Institute of Aerospace Medicine
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Single and collective cell forces in 3-D hydrogels

Culturing cells in 3-dimensional hydrogels has become increasingly common - a development that is driven by the rapidly advancing fields of tissue engineering and biofabrication. Currently, the most widely used hydrogels for 3 D cell culture are extracellular matrix (ECM)-based natural biopolymers such as collagen, fibrin, or Matrigel (a mixture of different extracellular matrix components). These biopolymers form soft, porous networks with elastic moduli on the order of 100 Pa and pore sizes on the order of microns. They support the adhesion of cells, and they can be locally remodeled by the cell through mechanical forces and the secretion of matrix-degrading enzymes. These properties together lead to cell behavior that is desirable for many applications, such as a high degree of cell spreading and polarization, migration, and proliferation. These essential cellular processes are tightly regulated by mechano-chemical signal transduction processes, that in turn are governed by a force balance between active cell-generated contractile and adhesive forces, and opposing forces from the extracellular matrix and neighboring cells. In my talk, I will focus on methods to measure cell forces in 3-D environments and present data on how 3-D migration of tumor cells and immune cells depend on adhesion and force generation.