Analysis of a model of gradient sensing in *Dictyostelium* and neutrophils

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Abstract

The phenomenon of chemotaxis — the motion of a cell in response to gradients in external chemical concentration — is crucial to the proper functioning of uni- and multicellular organisms. There has been a lot of research on bacterial chemotaxis focussing recently on modeling the underlying signalling networks. However there have been few systematic modeling efforts of the signalling networks underlying chemotaxis in eukaryotes such as *Dictyostelium* and neutrophils. It is known experimentally that the ability of these cells to sense gradients persists even when they are immobilized, suggesting that various aspects of the gradient sensing can be studied independent of cell motion. In this talk we consider a recent model of gradient sensing in these systems [1]. This model is constructed to account for some important features of gradient sensing:

1. Adaptation to homogeneous external concentrations
2. Persistent response to fixed external gradients
3. High amplification of external gradients, responsible for the ability to sense shallow external gradients.

We examine a modified version of this model in detail theoretically and computationally and analyze its response to various inputs of experimental relevance. Inputs such as homogeneous oscillations, constant gradients, static and rotating localized peaks, multiple peaks and switching gradients are considered. If time permits, we briefly contrast features of this model with those of other modeling efforts.

References

1. A. Levchenko and P. A. Iglesias. Models of eukaryotic gradient sensing -applications to chemotaxis of amoebae and neutrophils. *Biophysical J.*, **82**(1): 50–63, Jan. 2002.