Are microtubules their own mechanosensors?

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In plant cells, cortical microtubules (CMTs) generally control morphogenesis by guiding the synthesis of stiff cellulose microfibrils in the wall. CMT orientation has been proposed to depend on geometrical cues, with microtubules aligning with the cell long axis in silico and in vitro. Yet, CMTs are usually transverse in vivo, i.e., along predicted maximal cortical tension, which is transverse for cylindrical pressurized vessels. Here, we confined protoplasts laterally to impose a curvature ratio and modulated pressurization through osmotic changes. We find that CMTs can be longitudinal or transverse in wall-less protoplasts and that the switch in CMT orientation depends on pressurization. In particular, longitudinal CMTs become transverse when cortical tension increases, consistent with observations *in planta*. To search for upstream regulators, we investigated the contribution of Receptor-Like Kinase (RLK) to the CMT response to tensile stress. We found that both CMT and RLK pathways independently control the mechanical integrity of the cell. Conversely, when both RLK signaling and CMTs are impaired, plant cells behave like passive material. Altogether, these results reveal the key role of microtubule response to cortical tension in plant cell morphogenesis, and further support the idea of an autonomous microtubule mechanosensing pathway.