FIRST REPORT OF A 'PLASTID-TO-NUCLEUS RETROGRADE SIGNALING MECHANISM' IN DIATOMS: EVIDENCE THAT THE REDOX STATE OF THE PLASTOQUINONE POOL TRIGGERS THE PHOTOPROTECTIVE RESPONSE IN *PHAEODACTYLUM TRICORNUTUM*

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Diatoms possess a pronounced capacity for a photoprotection mechanism called Non Photochemical Fluorescence Quenching (NPQ), which helps them to populate habitats exhibiting light fluctuations regularly punctuated by high light intensity exposures. The most prominent part of NPQ is the energy dependent fluorescence quenching, qE. Three main actors of qE in diatoms can be distinguished: 1) the build-up of a transthylakoidal proton gradient in the light, 2) the conversion of the xanthophylls diadinoxanthin (Dd) to diatoxanthin (Dt) depending on the magnitude of the proton gradient, and 3) the presence of specific nuclear-encoded antenna proteins, called Lhcx. We used *P. tricornutum* as a model organism to investigate its acclimation to different light climates with respect to the expression of the four *lhcx* genes and the amount of Dd+Dt. Some *lhcx* genes were markedly up-regulated in response to high light (HL) illumination and the amount of Dd+Dt was concomitantly increased. Both correlated with a pronounced rise of qE. By blocking the conversion of Dd to Dt with DTT or by inhibiting the translation of *lhcx* genes with cycloheximide, the amplification of qE was stopped and the diatom suffered stronger photoinhibition during HL exposure. By applying DCMU and DBMIB to artificially modify the redox state of the plastoquinone (PQ) pool we achieved to stop the Dd+Dt synthesis under HL as well as to stimulate their synthesis under low light (LL) conditions, respectively. However, it appears that the regulation of Dd+Dt content was not exerted on the gene level, but probably via enzyme activation in the chloroplast. In contrast, a selective expression induction of some of the *lhcx* genes under LL conditions by an artificially reduced PQ pool (with DBMIB) was reached. These results underline the central role of the redox state of the PQ pool in acclimation responses to HL in diatoms. Moreover, they bring strong evidence for a signaling cascade from the chloroplast, via the redox state of the electron transport chain, to the nucleus, as previously described in green microalgae and land plants. This is the first report for the existence of a so-called 'plastid-to-nucleus retrograde signaling mechanism' in an organism with secondary endosymbiosis derived chloroplasts.