Krajowa Konferencja Zastosowań Matematyki w Biologii i Medycynie

Łochów, 23rd–27th September 2014

A MULTIPHASE MODEL OF SOLID TUMOUR GROWTH, INVASION AND VASCULARIZATION

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ABSTRACT

The microenvironment of solid tumours plays a crucial role in a complex process of tumour growth and invasion. In work [1] we describe a mathematical model of tumour growth which take into account interactions between stromal and cellular components of the tissue. Therefore progression of the tumour is possible due to action of the proteases degrading the extracellular matrix proteins. The multiphase model includes also the effect of tissue compression. For the particular set of the parameters simulation of the model reveals desmoplastic type of the tumour progression (i.e. a tumour rich in fibrous connective tissue).

The primary model [1] focuses on a single phenomenon neglecting the tumour neovascularization. The importance of blood vessels is due to their delivery of oxygen and nutrients necessary for cell survival and proliferation. The model was extended by a discrete part devoted to a blood vessels growth and continuous part for the changes of oxygen and vascular endothelial growth factor concentrations. Neovascularization was based on the model by Owen [3] with necessary modifications. Extended model takes into account the cellular state dependence on the oxygen, similarly like in [2]. However, instead of using model with a structure, the multiphase model with separable cell type classes (apoptotic, proliferative, quiescent) was used.

ACKNOWLEDGEMENTS

This work was partially supported by the Polish National Centre of Science under the grants no. N-N519-647840 in year 2013 and no. DEC- 2011/03/B/ST6/04384 in year 2014.

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