ASPECTS OF DIATOM METABOLISM

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Algal research to date experiences a strong boost from actual genome projects and the development of molecular tools to study algae and algal processes, like large scale transcription analyses, transformation techniques and gene silencing approaches. For diatoms there are two genomes published (for the pennates *Phaeodactylum tricornutum* and the centric *Thalassiosira pseudonana*) including two more genomes close to publication (*Pseudonitzschia* sp. and *Fragilariopsis cylindrus*). Diatoms are very interesting organisms for various reasons, including their ecological relevance, their silicified cell walls and their peculiar evolution via secondary endocytobiosis (the incorporation of a eukaryotic alga into a eukaryotic host cell, followed by transformation of the endosymbiont into a plastid). Especially the latter process resulted in various differences with respect to the physiology and cell biology of these algae when compared to green algae and land plants. Comparative analyses revealed relocated metabolic pathways, modified regulation processes and unexpected proteins:

(i) In diatoms very few enzymes of the Calvin cycle are redox regulated by small proteins termed thioredoxins that function as a "light switch" for CO_2 fixation by reducing target enzymes.

(ii) Essential pathways like the oxidative pentose phosphate together with nucleotide synthesis pathways have been reallocated in diatoms.

(iii) Diatoms possess a urea cycle.

(iv) Diatoms possess the bacterial Entner-Douderoff pathway.

(v) As a consequence, additional plastidic translocators for nucleotides and carbohydrates were established to allow the essential transport of triosephosphates as well as nucleotides into and out of the plastids.

(vi) Enzymes of the second half of glycolysis can be found in the cytosol, in the plastids as well as in the mitochondria.

(vii) There are first indications that enzymes might be located in the periplastidic space of diatoms, including an NADP-dependent thioredoxin reductase and a phosphogluconate dehydrogenase.

(viii) Diatoms also show a very unusual distribution of carboxylating and decarboxylating enzymes possibly involved in photosynthesis.