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Geometrical Reorganisation of the Cytoskeleton and Changes in Cellular Stiffness Following Stretch HARIKRISHNAN PARAMESWARAN, BELA SUKI, Boston University — Cells in the lung and the vasculature are under a highly dynamic mechanical environment where they are constantly exposed to stretch. Cells adapt to these fluctuations in stretch by remodeling their cytoskeleton. However, the influence of these geometrical changes on cell stiffness is not well understood. We developed a computational model to simulate the geometrical reorganization of the actin by non-muscle myosin-II under conditions of monotonous cyclic stretch, where amplitude and frequency is constant from cycle to cycle and variable stretch, where the amplitude is varied from cycle-to-cycle and the frequency is inversely proportional to amplitude. With the monotonous cyclic-stretch, the network exhibited significant hysteresis in geometry, it reorganized itself into a more stable configuration and the internal prestress decreased after each cycle. In contrast, the more realistic variability in stretch amplitude prevented these stable configurations from forming and preserved the prestress. This behavior was dependent on the variability in stretch amplitude and the timing of the large amplitude stretches. We conclude that prestress is a consequence of cytoskeletal reorganization which exhibits structural hysteresis and is dependent on the nature of the stretch pattern.

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