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Mechanics of cell division in fission yeast

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Cytokinesis is the stage of cell division in which a cell divides into two. A paradigm of cytokinesis in animal cells is that the actomyosin contractile ring provides the primary force to squeeze the cell into two. In the fission yeast *Schizosaccharomyces pombe*, cytokinesis also requires a actomyosin ring, which has been generally assumed to provide the force for cleavage. However, in contrast to animal cells, yeast cells assemble a cell wall septum concomitant with ring contraction and possess large (MPa) internal turgor pressure. Here, we show that the inward force generated by the division apparatus opposes turgor pressure; a decrease in effective turgor pressure leads to an increase in cleavage rate. We show that the ring cannot be the primary force generator. Scaling arguments indicate that the contractile ring can only provide a tiny fraction of the mechanical stress required to overcome turgor. Further, we show that cleavage can occur even in the absence of the contractile ring. Instead of the contractile ring, scaling arguments and modeling suggest that the large forces for cytokinesis are produced by the assembly of cell wall polymers in the growing septum.