

Modeling the chemotactic behavior of *Dictiostelium discoideum* using a voxel-based stochastic approach

a², b², c³, d⁴, e⁵, Mehdi Sadeghi^{1*}

¹ National Institute of Genetic Engineering and Biotechnology (NIGEB), Tehran, Iran

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These authors contributed equally to this work.

* sadeghi@nigeb.ac.ir

Abstract

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Introduction

Materials and methods

Modeling the movement of a single-celled organism is seemingly an insurmountable task; given the complexity of such behavior, a faithful recreation would be computational cal-da-sac. Instead we have chosen to study this behavior at three different levels:

1. *The chemical level:* at this level we simulate the chemical reaction in pre-defined compartments, “voxels”, using the Gillespie’s method. The formation of pseudopodia is net result of these reactions.
2. *The mechanical level:* the collective outcome of the the chemical reactions is translated into Newtonian equations in order to transform the chemical level into the movement of a physical entity –i.e., the cell– on a surface.
3. *The behavioral level:* The chemotactic response of a single-celled organism to external stimuli separates the realm of goal-less, unguided, and mindless objects from the realm of living entities that change their behaviors vis-à-vis their *Umwelt*.

The chemical level

Diffusion, time

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