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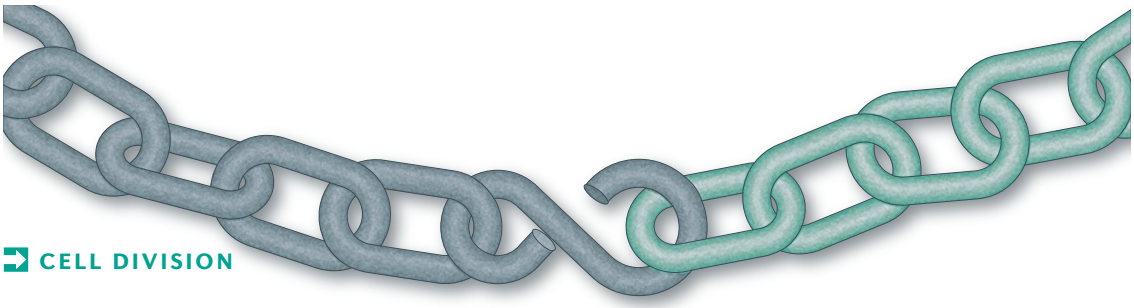

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CELL DIVISION

The benefits of tension release

> forces exerted by daughter cells on the intercellular bridge determine the timing of abscission onset

The final cut during cytokinesis, termed abscission, varies in its timing. Piel and colleagues show that the forces exerted by daughter cells on the intercellular bridge determine the timing of abscission onset, by allowing ESCRT-III (endosomal complex required for transport III), which drives this final cut, to assemble only when tension is released.

Abscission requires the assembly of ESCRTs, which in turn recruit the microtubule-severing enzyme spastin. To dissect the factors that might contribute to differences in the timing of abscission, the authors looked at the conditions that correlated with this process. They saw that the onset of abscission was quicker when cells were cultured at higher density. Moreover, for cells plated on micropatterns that increased their ability to move apart, microtubule severing and abscission were delayed.

Contrary to earlier models of cytokinesis, these findings suggested that tension at the cytokinetic bridge might actually delay abscission. To test this directly, the authors used traction force microscopy (TFM) and laser ablation to measure forces on the intercellular bridge. This showed that the bridge experienced forces in the nanonewton range. They also saw that bridges that were about to undergo abscission (identified on the basis of their microtubule morphology) were in a more 'relaxed' form. Furthermore, the pharmacological inhibition of cell contraction reduced bridge tension and led to more rapid abscission onset; and analysis of membrane tension using a membrane tether and a laser trap showed that membrane tension was higher in cells with longer abscission times. Thus, both cell contractility and membrane tension contribute to bridge tension.

On the basis of this, the authors proposed that abscission is triggered when daughter cells stop pulling on one another and bridge tension is reduced. They tested this possibility by using laser ablation to produce a cut on one side of the intercellular bridge in dividing cells. This induced an abscission-like cut on the other side of the bridge, and this effect was specific as it required both ESCRT-III-mediated 'pinching' of the bridge and spastin-mediated microtubule severing. Finally, they assessed when ESCRT-III is assembled relative to loss of tension by tracking the ESCRT-III component CHMP4B (charged multivesicular body protein 4B) in live cells that were subjected to laser ablations at different time points. This revealed that tension release is required to induce ESCRT-III assembly.

Whether this tension release affects ESCRT-III assembly directly or through mechanotransduction signalling pathways is not yet clear, but this new control step adds to the growing appreciation that cells have multiple mechanisms in place to ensure abscission occurs only at the right place and time.

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ORIGINAL RESEARCH PAPER Lafaurie-Janvore, J. *et al.* ESCRT-III assembly and cytokinetic abscission are induced by tension release in the intercellular bridge. *Science* **339**, 1625–1629 (2013)