

Supplemental material

Supplemental Table S1

Table S1: Summary of parameters estimated from measurements and theory

Parameter	Description	Value	Note
$\Delta\Pi_{n0}$	Osmotic pressure difference across the nuclear envelope in the adherent state (Pa)	839 ^a	Solved
F	Force applied by actin fibers atop the nucleus in the adherent state (nN)	122 ^a	Solved
P_{m0}	Pressure applied by microtubules in the adherent state (Pa)	23.3 ^a	Solved
P_{mi}	Increased pressure applied by microtubules in the suspended state (Pa)	1.6 ^a	Fitted
$\gamma = \Pi_{n0}/\mu$	Ratio between the osmotic pressure inside the nucleus and the shear modulus of the nucleus	50	Fitted
$\bar{\alpha}$	Rate constant of water transport (min^{-1})	3×10^{-3}	Fitted

^aThe shear modulus of the nuclear envelope has been taken as $\mu \sim 10^4\text{Pa}$

Supplemental Figures

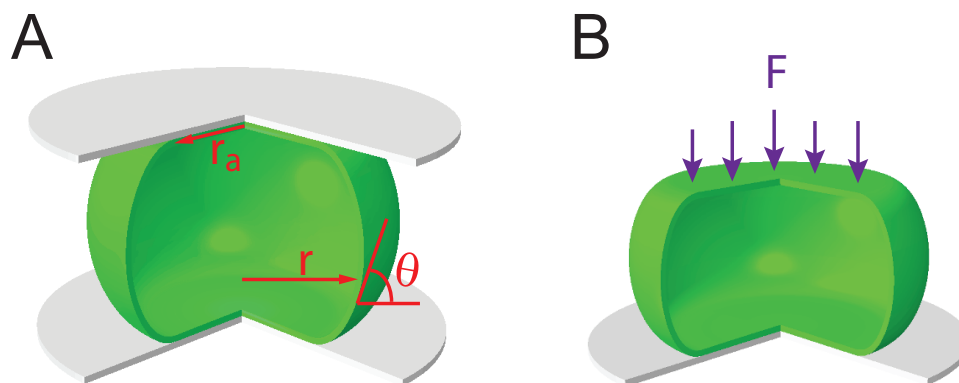


Figure S1: Schematic of the cell nucleus in the attached state. (A) We model the compression force from perinuclear actin stress fibers as a compressive plate. (B) The total force from actin stress fibers is F .

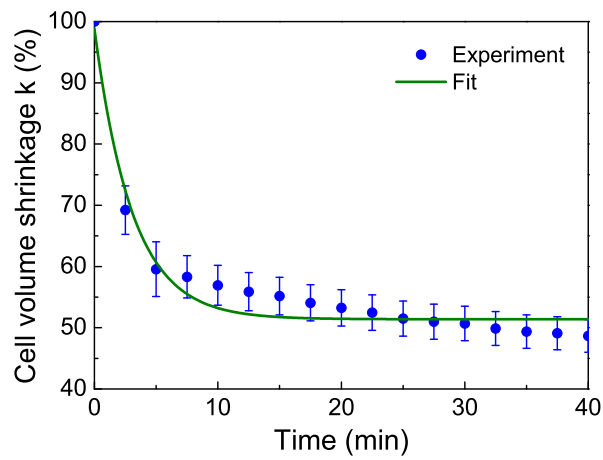


Figure S2: Shrinkage in MEF cell volume during detachment from the substrate as computed from $k(t) = V_c(t)/V_{c0}$ (standard errors are computed from 37 cells). The volume decreased by 50%. The green line is a numerical fit to the data, which is then used in Eq. 17 to compute the nuclear volume.

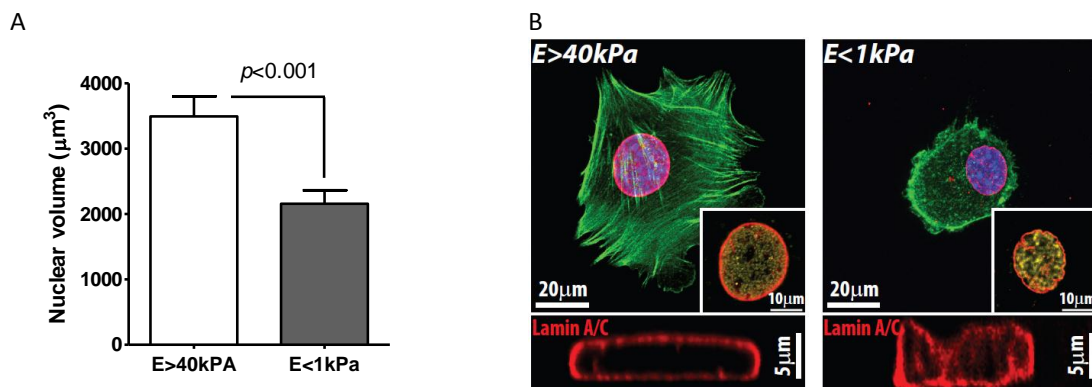


Figure S3: Nuclear volume change in MEF cells on substrates of different stiffness. (A) Average nuclear volume for cells on stiff ($E > 40\text{kPa}$) and soft ($E < 1\text{kPa}$) polyacrylamide hydrogels. $N > 20$ cells were tested per condition (B) 3D reconstructed images of cell nuclei on stiff and soft substrates. Images are modified from Fig. 3J and K in Kim and Wirtz (2015).

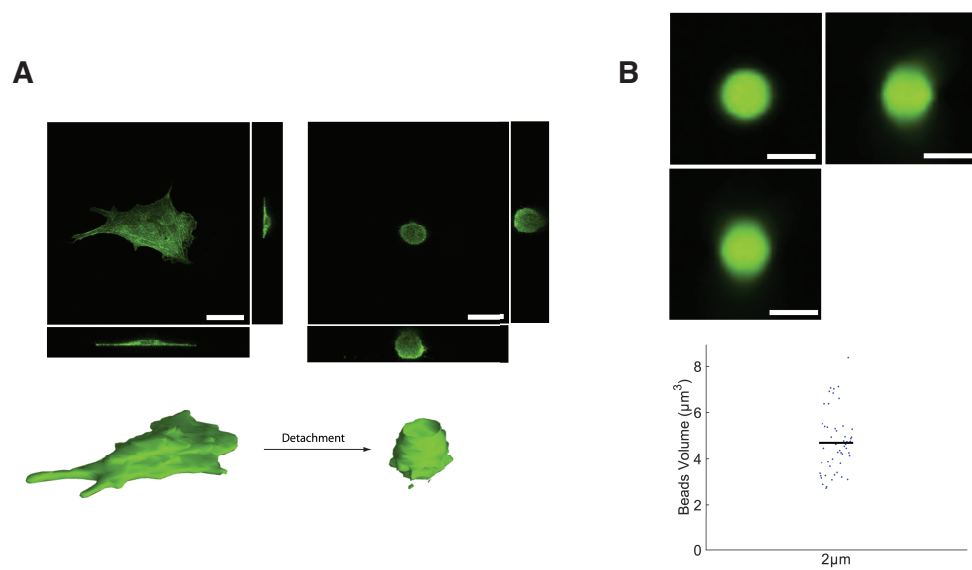
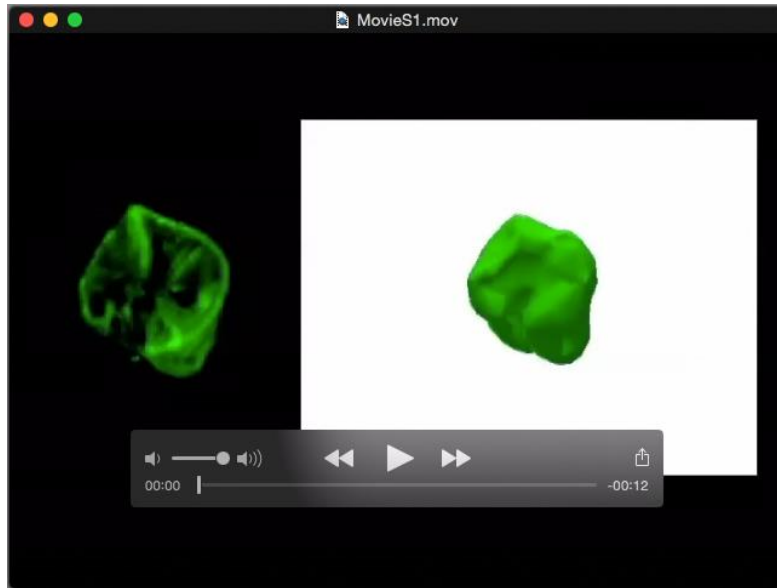


Figure S4: (A) 3D confocal images of MEF cells in attached and detached state. The reconstructed shapes are shown below. The scale bar is $30\mu\text{m}$. (B) 3D confocal images of $2\mu\text{m}$ diameter beads. The scale bar is $2\mu\text{m}$. The average computed volume is within 10% of the theoretical volume, but there are significant measurement errors for small beads.

Supplemental Movies



Movie 1 A movie comparing the 3D confocal images of the nucleus with the 3D reconstructed nucleus.