Mechanobiology of mitosis

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Segregation of the genome from a mother cell into two daughter cells during cell division is one of the fundamental processes of life. Physical separation of chromosomes is carried out by the spindle, a fascinating and complex molecular assembly made of microtubules and numerous other proteins. The mechanobiology of the spindle uses force and length as a language to tell its story, because the regulation of these two players defines how the spindle self-organizes and performs its function. As the spindle is basically a mechanical micro-machine, understanding its functioning requires experimental approaches based on mechanical perturbations, which complement and work together with classical genetic and biochemical methods. Recent data emerging from these approaches in combination with theoretical modeling have led to novel ideas and significant revisions of basic concepts in the field. I will discuss our efforts to understand spindle mechanics, focusing on microtubule forces that control chromosome movements and their role in ensuring chromosome segregation fidelity.