Molecular Mechanobiology of Extracellular Matrix: Functional implications in healthy and diseased organs.

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Reciprocal mechanical signaling between cells and their environment is key to the spatio-temporal coordination of tissue growth and regenerative processes, and if miss-balanced can tip the niche towards pathological transformations. Yet, these reciprocal processes and how they tune cell function are difficult to quantify in real organs. Translating what was learned in Mechanobiology mostly on single cells to the tissue level is hampered by at least two challenges, the lack of nanoscale sensors to probe forces or tissue fiber tension in organs, as well as appropriate de novo grown 3D microtissues to mimic essential aspects of healthy versus diseased tissue niches. To address these challenges, we developed a peptide-based nanosensor that can read out the tensional state of ECM fibers, and validated it using either tissue cryosections or upon injection into living animals. We will discuss our recent insights by comparing healthy versus diseased organ tissues as compared to cancer. Discoveries into the molecular mechanobiology of ECM at the tissue level are prone to open new diagnostic and therapeutic avenues.

[1] Viola Vogel (2021).