Analysis of Osmoadaptation Systems in C. reinhardtii in Response to Osmotic Stress Produced by Toxic Brine Dumping Cycles

Bhushan, Rithik (School: Monterey High School)

This project analyzes the efficacy of osmoadaptation systems in the algae Chlamydomonas reinhardtii in response to osmotic stress caused by brine dumping cycles from desalination plants. As new desalination plants are constructed to combat the effects of drought in California, the excess salt created after filtration is dumped into the ocean in the form of brine, creating harmful environments of osmotic stress for microalgae. Osmoadaptation systems, genetic systems developed through evolution, allow the algae to withstand osmotic stress. During Phase 1 of experimentation, water samples were taken from marine environments at 4 locations of varying distance from desalination plants in the Monterey Bay and tested for salinity. Results showed a correlation between salinity levels and proximity to local desalination plants but research with further samples is necessary to determine if there is direct causation. During Phase 2, five samples with C. reinhardtii were tested with increasing frequencies of brine dumping over a period of ten days. Samples were tested for cell size, glucose concentration, and cell lysis, with each variable correlating to a specific osmoadaptation system, along with cell count for an overall indication of cell survival. Following Phase 2, results showed that the sample with the most frequent brine dumping cycle simulating that of a desalination plant had the most significant negative impact on osmoadaptation systems in C. reinhardtii. With these results, more awareness can be created on the negative impacts of desalination filtration and sustainable frequencies of brine dumping can be implemented for the management of desalination plants.

Awards Won: