Mohammed Shuker Mahmood
Department of Applied Mathematics, Mechanical Engineering Faculty, University of Žilina, 010 26 Žilina, Slovakia
e-mail: mahmoodm@fstroj.uniza.sk
Silvia Mahmood
Institute of Medical Biochemistry, Jessenius Faculty of Medicine, Comenius University, 037 54 Martin, Slovakia
e-mail: mahmood@jfmed.uniba.sk
Dušan Dobrota
Institute of Medical Biochemistry, Jessenius Faculty of Medicine, Comenius University, 037 54 Martin, Slovakia
e-mail: dobrota@jfmed.uniba.sk

Numerical simulations of a continuum model for avascular tumor growth

Avascular growth is a benign stage of cancer. Multicellular spheroids serve as powerful 3D experimental model system for the study of this early stage of solid tumor growth. We present results obtained from using a continuum model that we previously developed (Mahmood et al., 2010, 2011). The three cell types considered within the model are: the proliferating cells, able to grow and divide at intervals dependent upon their size, environment and regulation of cell cycle; the quiescent non-dividing cells that may return to the proliferative part of the cycle either by an increase in nutrient concentration or in response to external stimuli such as growth factor; dead cells due to apoptosis or necrosis. We assume a different motile response kinetics of the proliferating and quiescent cells to the available nutrient gradient. Moreover, the model includes viable cell diffusion, diffusion of cellular material, viability inhibitor contributing to the expansion of necrotic centre and process of removal of dead cell. This means that our model is a system of equations of parabolic and hyperbolic types. The numerical simulations are performed using different sets of parameters, including biologically realistic ones, to explore the effects of each of these model parameters on reaching the steady state reflecting growth saturation, the number of viable cells, and the spheroid size.

Acknowledgement: This work was supported by project "CENTER OF EXCELLENCY FOR RESEARCH IN PERSONALIZED THERAPY (CEVYPET)", code: 26- 220120053, co-financed from EU sources and European Regional Development Fund and by project "CENTER OF TRANSLATIONAL MEDICINE" co-financed from EC sources and European Regional Development Fund, by Ministry of Health of the Slovak Republic 2007/57-UK-17.

References

[1] Mahmood, M. S., Mahmood, S., Dobrota, D., *A numerical algorithm for avascular tumour growth model.* Mathematics and Computers in Simulation, Vol. 80 (6),**(2010)**, pp. 1269-1277.
[2] Mahmood, M. S., Mahmood, S., Dobrota, D., *Formulation and numerical simulations of a continuum model of avascular tumor growth.* Accepted in Mathematical Bioscience.