576b Propagation of Signals within a Collection of Cells

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In this paper we investigate the speed of propagation of the signaling chemical waves within a population of cells of a given density. We analyse the problem by taking an approach similar to that used for studying the wave propagation in granular flow [Ocone and Astarita, J. Rheol, Vol: 38(1), 1994] adapted for the specific biological system under investigation. We study communications between cells by exploring whether non-equilibrium statistical analysis can be applied to this system. Our results suggest that once we define the influencing variables, such as population pressure, metabolic temperature and metabolic energy, the set of equations analogous to the classical Maxwell equations for gases can be formulated.

The propagating speed of the signaling waves between the cells is obtained by writing the appropriate governing equations. Our results suggest that the expression for the propagating speed is similar to the one obtained in the classical thermodynamics theory. We illustrate the methodology by solving a specifying problem, where we choose the function describing the population pressure in accordance with the results by Sherratt and Painter [J. Theor. Biol., Vol:225, 2003]. The results are very encouraging showing interesting features when compared to earlier and parallel work.