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Uniform Distribution in Negative Chemotaxis

In contrast to random diffusion without orientation, chemotaxis is the biased movement of organisms toward the region that contains higher concentration of beneficial or lower concentration of unfavorable chemicals. The former often refers to the attractive chemotaxis and latter to the repulsive chemotaxis. Chemotaxis has been advocated as a leading mechanism to account for the morphogenesis and self-organization of a variety of biological coherent structures such as aggregates, fruiting bodies, clusters, spirals, spots, rings, labyrinthine patterns and stripes, which have been observed in experiments. In this talk, I will present some recent results regarding the rigorous analysis of a nonlinear PDE model arising from the study of repulsive chemotaxis. In particular, local/global well-posedness, long-time asymptotic behavior and diffusion limits of classical solutions will be discussed. The long-time behavior results show that constant equilibrium states are stable, which indicates that chemo-repulsion problem with logarithmic chemotactic sensitivity exhibits a strong tendency against pattern formation. The diffusion limit results demonstrate that the chemically diffusive model is consistent with the non-diffusive model under certain boundary conditions, which may help reduce the computational cost for numerical simulation of the model.