

Numerical Study of a Chemotaxis System with Non-Linear Boundary Conditions

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A mathematical model for haematopoietic stem cells migration towards their niche in the bone marrow has been proposed in the literature. It consists of a chemotaxis system of partial differential equations (PDEs) with non-linear boundary conditions and an additional ordinary differential equation on a part of the computational boundary. Various classical numerical methods applied directly to this system may lead to numerical instabilities and loss of the positivity property of the solution, as illustrated in [1]. Finite volume method with appropriate flux limiter and time integration scheme can be used to ensure positivity and nonoscillatory nature of the numerical solution. The non-linear boundary conditions require specific approximation (proposed in [2] for the considered system of PDEs) of the unknown functions when the finite volumes close to the boundary are treated. The aim in the current study is to extend the theoretical results in [2] with numerical experiments and analysis of the properties of the numerical method. Ongoing results for various sets of parameters (e.g. chemotactic sensitivity function, flux limiter, time/space mesh size) will be presented.

References

- [1] G. Bencheva, *Computer modelling of haematopoietic stem cells migration*, Computers and Mathematics with Applications **64(3)** 337–349.
- [2] G. Bencheva, *On the choice of limiters in a numerical approximation of a chemotaxis system with non-linear boundary conditions*, AIP Conference Proceedings **1487** 305–313.