



Photo courtesy herself.

Nutrient uptake kinetics of Microcystis aeruginosa in the San Francisco Estuary

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Jamie Lee is the recipient of the 2012 AAAS, Pacific Division Alan E. Leviton Student Research Award. Dr. Frances Wilkerson is her advisor.

My master's thesis work utilizes nutrient uptake kinetics to study the nitrogen uptake capability of the harmful bloom-forming cyanobacterium *Microcystis aeruginosa* in the San Francisco Estuary Delta (SFE Delta). This approach looks at the relationship between the uptake rate by an organism, typically measured using an isotopically-labeled nutrient such as ^{15}N -labeled nitrate or ammonium, and the nutrient substrate concentration. The parameters obtained from such studies can describe an organism's affinity or preference for different forms of nitrogen, and can be used to infer competitive advantages between different algal species based on the types and concentrations of nutrients present. Four different nitrogenous substrates are being investigated: nitrate, ammonium, urea and glutamic acid. Nitrogen is an important nutrient because it is used in photosynthesis and also in protein synthesis by phytoplankton.

Funding provided by the AAAS, Pacific Division Alan E. Leviton Award has allowed me to conduct eight nitrogen uptake kinetics experiments to date (generating 512 uptake samples), using field-assemblages of *M. aeruginosa* from the SFE Delta. These samples were assayed for nutrient concentration, cyanobacterial nitrogen biomass, and isotopic composition with mass spectrometry so that uptake rates could be calculated.

Preliminary results show that, based on the maximal uptake velocities measured (V_{max}), *Microcystis* collected from the field show a nitrogen preference for ammonium, followed by urea, nitrate and lastly, glutamic acid. Ambient nitrogen concentrations in the SFE Delta measured during these experiments indicated that concentrations may be at sub-saturating levels for nutrient uptake, implying that *Microcystis* could increase its nitrogen assimilation rates if nutrient concentrations in the field were to rise; this may translate into increased cyanobacterial growth.

Observed variability in the kinetics parameters obtained during the different experiments was expected, as the field assemblages used varied in algal composition. For example, the cyanobacteria *Anabaena* and *Aphanizomenon* were present in some of the field assemblages that I collected and may have had different uptake kinetics than samples that were dominated entirely by *Microcystis*. Still, the parameters generated from this research to date are comparable and within range of nitrogen uptake kinetics studies reported in the literature for other phytoplankton, including *Microcystis*.

Follow-up work will include conducting nitrogen uptake kinetics experiments using cultures of toxic and non-toxic strains of *Microcystis*. Using a pure culture of *Microcystis* will allow me to narrow down the variation seen in the field samples. Studying these two strains will also enable me to see if there are different nutrient uptake capabilities related to toxin production or lack of toxicity.

Improved understanding of the nitrogen uptake capabilities of *Microcystis* should inform managers concerned with water quality and the control of *Microcystis* blooms in the SFE Delta. 📧