Protein-protein interactions within the diatom chloroplast three-component system

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Phaeodactylum tricornutum is a unicellular marine alga belonging to the diatoms, a diverse group of photosynthetic eukaryotes adapted to fluctuating aquatic environments with variable light and nutrient availability. Despite these environmental challenges, diatoms exhibit high photosynthetic productivity, making them promising candidates for biofuel production and bioengineering. Diatom plastids originated through secondary endosymbiosis with a unicellular red alga, retaining genetic material from both red algal and cyanobacterial ancestors. One example of conserved prokaryotic genes in diatoms is the two-component system (TCS), which consists of a sensor histidine kinase and a response regulator. In diatom plastids, the sensor kinase is the chloroplast sensor kinase (CSK), while two paralogous response regulators, chloroplast response regulator 1 (CRR1) and chloroplast response regulator 2 (CRR2), likely arose from a gene duplication event. The function of this "three-component" system in diatom plastids remains unclear. We hypothesize that CRR1 and CRR2 regulate plastid-encoded heat shock genes and are activated in response to changes in temperature and light. Using yeast two-hybrid analysis, we present preliminary evidence of interaction between CSK and CRR1, as well as between CRR1 and CRR2. These findings contribute to understanding the protein-protein interactions within the diatom chloroplast two-component system.