

Analysis of a reaction-diffusion model of spatial sensing

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ABSTRACT

This paper analyzes a spatial gradient-sensing model for eukaryotic chemotaxis. The model is in the form of a reaction-diffusion system and comprises two enzymes A and I , whose production is mediated by the external signal S , as well as a response element R . This model possesses the property of adaptation to spatially homogeneous signals: the response to spatially homogeneous signals is independent of the concentration of the signal. The response to spatially inhomogeneous signals results in a spatially inhomogeneous response element. We consider the response of the cell in two cases: (a) A disk-shaped cell in 2-D in a constant gradient of chemoattractant and (b) A spherical cell in 3-D in a constant gradient of chemoattractant. The response of the cell is studied both analytically and numerically.

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