

Novel models for diatom life cycle and photosynthesis regulation

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Diatoms are ecologically important microalgae responsible for 20% of global primary production. However, research on fundamental biological processes such as life cycle regulation and photosynthesis has been constrained by the limitations of current model species. The widely used *Phaeodactylum tricornutum* and *Thalassiosira pseudonana* are obligate autotrophic and asexual, precluding experimental access to sexual reproduction and metabolic flexibility.

To overcome these limitations, new diatom model systems have been developed to enable investigations into life cycle control and photosynthetic regulation. In the pennate, heterothallic species *Cylindrotheca closterium*, a comparative sexual transcriptome revealed stage-specific gene expression associated with pennate sexual differentiation. The establishment of a stable transformation protocol further enables functional characterisation of candidate genes.

The centric, facultative heterotrophic diatom *Cyclotella cryptica* has been developed as model for studies on photosynthesis and metabolic flexibility. The generation of a photosynthetic KO mutant in the γ -subunit of plastidial ATP synthase has, for the first time, revealed photosynthetic control in diatoms, providing a new framework for exploring their bioenergetic regulation.