Unravelling the light-dependent cell cycle onset in diatoms

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Despite the enormous importance of diatoms in aquatic ecosystems and their broad industrial potential, little is known about their life cycle control. Diatoms typically inhabit rapidly changing and unstable environments, suggesting that cell cycle regulation in diatoms must have evolved to adequately integrate various environmental signals.

From the first genome analyses of *Thalassiosira pseudonana* (Armbrust *et al.*, 2007) and *Phaeodactylum tricornutum* (Bowler *et al.*, 2008), it became clear that the cyclin family in diatoms represents an expanded gene family. By comparative analysis of cyclin abundance among several closely related Chromalveolate species, this expansion was found to be specific to diatoms. In addition, phylogenetic analysis of the cyclin gene family lead to the discovery of a novel type of cyclins, the diatom-specific cyclins (dsCYCs) (Huysman *et al.*, 2010). Their early expression during the cell cycle, and the induction of several members upon changing nutrient or light conditions, hints at a role for the *dsCYCs* in transduction of the environmental status of the cell to the cell cycle machinery. Related to this, a crucial role in regulating cell cycle onset upon light exposure was found for one of these *dsCYCs* (*dsCYC2*). This cyclin was found as one of the first cell cycle genes expressed upon release by illumination of dark-arrested cells (Huysman *et al.*, 2010). In addition, silencing of *dsCYC2* interferes with normal cell cycle progression, suggesting that it is crucial to the control of the light-dependent G1-checkpoint in diatoms. The light-regulated transcription of *dsCYC2* and control of cell cycle onset is further demonstrated by its specific response to various spectral qualities (white, blue and red light) at different light intensities.

The results that will be presented here give more insights into the molecular mechanisms that tightly regulate the onset of the cell cycle machinery upon light exposure. They will contribute to our understanding of how diatoms succeed to respond adequately and rapidly to changing light conditions and will help to explain how diatoms gained this competitive advantage over other marine phototrophs during evolution. From an economic perspective the results will be useful for studies that aim to optimize diatom and algal cultivation techniques for industrial applications.

References

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