Two Dimensional Collective Motions of Cancer and Endothelium Cell Mixtures

Yi-Teng Hsiao(蕭翌登)[1], Hsiang-Ying Chen (陳香穎)[1], Shu-Chen Liu (劉淑貞)[2],
Tien Hsu (徐沺)[2], Wei-Yen Woon(溫偉源)[1], and Lin I (伊林)[1]
Department of Physics, National Central University[1]
Department of Biomedical Sciences and Engineering, National Central University[2]

In biological processes, such as embryogenesis, tumorigenesis and wound healing, cells exhibit cooperative motion through the interplay of active driving, adhesion, and mutual coupling. The past studies have mainly concentrated on the systems formed by the same type of cells. In this work, the cooperative motion of the binary cell mixture formed by the invading of bone marrow metastasis nasopharyngeal carcinoma cells (BM1) into the human umbilical vein endothelial cells (HUVECs) on the 2D substrate is investigated experimentally. It is found that, the motilities of the two different types of cancer cells strongly affect the packing and cooperative motion of cancer cells and the adjacent endothelia cells. The invasion by the high motility cancer cell causes the formation of low speed endothelial clusters surrounded by the cancer cells with high speed cooperative motion with non-Gaussian velocity distribution. For the opposite case, low speed cancer cell clusters surrounded by endothelial cells with high speed cooperative motion are observed. The cell shape factor also determines whether a cell can be the moving cell or the center for the vortex or the saddle point of formed by the surrounding moving cells.