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# Effects of biotic and abiotic stress on physiology and metabolism of *Thalassiosira weissflogii*

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## Abstract

Diatoms are crucial primary producers in the marine environment. Despite the extensive studies addressing the physiological variations of diatoms in response to biotic and abiotic stresses, e.g. phycosphere bacteria and elevated CO<sub>2</sub> levels, the molecular and metabolic mechanisms remain largely unexplored. We performed transcriptome and metabolome analysis, along with physiological detection, on the marine diatom *Thalassiosira weissflogii* under a 60-day co-culture with *Vibrio parahaemolyticus* and 40-day high CO<sub>2</sub> conditions. (1) Although *Vibrio* did not significantly impact the growth of *T. weissflogii*, they did affect its photosynthetic efficiency and pigment biosynthesis. The balance of carbon and nitrogen metabolism, as well as energy pathways, including the tricarboxylic acid cycle and glycolysis, was also disrupted. *T. weissflogii* might be capable of maintaining normal growth by upregulating cell cycle-related proteins and utilizing certain bacterial metabolites, such as indole-3-acetic acid. Moreover, *T. weissflogii* reinforced its cell wall in response to *V. parahaemolyticus* infection by increasing chitin biosynthesis and inhibiting chitinase activity. (2) Ocean acidification has the capacity to up-regulate the C/N ratio, pigment biosynthesis and photosynthetic capacity of *T. weissflogii*. The up-regulation of chitin synthesis and the down-regulation of chitin degradation in *T. weissflogii*, might consequently lead to an augmentation in chitin content within the cell wall. The results indicate the significant impacts of algal-bacterial interactions and decreased pH on diatoms and offer new insights into the environmental adaptations of *Thalassiosira weissflogii*.

**Keywords:** Carbon fixation, Chitin metabolism, Diatom, Ocean acidification, Photosynthesis, Phycosphere, Transcriptome

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