



Microtubule teamwork

During mitosis, sister chromatids are anchored to the mitotic spindle (microtubules originating from spindle poles) at their centromere by kinetochores. Microtubules can also be generated at kinetochores, although their role and regulation here are unclear. Kitamura *et al.* now show that, in *Saccharomyces cerevisiae*, microtubules assemble at kinetochores early in mitosis and interact with spindle pole microtubules to facilitate the loading of kinetochores onto them.

Microtubules are composed of α - β -tubulin heterodimers, the orientation of which defines their plus and minus ends. The authors constructed and studied a *S. cerevisiae* strain in which the chromosome 3 centromere is fluorescently labelled and can be activated to trigger kinetochore assembly. In addition to this engineered situation, they investigated kinetochores before they interacted with spindle pole microtubules in

normal mitosis. Microtubules were seen to extend from kinetochores prior to their attachment to spindle pole microtubules, with their plus ends furthest away from the kinetochore. But how are they generated?

Plus end-tracking proteins (Stu2, Bim1 and Bik1) localize at microtubule plus ends to facilitate their extension. Kinetochore microtubule extension and nucleation was defective in Stu2-mutant cells, whereas only extension was defective in Bim1- or Bik1-mutant cells, suggesting a role for Stu2 in both the generation and extension of kinetochore microtubules.

So, what is the function of kinetochore-derived microtubules? The authors observed that they interact with spindle pole microtubules along their length, in a parallel or anti-parallel manner, which leads to the loading of kinetochores onto spindle pole microtubules in many cells. Furthermore, kinetochore microtubules



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appear more frequently when there is a delay in kinetochore interactions with spindle pole microtubules, and rapidly disappear once kinetochores are on spindle pole microtubules. Together, these data suggest that kinetochore microtubules are generated prior to the kinetochore and spindle pole microtubule interaction, in order to facilitate this important event in mitosis.

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ORIGINAL RESEARCH PAPER Kitamura, E. *et al.* Kinetochores generate microtubules with distal plus ends: their roles and limited lifetime in mitosis. *Dev. Cell* **18**, 248–259 (2010)

FURTHER READING Walczak, C. E. *et al.* Mechanisms of chromosome behaviour during mitosis. *Nature Rev. Mol. Cell Biol.* **11**, 91–102 (2010)