Modeling the demise of migrating brain tumor cells

June 6 2012

An Israeli physicist has developed a theoretical model to simulate the evolution of highly proliferating brain tumour core cells subjected to treatment by alternating radio frequency electric field. The research, by Alexander Iomin from the Israel Institute of Technology Technion in Haifa, is about to be published in *European Physical Journal E*. In another model, the author examines the possibility of enhancing the level of treatment by targeting the outer area of the tumour.

Iomin introduced a theoretical evaluation of the effect of a standard treatment known as tumour-treating-field (TTF) on the speed of development of a type of brain tumour called glioma. To do so, he adapted a well-established model -- the so-called fractal comb model, which looks like the regularly spaced teeth of a comb -- based on a mathematical approach called fractional calculus. This model is based on the hypothesis that TTF treatment had limited efficiency in the outer region and would only be effective on the inner part of the tumour, which is characterised by a higher proliferation rate of cancer cells.

By contrast, the peripheral part of the tumour is characterised by high migration and low proliferation rates of cancer cells. In his second model, the author considered glioma cancer as a composite of cancer cells and normal tissue cells. Each cell type exhibits a distinctive polarisation by an electric field, following a pattern similar to fractal geometry. He established a model reflecting the difference between the two types of cells and applied fractal calculus to their geometry. Iomin suggested that because of the fractal nature of cancer cells the TTF

treatment might be enhanced at certain frequencies. As a result, the cancer cells' plasma membrane permeability would irreversibly increase, which could lead to their demise. This approach may constitute an effective non-invasive method for treating brain cancer.

More information: Iomin A., A toy model of fractal glioma development under RF electricfield treatment (2012), *European Physical Journal E* (EPJ E) 35: 42, DOI 10.1140/epje/i2012-12042-9

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