Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Collective Calcium Dynamics in Networks of Communicating Cells TOMMY BYRD, Purdue University, GARRETT POTTER, BO SUN, Oregon State University, ANDREW MUGLER, Purdue University — Cells can sense and encode information about their environment with remarkable precision. These properties have been studied extensively for single cells, but intercellular communication is known to be important for both single- and multicellular organisms. Here, we examine calcium dynamics of fibroblast cells exposed to external ATP stimuli, and the effects of communication and stimulus strength on cells' response. Experimental results show that increasing communication strength induces a greater fraction of cells to exhibit oscillatory calcium dynamics, but the frequencies of oscillation do not systematically shift with ATP strength. We developed a model of calcium signaling by adding noise, communication, and cell-to-cell variability to the model of Tang and Othmer [1]. This model reproduces cells' increased tendency to oscillate as a function of communication strength, and frequency encoding is nearly removed at the global level. Our model therefore suggests that the propensity of cells to oscillate, rather than frequency encoding, determines the response to external ATP. These results suggest that the system lies near a critical boundary separating non-oscillatory and oscillatory calcium dynamics.

[1]Tang, Y. and Othmer, H. G., **Proc. Natl. Acad. Sci.** 92, 1995.

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Date submitted: 04 Nov 2015 Electronic form version 1.4