Bio-Reporter to Sense Nitrate in Narragansett Bay

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The concentrations of nitrate (NO^{3-}) and phosphate (PO_4^{3-}) in Narragansett Bay have been shown to undergo considerable temporal and spatial variation. However, the dynamics of these fluxes have never been monitored on a fine-scale (<100 m, < 1 day) or in real-time. Continuous monitoring of estuarine systems, such as Narragansett Bay, remains in its infancy and requires a new and innovative approach to analysis. Additionally, bioavailable nutrients often constitute only a small fraction of the chemically measured element (in some cases only about 1%).

Whole-cell bio-reporters are promising candidates for low cost, continuous environmental sensing of bioavailable nutrients. In this poster, the creation and validation of a sensor using a self-bioluminescent strain of the cyanobacteria *Synechococcus elongatus pcc* 7942 for the direct measurement of bioavailable nitrate will be described. For this analysis bio-reporters were constructed by fusing the promoters of glnA to the luxAB operon. This allowed for the measurement of nitrate bioavailability through the measurement of light emission. Studies confirmed gene sequence as well as transformation into *Synechococcus elongatus*. Validations of bio-reporter specificity, sensitivity and longevity are reported for both known nitrate standards and estuarine water. Proposed sensor designs are also presented with a specific focus on storage, longevity and cell viability.

The specificity, sensitivity, and low cost of these bio-sensors make them ideal candidates for continuous monitoring of biological nitrates in estuaries such as Narragansett Bay.