Spindle pole focusing is controlled by a buckling instability

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The mitotic spindle is a dynamic self-organized structure consisting of microtubules and other associated proteins. The bipolar shape of the structure is essential for the proper segregation of sister chromatids to the two daughter cells. Indeed, the inhibition of motor proteins in the spindle is known to lead to dramatic morphological changes in size and shape [1]. Although the interplay of molecular motors such as Dynein or Kinesin-5 are known to control spindle pole focusing, the underlying physical and molecular mechanisms are poorly understood. Here we use an active liquid crystal description to understand spindle shape and we find that stresses at the spindle poles control a buckling instability. Contractile stresses are found to close spindle poles whereas extensile stresses tend to open them. We hypothesize that molecular motors at the poles set a net active stress that controls the buckling transition. Finally, we are currently testing our predictions in meiotic *Xenopus laevis* egg extract spindles by means of fluctuation analysis, laser ablation and biochemical perturbations.

[1] Mitchison TJ, *et al. Mol. Biol. Cell*, **16,** 3064-3076 (2005)