TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 12 October 2016, 4:00 p.m.
Room 617 Wachman Hall

(refreshments and social at 3:45 p.m)

Interactions of Solitary Pulses of E. coli in a One-Dimensional Nutrient Gradient

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Abstract. We study an anomalous behavior observed in interacting E. coli populations. When two populations of E. coli are placed on opposite ends of a long channel with a supply of nutrient between them, they will travel as pulses toward one another up the nutrient gradient. We present experimental evidence that, counterintuitively, the two pulses will in some cases change direction and begin moving away from each other and the nutrient back toward the end of the channel from which they originated. Simulations of the Keller-Segel chemotaxis model reproduce the experimental results. To gain better insight to the phenomenon, we introduce a heuristic approximation to the spatial profile of each population in the Keller-Segel model to derive a system of ordinary differential equations approximating the temporal dynamics of its center of mass and width. This approximate model simplifies analysis of the global dynamics of the bacterial system and allows us to efficiently explore the qualitative behavior changes across variations of parameters, and thereby provides experimentally testable hypotheses about the mechanisms behind the turnaround behavior.