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SEMINAR

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October 30, 2003
304 Whitehead Hall
Refreshments: 3:30 p.m.
Seminar: 4:00 p.m.

MODELING THE CELL'S SENSE OF DIRECTION

Abstract

Many biological systems have the ability to sense the direction of external chemical sources and respond by polarizing and migrating toward chemoattractants or away from chemorepellants. This phenomenon, referred to as chemotaxis, is crucial for proper functioning of single cell organisms, such as bacteria and amoebae, as well as multi-cellular systems as complex as the immune and nervous systems. Chemotaxis also appears to be important in wound healing and tumor metastasis. A common feature of most chemotactic signaling systems is the ability to adapt to different levels of external stimuli, so that it is the gradient of signaling molecule rather than the average signal value that determines the response. Chemotactic cells exhibiting perfect adaptation respond to spatially homogeneous increases in external stimulus by transient activation of specific intracellular signaling pathways. The same signaling pathways, however, can be activated persistently if the signal is presented in a spatially inhomogeneous, graded manner.

Recently there has been much effort in trying to elucidate the mechanism used by cells to perceive this external gradient. In this talk I present a model in which the cellular response is regulated by the balance between a fast, local excitation signal and a slower, global inhibitor. I will show how the model makes distinctive predictions that differentiate it from other published models. Finally, I will discuss experimental efforts used to validate this model.