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Collective Behavior of Brain Tumor Cells: the Role of Hypoxia EVGENIY KHAIN, Oakland University, MARK KATAKOWSKI, Henry Ford Hospital, SCOTT HOPKINS, Oakland University, ALEXANDRA SZALAD, XUGUANG ZHENG, FENG JIANG, MICHAEL CHOPP, Henry Ford Hospital —
We consider emergent collective behavior of a multicellular biological system. Specifically we investigate the role of hypoxia (lack of oxygen) in migration of brain tumor cells [1]. We performed two series of cell migration experiments. The first set of experiments was performed in a typical wound healing geometry: cells were placed on a substrate, and a scratch was done. In the second set of experiments, cell migration away from a tumor spheroid was investigated. Experiments show a controversy: cells under normal and hypoxic conditions have migrated the same distance in the "spheroid" experiment, while in the "scratch" experiment cells under normal conditions migrated much faster than under hypoxic conditions. To explain this paradox, we formulate a discrete stochastic model for cell dynamics [1,2]. The theoretical model explains our experimental observations and suggests that hypoxia decreases both the motility of cells and the strength of cell-cell adhesion. The theoretical predictions were further verified in independent experiments [1].

[1]. E. Khain, M. Katakowski, S. Hopkins, A. Szalad, X.G. Zheng, F. Jiang, M. Chopp, Physical Review E 83, 031920 (2011).
[2]. E. Khain, C. M. Schneider-Mizell, M. O. Nowicki, E. A. Chiocca, S. E. Lawler and L. M. Sander, EPL (Europhysics Letters) 88, 28006 (2009).

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