PDEs models for pattern formation in cultures of breast cancer cells

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We focus on nonlinear variants of the parabolic-parabolic Keller-Segel model which describe the aggregation of organisms through the emission of a chemical substance called chemoattractant. Under certain instability condition of Turing type, these models present spatially inhomogeneous solutions, also called patterns, which can describe a variety of biological phenomena, from bacterial aggregation to wound healing. In particular, we propose that the unstable solutions of the chemotaxis systems could give insights on the main phenomena which lead to the creation of spheroidal cellular aggregates observed in *in vitro* cultures of breast cancer cells. In fact, the biological experiments carried out by M. Sabbah and N. Ferrand (INSERM Paris), show that, after few days growing in 3-D matrigels that mimic the extra-cellular matrix, breast cancer cells break the initial uniform distribution to aggregate in spheroidal structures. The main interest in these experiments in motivated by the fact that cancer cells forming metastasis, typically move in clusters and not alone to escape the immune response. The biological interest of the model requires suitable numerical schemes to solve the Keller-Segel system. We propose a one-dimensional positivity-preserving, conservative, finite-volume scheme able to approximate the unstable solutions preserving the energy decay also at the discrete level.

References

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