MATHEMATICAL MODELING OF THE FORMATION OF TUMOR STRUCTURES WITH CARCINOMA GROWTH

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Recently, in the literature [1], the influence of the mechanisms of epithelial-mesenchymal transition (EMT) and the reverse mesenchymal-epithelial transition (MET) in cells on the processes of formation and development of neoplasms is discussed. Much attention is devoted to the formation of heterogeneous structures in the tumor, observed in clinical studies. Under the influence of EMT, cancer cells acquire a mesenchymal phenotype, which contributes to their migration into tissue and subsequent metastasis to other organs.

In this paper, we present a modified version of a mathematical model of carcinoma growth in squamous tissue of the epithelium, proposed for the first time in [2] and generalized in [3] to the case of EMT and MET. The changes relate to the mechanism of "dilution" by a tumor of a layer of healthy cells adjacent to it, which simulates the process of reducing the concentration of integrins and cadherins in this layer, which keep healthy cells in the epithelial phenotype. The concept of cellular society is introduced, in which three groups of cancer cells with different sets of values of physicochemical parameters are identified. Thus, the tumor evolves as a complex heterogeneous system. The simulation results show that cancer invasion can occur under different scenarios and lead to the formation of various structures reflecting the process of self-organization of tumor cells and its adaptation to environmental conditions. A comparison of simulation results with experimentally identified structures of breast carcinoma was carried out.

References

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