low light but without the peculiar high light dependent accumulation. This constitutive low level of LHCSR3 accumulation leads to an NPQ activity strongly reduced compared to WT with no significant increments after HL exposure. Complemented strains with constitutive low LHCSR3 expression were characterized by a better photosynthetic efficiency leading to an higher biomass accumulation. A lower expression of LHCSR3 can, thus, ensures high photosynthetic efficiency with an adequate protection from photo damage.