Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Gain control in molecular signaling without feedback[1] ILYA NEMENMAN, Los Alamos National Laboratory — Statistical properties of environments experienced by biological systems in the real world change, and this requires adaptation to achieve a high fidelity information transmission in cellular networks. One form of such adaptive response is gain control. When the mean response of a signaling system is matched to the mean value of its signal, rescaling the gain allows to respond to signals with different variances without saturation and by utilizing the entire available dynamic range of the response. Here we argue that a certain simple mechanism of gain control, understood well in the context of systems neuroscience, translates to molecular signaling systems as well. The mechanism allows to transmit more than one bit (on or off) of information about the signal independently of the signal variance. The mechanism does not require additional molecular circuitry beyond that already present in many molecular systems, and, in particular, it does not depend on existence of feedback loops. This analysis provides a plausible explanation for certain structural aspects of cellular networks.

[1]Supported by DOE under Contract No. DE-AC52-06NA25396

Ilya Nemenman
Los Alamos National Laboratory

Date submitted: 21 Nov 2008 Electronic form version 1.4