FRACTAL EVALUATION OF TUMOR GROWTH MODELS

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Abstract. *The paper presents two applications of fractal analysis techniques in order to develop new software instruments for cancer research. Essentially the applications refer to two types of tumor growth models, the first in the case of avascular tumors, the second in the case of vascularized tumors. The fractal evaluation of the accuracy of tumoral growth models is discussed, with care to avoid the conflict between the real complexity of the biological process and a reductionist approach for simplest modeling.*

Keywords: Biological system modeling, Biomedical informatics, Cancer, Fractals, Tumor growth, Simulation

1. Introduction

Tumor growth is a most complex process, ultimately dependent on tumor cells proliferating and spreading in host tissues. A very important implication of the spatial and temporal symmetries of tumors is that certain universal quantities can be defined which allow the characterization of the tumor growth dynamics.

Modeling and simulation of tumor growth in competition with the immune system is certainly one of the challenging frontiers of applied mathematical which could have a great impact both on the quality of life and development of mathematical sciences. The common feature of the above mathematical approach is that the equation model living matter and the ability of cells to organize their dynamics needs to be an essential feature of these mathematical models.

Tumor evolution is a most complex process involving many different phenomena. Understanding the dynamics of cancer growth is one of the great challenges of modern science. Solid tumors develop initially as a single mass of cells. These divide more rapidly than the cells around them because of a proliferative advantage caused by mutation, and a number of genetic pathways responsible for these mutations have been identified over the last decade [1], [2].

Because there are three distinct stages (avascular, vascular, and metastatic) to cancer development, researchers often concentrate their efforts on answering specific questions on each of these stages. Nevertheless, when attempting to model any complex system it is wise to try and understand each of the components as well as possible before they are all put together.

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