Nucleotide biosynthesis and transport in diatoms

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Plastids of diatoms and related algae evolved via eukaryote – eukaryote endosymbiosis, a process that increased the structural complexity of the resulting cell. For example, diatom plastids are surrounded by four envelope membranes, two membranes more compared to plastids of land plants. These additional membranes are barriers for the exchange of metabolites between the plastid and the cytosol or other organelles.
Furthermore, eukaryote – eukaryote endosymbiosis also altered the metabolic complexity of the resulting cell. This can be seen in the intracellular distribution of metabolic pathways compared to other photosynthetic organisms. For example, diatom plastids depend on nucleotide uptake from the cytosol because, unlike in plants, nucleotide de novo synthesis exclusively occurs in the cytosol. Diatom genomes encode a higher number of nucleotide transporters (NTTs) compared to plants. By exchanging ATP against ADP+Pi, land plant NTTs (which are only found in the inner plastid envelope) provide energy to the plastid without net transport of nucleotides. In contrast to this, diatom NTTs are also found in other parts of the cell and show a broader range of transport activities. Six different isoforms of diatom NTTs (NTT1, -2 and -3 of *Thalassiosira pseudonana* and NTT1, -2 and -5 of *Phaeodactylum tricornutum*) have meanwhile been characterized by phylogenetic studies, transport assays with the recombinant proteins and GFP-based targeting analyses. The results provide evidence that diatom NTTs form a specifically adapted system for net nucleotide transport between cytosol and plastids in diatoms.