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Pattern formation of glioma cells: effects of adhesion EVGENIY KHAIN, Department of Physics, the University of Michigan, Ann Arbor, MI 48109, MICHAL O. NOWICKI, E. ANTONIO CHIOCCA, SEAN E. LAWLER, Department of Neurological Surgery, The Ohio State University Medical Center, Columbus, OH 43210, LEONARD M. SANDER, Department of Physics, the University of Michigan, Ann Arbor, MI 48109 — *Glioblastoma multiforme* is a highly malignant brain tumor. We investigate the mechanism of clustering of glioma cells *in vitro*; this may shed light on clustering in the brain. Recent experiments with tumor spheroids growing in a transparent gel showed that one cell line formed clusters in a region where invasion occurs, whereas a very similar cell line does not cluster significantly. Using stochastic discrete modeling of motile adhesive and proliferative cells, we identified two important mechanisms which may lead to clustering. First, there is a critical value of the strength of cell-cell adhesion; above the threshold, large clusters grow from a homogeneous suspension of cells; below it the system remains homogeneous. Second, when several single cells form a small cluster, they may switch their phenotype from "invasive" to "proliferative," increasing their division rate. The theoretical predictions were tested in an experiment in which we followed the clustering dynamics of glioma cells on a surface. We have successfully reproduced the experimental findings and found that both mechanisms are crucial for cluster formation and growth.

Evgeniy Khain
Department of Physics, the University of Michigan, Ann Arbor, MI 48109

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