Mechanical interaction between cells in fibrous environments

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Tissues are made up of cells and an extracellular matrix (ECM), a cross-linked network of biopolymers with complex mechanics. Cells actively alter the extracellular matrix (ECM) structure and mechanics by applying contractile forces. These forces can propagate to far distances and allow for remote sensing. We study experimentally and computationally how cell-induced forces are transmitted in fibrous environments, the underline physical mechanisms [1], and the ability of the propagated forces to support mechanical interaction between distant cells. We also demonstrate how the changes in ECM isotropy and density can lead to improve transport of molecules traveling between the cells, facilitating mechano-biochemical feedback interactions [2]. Such long-range interactions through the matrix can drive large-scale cooperative biological processes, such that occur during wound healing and morphogenesis. Our work can also provide design parameters for biomaterials used in tissue engineering.

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2. D. Gomez, S. Natan, Y. Shokef, and A. Lesman. Mechanical interaction between cells facilitates molecular transport. arXiv:1904.08340, 2019.