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ECM remodeling and its plasticity JINGCHEN FENG, center for theoretical biological physics, Rice university, Houston, TX 77005, CHRISTOPHER A. R JONES, MATTHEW CIBULA, Department of Physics, Oregon State University, Corvallis, OR 97331, XIAOMING MAO, Department of Physics, University of Michigan, Ann Arbor MI 48109-1040, LEONARD M. SANDER, Physics Complex Systems, University of Michigan, Ann Arbor MI 48109-1040, HERBERT LEVINE, center for theoretical biological physics, Rice university, Houston, TX 77005, BO SUN, Department of Physics, Oregon State University, Corvallis, OR 97331 — The mechanical interactions between cells and Extracellular Matrix (ECM) are of great importance in many cellular processes. These interactions are reciprocal, i.e. contracting cells pull and reorganize the surrounding matrix, while the remodeled matrix feeds back to regulate cell activities. Recent experiments show in collagen gels with densely distributed cells, aligned fiber bundles are formed in the direction between neighboring cells. Fibers flow into the center region between contracting cell pairs in this process, which causes the concentration of fibers in the fiber bundles to become significantly enhanced. Using an extended lattice-based model, we show that viscoelasticity plays an essential role in ECM remodeling and contributes to the enhanced concentration in fiber bundles. We further characterize ECM plasticity within our model and verify our results with rheometer experiments.

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