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Stability and Perturbation Analysis on a Model of Cell Chemotaxis COLIN MCCANN, University of Maryland, RON SKUPSKY, National Institutes of Health, WOLFGANG LOSERT, University of Maryland, RALPH NOSSAL, National Institutes of Health — Many eukaryotic cells respond with directional movement to spatial and/or temporal gradients of small molecules that bind to cell surface receptors. The computational model of a chemotaxing cell developed in [1], which models cells such as neutrophils or Dictyostelium discoideum, is investigated with regard to stability and response to perturbations. A formal stability analysis finds that, when placed in an initial linear gradient, the model is most sensitive to perturbations at a 60-90 degree offset from the direction of the initial gradient. The model also responds most quickly and strongly to external point sources placed in that direction. These responses hold for all four of the model variants developed in [1]. This suggests that the observed 'zigzag' behavior of real cell movement in a gradient may be influenced by the nature of the biochemical reactions that control a cell's chemotactic response. This research was funded in by the National Institutes of Health (NIH) and the National Institute of Standards and Technology (NIST). [1] Skupsky, R., W. Losert, and R.J. Nossal. 2005. "Distinguishing modes of eukaryotic gradient sensing". Biophys. J. 89:2806–2823

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