Differential cellular contractility as a mechanism for stiffness sensing: Electronic Supplementary Information

1. Strains within cells on soft substrates exhibiting circular geometry: consideration of both radial and circumferential strains.

![Figure S1](image.png)

**Figure S1.** Plot of the strains within the cell corresponding to the plots of Fig. 1. The dashed, dotted and solid lines represent the radial strain ($e_{rr}$), circumferential strain ($e_{\theta\theta}$) and the strain invariant ($e_{rr} + e_{\theta\theta}$), respectively. Blue lines correspond to $\gamma = 10$ and black lines correspond to $\gamma = 5$, all other parameters as for Fig. 1.

2. Calculation of stresses.

As discussed in the main text the active stress approach naturally leads to a consideration of cellular strains which are considered here as the primary mechanism of mechanotransduction. Stresses if required are easily accessible once the deformations have been calculated through the material constitutive relations. The active stress framework assumes an active contractile network which is assumed to be embedded.
Figure S2. Plot of the radial and hoop elastic stresses within the cell corresponding to the plots of Fig. 1. The solid and dotted and solid lines represent the radial stress ($F_{rr}$), circumferential stress ($F_{\theta\theta}$), respectively. Blue lines correspond to $\gamma = 10$ and black lines correspond to $\gamma = 5$, all other parameters as for Fig. 1.

within the cell. However, while the deformations throughout the cell both in active contractile and in passive non-contractile elements are the same we note that the stresses experienced are not. Within the active contractile network (e.g. actin-myosin complexes) the stress experienced will be the total stress $F_{ij}$ given by the elastic stress $F_{ij}^e$ (calculated from the deformation) plus the added active component. Contractile elements thus experience a resistance to contraction and this will determine e.g. molecular stall forces. However, in elements of the cell which are not contractile and that are passively deformed the relevant stress is an elastic stress corresponding to the experienced deformation. As an example of the translation of deformation to stress, the elastic stress for the circular cell is plotted in Fig. S2.

3. Displacements for elliptical cell along major and minor axes
Figure S3. a) Plot of horizontal displacements along the semi-major axis for an elliptical cell with \( \alpha = 1.5 \) for substrates of stiffness \( \gamma = 5, 7, 10, 20 \) from bottom to top. (By symmetry there are no displacements in the \( y \) direction) b) Plot of vertical displacements along the semi-minor axis for an elliptical cell with \( \alpha = 1.5 \) for substrates of stiffness \( \gamma = 5, 7, 10, 20 \) from bottom to top. Note that as stated in the main text the displacement at the end of the semi-major axis is always greater than at the end of the semi-minor axis, specifically the value for the semi-major axis represents an increase of between 0.7\% and 43\% over the value for the semi-minor axis for the parameter values plotted here.