The underlying difference of metastatic and benign cancer cells in configuring the fibre matrix to promote migration by long-distance cell mechanics

Mingxing Ouyang[1], Weihui Chen[1], Ting Zhou[1], Teng Luo[1], Chenyan Zhu[1], Lingyun Yan[1], Lei Liu[1], Bing Bu[1], and Linhong Deng[1]

[1]Changzhou University

October 30, 2023

Abstract

The progression of tumors is heavily influenced by mechanical properties of their microenvironment. In this work, we designed micropatterned models with varying distances and shapes to investigate the differences between metastatic breast cancer cells MDA-MB-231 and non-metastatic MCF-7 in reconfiguring the extracellular matrix to promote cell migration induced by long-distance cell mechanics. Both cancer cells were able to rearrange type I collagen fibres to form collagen threads, in which MDA-MB-231 consistently migrated more rapidly than MCF-7, ranging from matrix model with differently arrayed spacings to complex polygonal models. MDA-MB-231 displayed higher capability of reorganizing fibre bundles at longer distance (800 μm). Further looking for differences in cellular mechanical mechanisms, siRNA knockdown inhibiting either integrin β1 or Piezo1 decreased fibre assembly. Metastatic MDA-MB-231 showed inhibited migration with integrin knockdown, whereas scattered migration with Piezo1 knockdown indicating cells losing distant mechanosensation. MCF-7 with reduced E-cadherin by siRNA transfection showed less significant differences in migration compared to MDA-MB-231 that didn't express E-cadherin. MDA-MB-231 expressed little E-cadherin mRNA indicating mutagenetic change in genome. In summary this work has explored the differences between malignant and benign breast cancer cells, particularly in terms of fibre matrix remodelling and cell migrations, along with significant differences in E-cadherin expressions, of which had an important effect on cell migration. The results of this study provide new research approaches for therapeutic advances in breast cancer.

Hosted file

`Difference in long-distance mechanics-2023.10.21.docx` available at https://authorea.com/users/682859/articles/678205-the-underlying-difference-of-metastatic-and-benign-cancer-cells-in-configuring-the-fibre-matrix-to-promote-migration-by-long-distance-cell-mechanics