Zuzanna Szymańska
ICM, University of Warsaw
e-mail: Z.Szymanska@icm.edu.pl
Mark A. J. Chaplain
Division of Mathematics, University of Dundee
Mirosław Lachowicz
Institute of Applied Mathematics and Mechanics,
University of Warsaw
Dariusz Wrzosek
Institute of Applied Mathematics and Mechanics,
University of Warsaw

Mathematical modelling of cancer invasion: distinguishing between the relative importance of cell-cell adhesion and cell-matrix adhesion

The process of invasion of tissue by cancer cells is crucial for metastasis – the formation of secondary tumours – which is the main cause of mortality in patients with cancer. In the invasion process itself, adhesion, both cell-cell and cell-matrix, plays an extremely important role. In our talk we present a novel mathematical model of cancer cell invasion of the extracellular matrix taking into account cell-cell adhesion as well as cell-matrix adhesion. Considering the interactions between cancer cells, extracellular matrix and matrix degrading enzymes, the model consists of a system of reaction-diffusion partial integro-differential equations, with non-local (integral) terms describing the adhesive interactions between cancer cells and the host tissue, i.e. cell-cell adhesion and cell-matrix adhesion. We first describe the main results that we obtained from a mathematical analysis of the model, i.e. the existence and uniqueness of global in time classical solutions which are uniformly bounded. Then, using computational simulations we investigate the effects of the relative importance of cell-cell adhesion and cell-matrix adhesion on the invasion process. In particular we examine the roles of cell-cell adhesion and cell-matrix adhesion in generating heterogeneous spatio-temporal solutions.

References

[1] M. A. J. Chaplain, M. Lachowicz, Z. Szymańska and D. Wrzosek (2011) Mathematical modelling of cancer invasion: the importance of cell-cell adhesion and cell-matrix adhesion, *Math. Models Methods Appl. Sci.*, **21**, 1-25.