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Biophysical force regulation in 3D tumor cell invasion[1]

MINGMING WU, Cornell University

When embedded within 3D extracellular matrices (ECM), animal cells constantly probe and adapt to the ECM locally (at cell length scale) and exert forces and communicate with other cells globally (up to 10 times of cell length). It is now well accepted that mechanical crosstalk between animal cells and their microenvironment critically regulate cell function such as migration, proliferation and differentiation. Disruption of the cell-ECM crosstalk is implicated in a number of pathologic processes including tumor progression and fibrosis. Central to the problem of cell–ECM crosstalk is the physical force that cells generate. By measuring single cell generated force within 3D collagen matrices, we revealed a mechanical crosstalk mechanism between the tumor cells and the ECM. Cells generate sufficient force to stiffen collagen fiber network, and stiffer matrix, in return promotes larger cell force generation. Our work highlights the importance of fibrous nonlinear elasticity in regulating tumor cell-ECM interaction, and results may have implications in the rapid tissue stiffening commonly found in tumor progression and fibrosis.

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