Supplementary material

First we compare MC3T3-E1 cells with primary osteoblasts. Though the former are a convenient cell line for experiments on a daily basis, primary cells are much closer to the in-vivo situation. As shown in Fig. 1A and Supplementary Movie 2, the phenomenology is the same as for MC3T3-E1 osteoblasts. The contraction rate is even of the same order of magnitude. In contrast, we observe a different behaviour with 3T3 fibroblasts. Neither alignment nor contraction are observed within the first 20 hours after gelation, even though fibroblasts can extend protrusions and move inside the gel (see Fig. 1B and Supplementary Movie 3). However, lowering collagen concentration merely by a factor of two makes fibroblasts behave like osteoblasts: they contract the gel anisotropically, also in a cell density-dependent manner (see Fig. 1C and Supplementary Movie 4).

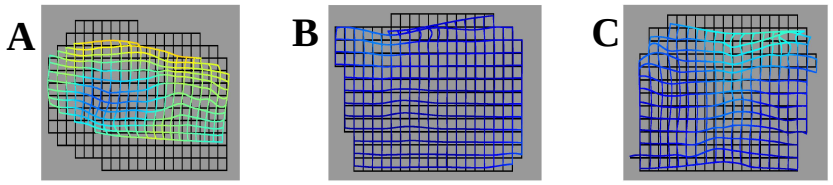

Figure 1: Effect of cell type and collagen concentration on gel contraction. The black grids correspond to the initial state of the gel right after gelation. The color code gives the perpendicular stretch factor $\lambda_\perp$. **A:** Primary osteoblasts strongly contract the gel within 3 h. **B:** 3T3 fibroblasts do not attain a significant contraction after 15 h (see also Supplementary Movie 3). **C:** By lowering collagen concentration from 3 mg/ml to 1.5 mg/ml (which amounts to a decrease in rigidity from 14 Pa to 2 Pa), anisotropic contraction is achieved by 3T3 fibroblasts within 15 h (see also Supplementary Movie 3).

Supporting Video #1: Contraction of a collagen gel (collagen concentration 3 mg/ml) by MC3T3-E1 osteoblasts. Total elapsed time is 9 h.

Supporting Video #2: Contraction of a collagen gel (collagen concentration 3 mg/ml) by primary osteoblasts (from human spongiosa). Total elapsed time is 2 h.

Supporting Video #3: 3T3 fibroblasts do not significantly contract the collagen gel (collagen concentration 3 mg/ml). Total elapsed time is 15 h.

Supporting Video #4: By lowering collagen concentration to 1.5 mg/ml, anisotropic contraction by 3T3 fibroblasts can be observed. Total elapsed time is 15 h.

Supporting Video #5: Heterogeneous distribution of MC3T3-E1 osteoblasts highlights the importance of cell density. Whereas the cells located at the lower edge contract the gel, the isolated cells wandering at the upper edge do not. Total elapsed time is 4 h.