Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Modeling of storage-based heterocyst commitment and patterning in cyanobacteria AIDAN BROWN, ANDREW RUTENBERG, Dalhousie University, Halifax, Nova Scotia, Canada — When deprived of fixed nitrogen, filamentous cyanobacteria differentiate nitrogen-fixing heterocyst cells in a regular, one-dimensional pattern. Many genes have been identified that contribute to heterocyst selection, but the selection process is still not well understood. By including fixed-nitrogen storage in a computational model of nitrogen dynamics, growth, and heterocyst differentiation with lateral inhibition along the filament we can explain the stochastic timing of heterocyst commitment. Notably, the only stochastic element of our model is growth rate randomness sufficient to achieve a natural population structure of cell lengths. Our computational model qualitatively reproduces many measurements associated with heterocyst differentiation including both initial and steady state heterocyst patterns. Our model shows that a fixed storage percentage, together with variability in cell length, can produce a strong implicit cell cycle effect on heterocyst commitment which favors the commitment of shorter cells.

Aidan Brown
Dalhousie University, Halifax, Nova Scotia, Canada

Date submitted: 08 Nov 2012 Electronic form version 1.4