EXPLORING THE MOLECULAR BASIS OF RESPONSES TO LIGHT IN MARINE DIATOMS

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Light is a source of energy for photosynthesis and a major source of information from the environment. As on land, both irradiance and light quality change drastically in different marine habitats. Spectral quality also varies with depth due to the absorption properties of water, with blue light prevailing at increasing depths. Recent progress in genomics and environmental metagenomics has revealed that differences in the light field have led to a variety of evolutionary adaptations and to previously unsuspected types of phototrophy in aquatic microorganisms, which are without parallel in terrestrial systems. These discoveries highlight the fact that the light-driven processes are still largely unknown in marine organisms and we expect many mechanisms remain to be discovered.

The major focus of our research is in understanding the biology of the diatoms. We believe that these prominent algae must have developed sophisticated strategies (physiological, biochemical and behavioral) for responding to environmental light variations. We are therefore exploiting novel genetic tools and genomic information to try to decipher light sensing and acclimation mechanisms, still largely uncharacterized at molecular level. In particular, we have undertaken a comprehensive characterization of the diatom photoreceptors identified in the genomes by studying their spectral properties, their signaling pathways and their function *in vivo*. The structural and functional characterization of a Cryptochrome/Photolyase Family member (CPF1) isolated from the diatom *P. tricornutum* has revealed that PtCPF1 is a novel and interesting member of this family because it displays a dual activity: a (6-4) photolyase activity, likely of functional relevance for cell survival following UV irradiation, and a photoreceptor activity, controlling gene expression and possibly circadian regulated processes. We now also focus on possible red light signal, by characterizing a Red/Far Red Phytochrome photoreceptor identified in the genome. Its down-regulation by RNA interference induces the formation of cell chains and aggregates, possibly through altered photoprotection and/or neighbour perception. These data raise novel hypotheses about the role of photoreceptors in controlling growth and life strategies in the oceans.