

# Mitotic cells contract actomyosin cortex and generate pressure to round against or escape epithelial confinement

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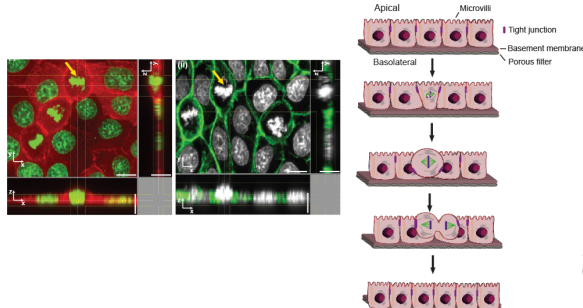
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## SUMMARY

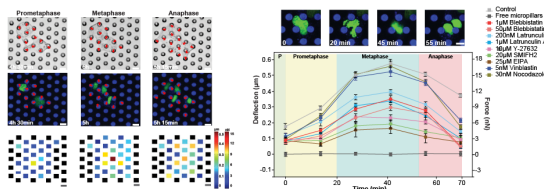
Little is known about how mitotic cells round against epithelial confinement. Here, we engineer micropillar arrays that subject cells to lateral mechanical confinement similar to that experienced in epithelia. If generating sufficient force to deform the pillars, rounding epithelial (MDCK) cells can create space to divide. However, if mitotic cells cannot create sufficient space, their rounding force, which is generated by actomyosin contraction and hydrostatic pressure, pushes the cell out of confinement. After conducting mitosis in an unperturbed manner, both daughter cells return to the confinement of the pillars. Cells that cannot round against nor escape confinement cannot orient their mitotic spindles and more likely undergo apoptosis.

## RESULTS

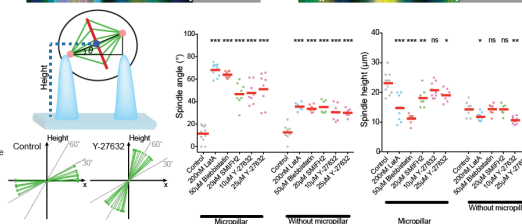
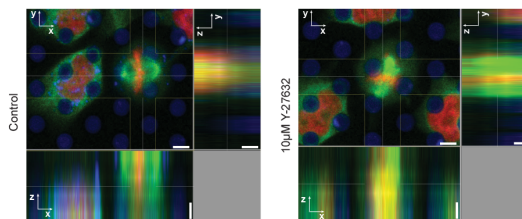
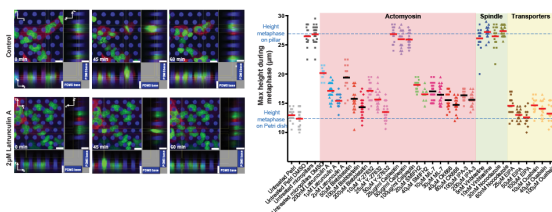
Mitosis in polarized MDCK cells: mitotic epithelial cells lose their cubical architecture and round towards the apical surface of epithelia.



Micropillar deflection reveals the forces generated by MDCK cells progressing through mitosis



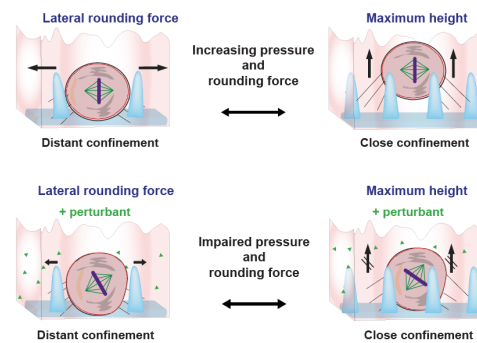
Height elevation of rounding mitotic MDCK cells confined by narrowly spaced micropillars depends on actomyosin cortex and hydrostatic pressure.



Effect of micropillar confinement on the orientation of mitotic spindle:

- a) cells that can escape the mechanical confinement and round up unperturbed orient their mitotic spindle parallel to the substrate
- b) cells that cannot deform or escape the micropillar confinement show an impaired spindle orientation.

## CONCLUSION



Proposed model of mitotic cell rounding in confinement:

- (a) mitotic cells generate an outward direct pressure to create space for rounding. This pressure deforms the micropillars. The deflection measures the force generated by the rounding mitotic cell
  - (b) mitotic cells in presence of perturbants that cannot create sufficient pressure to deform their confinement or to push themselves out of the confinement cannot round properly.
- The micropillar array opens up the possibility to perform large scale screen for genes and mechanisms involved in mitotic cell rounding.