Reversed Genetic Research of Nannochloropsis oceanica for Increased Thermal Tolerance

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Marine microalgae are responsible for nearly 50% of their ecosystem's oxygen production and primary productivity, making them essential in the marine environment. These organisms also play a crucial role in mitigating climate change by absorbing significant amounts of CO_2. However, due to the limitations of their thermal maximum, the increasing marine temperatures are expected to negatively affect a majority of marine microalgal species. Further, it is speculated that 20-40% of microalgal species will lose their current habitats by 2100. The Symbiodinium species are of specific interest in the following research due to their symbiotic relationships with their coral hosts, enabling corals to receive essential nutrients. However, coral bleaching has become a globally prominent issue as increasing numbers of Symbiodinium have experienced mortality due to their surrounding temperatures exceeding their thermal maximum. One of the worst coral bleaching events in history was recorded just last year, with 77% of coral reefs having been affected. Due to such prominence, this research aims to utilize reversed genetic engineering to identify specific genes which may allow marine microalgal species to exhibit an increased thermal tolerance. Promoter regions were inserted into the microalgal cells via electroporation to produce random mutants, which were then selected for by placing transformed colonies under their thermal maximum temperature. Results displayed a colony potentially exhibiting a higher thermal tolerance, which is to be confirmed through further trials and sequencing. Due to the complexity of the Symbiodinium genome, Nannochloropsis oceanica was utilized for the above methods as a model species to gain a better genetic insight of the organisms as a whole.

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