Positive and negative taxis in interspecies interactions

Dariusz Wrzosek

Uniwersytet Warszawski

We consider two models which describe interspecies interactions in which chemical signaling plays a crucial role. The models belong to the class of parabolic or degenerate parabolic systems with upper-triangular main part. The first system studied in [1] corresponds to the classical Lotka-Volterra model of competition which was extended to account for the random dispersal of individuals and for their capability to avoid encounters with competitors by means of a chemo-sensory reaction to the smell of rivals (chemorepulsion or negative taxis). We consider the case of diffusing and non-diffusing repellent and study existence of non-constant steady states (pattern formation) and long time-behavior.

The second model studied in [2] concerns predator-prey interactions such that the movement of predator searching for prey is the superposition of random dispersal and taxis directed towards the gradient of concentration of some chemical (positive taxis) released by prey, Model II, or released from damaged or injured prey due to predation (e.g. blood), Model I. The logistic o.d.e. describing the dynamics of prey population is coupled to a fully parabolic chemotaxis system describing the dispersion of chemoattractant and predators behavior. Global-in-time solutions are proved in any space dimension and stability of homogeneous steady states is shown by linearization for a range of parameters. For space dimension $N \geq 2$ the basin of attraction of such a steady state is characterized by means of nonlinear analysis under some structural assumptions. In contrast to model II, pattern formation may occur in model I at least in the case $N = 1$.

References

[1] J.I. Tello, D.W., *Interspecies competition and chemorepultion*, submitted.
[2] J.I. Tello, D.W., *Predator-prey model with diffusion and indirect taxis*, to appear in M3AS.