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Dynamics of cardiac laminar sheets under shear stress[1] LAURA TURCO, MARCO TARANTOLA, Max Planck Institute for Dynamics and Self-Organization — Cardiac tissue is continuously subjected to mechanical stress in vivo. Cells are both stretched and exposed to shear forces due to the relative movement of myocardial sheets against each other and due to the movement of interstitial fluid between individual cells and cell layers. The effect of shear forces, especially under pathological conditions and at different time scales, is not well understood so far. We apply different degrees of flow-induced shear stress to cardiac monolayers to simulate cardiomyopathy and to cardiomyocytes-fibroblast co-cultures as a model for fibrosis. By combining electric cell-substrate impedance sensing and optical microscopy, we analyze the short- and long-term effect of shear forces on cell-cell connectivity, cell morphology and functionality. At the onset of shear, we observe a decrease in the monolayer-substrate distance and a rapid increase in complex impedance of the cell layer. Moreover, this response is faster when higher shear stresses are applied. We quantify the increment of cell contact area, cell elongation and reorientation along the flow direction. Further, the impedance measurements show an increase in collective beating frequency and cell-cell connectivity with higher shear stresses.

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