Applied Mathematics

McGill Applied Mathematics Seminar Series

November 4, 2002

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Title: "Aggregation and centering in fish melanophore cells
- a quantitative exploration of cytoskeletal dynamics"

Monday November 4, 2002 **Time: 2:35 pm** **Room: Burnside 1205**

Coffee and refreshments will be served after the seminar

Abstract: (in collaboration with A. Mogilner (UC Davis, Mathematics) and V. Rodionov (UConn, Physiology)) Fish melanophore cells demonstrate a self-organizing behaviour that depends on the same cytoskeletal components that are at work during cell division and therefore provide a good "warmup" problem for that more complicated and vital process. When a fragment of the melanophore cell is excised, eliminating the centrosome (the regular cytoskeletal organizer) and therefore the cytoskeletal organization, stimulating the cell with adrenaline somehow reintroduces cytoskeletal organization, leading to the formation of a microtubule aster and the aggregation of the cell's pigment particles at the center of the fragment. This spontaneous organization arises through the interaction of microtubules and pigment granules.

We propose a mechanism by which this occurs and derive a system of seven non-linear PDEs (1D) that describes the mechanism. Numerical simulations of the equations demonstrate certain observed features (aggregation) but not others (centering). The system can be reduced (to an inhomogenous Telegraphers Equation) so as to facilitate analysis which allows for an understanding of the successes and failures of the original model. Finally, we generalize the reduced model to 2D, incorporating a stochatic element, and present numerical results.

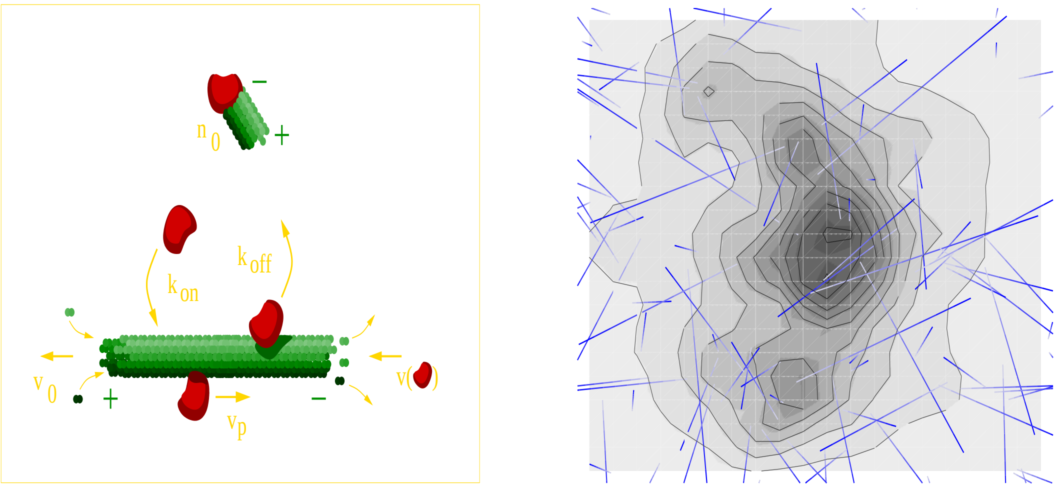

Figure 1: A schematic of the proposed mechanism (right) and some 2-D numerics (left)