

New models of chemotaxis: analysis and numerics

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Patlak-Keller-Segel (PKS) system is a classical PDE model of the chemotaxis. The system admits solutions that develop delta-type singularities within a finite time. Even though such blowing up solutions model a concentration phenomenon, they are not realistic since biological cells do not converge to one point (while the cell density grows sharply, it must remain bounded at all times).

I will present a new chemotaxis model, which can be viewed as a regularized PKS system. The proposed regularization is based on a basic physical principle: boundedness of the chemotactic convective flux, which should depend on the gradient of the chemoattractant concentration in a nonlinear way. Solutions of the new system may develop spiky structures that model the concentration phenomenon. However, both cell density and chemoattractant concentration remain bounded as supported by both our analytical results and extensive numerical experiments.