Mechanics at the cellular level: the case of brain tumor cells

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Abstract

In the last decades studies of tissue growth have essentially focused on biochemical and genetic factors. However in recent years research has shown that biomechanical cues also play an important role in cell migration [1]. Cells migrate through adhesion that is the binding to an extracellular matrix or another cell. During cell migration special structures in the cell detect the stiffness of the surrounding medium and when adhesions are strong, the cell moves forward. Recent studies have shown that manipulating the elasticity of a substrate in a cell culture can influence lineage of mesenchymal stem cells, spreading of vascular smooth muscle cells, or the migration and proliferation of tumor cells. Different biological theories [2] have been formulated to explain these processes, focusing essentially on a direct mechanical explanation or on biochemical explanations mechanically mediated. In this talk the proliferation and migration of brain tumor cells is addressed [3]. Some aspects of those theories are discussed. A mathematical model, represented by a nonlinear system of PDEs that describes the simultaneous growing of brain tumor cells and the therapeutic effects of drugs is analyzed. Stability results are established. Efficient treatment protocols are defined. The influence of mechanical properties is highlighted. Numerical results will illustrate the approach.

Keywords: Brain tumor cells, stiffness of the surrounding medium, efficient protocols, stability.

References

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