The Effect of Expression Patterns of Ammonium Transporters on the Interaction between Corals and Their Symbiotic Dinoflagellates

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Degradation of coral reefs due to increasing eutrophication of the Earth's oceans is of increasing global concern. Understanding the effects of nutrient enrichment on corals and their endosymbiotic dinoflagellates, on a molecular level, is crucial to better understand coral bleaching events. To shed light on these occurrences, the expression of ammonium transporter (AMT) genes in different species of dinoflagellates from the genus Symbiodinium was studied. AMT gene expression was compared in Symbiodinium microadriaticum on two time-points (Day 2 and 8) under low (20μM) and high (440μM) ammonium concentrations. AMT gene expression was also compared in SSB01 under the same nutrient conditions and in hospite. RNA was extracted and subsequent quantitative and qualitative analysis took place. Using qPCR, four AMT genes were compared per Symbiodinium species. In the S. microadriaticum samples, the increase of expression of AMT gene Smic-18076 was linearly proportional with the increase in ammonium, for Smic-18076 acted as a low affinity transporter. In the SSB01 samples, AMT gene SSB01-77 increased highly in expression only when in nutrient-poor conditions within the host, thus acting as a high affinity transporter. It was found that, in eutrophic conditions, increased gene expression of low affinity transporters, such as Smic-18076, allow Symbiodinium to uptake amounts of ammonium sufficient enough to stimulate marginal increases in population density, thus leading to overwhelming proliferation of the dinoflagellates and subsequent bleaching of corals. Regulation and maintenance of low concentrations of dissolved nitrogen in seawater is therefore crucial to prevent this behavior and help sustain valuable reef structures.

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