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Computational model for chromosomal instabilty STEFANO ZAPPERI, CNR-IENI, Milano, Italy. ISI Foundation, Torino, Italy. Aalto University, Finland, ZSOLT BERTALAN, ZOE BUDRIKIS, ISI Foundation, Torino, Italy., CATERINA LA PORTA, Department of Bioscience, University of Milano, Italy.
— Faithful segregation of genetic material during cell division requires alignment of the chromosomes between the spindle poles and attachment of their kinetochores to each of the poles. Failure of these complex dynamical processes leads to chromosomal instability (CIN), a characteristic feature of several diseases including cancer. While a multitude of biological factors regulating chromosome congression and bi-orientation have been identified, it is still unclear how they are integrated into a coherent picture. Here we address this issue by a three dimensional computational model of motor-driven chromosome congression and bi-orientation. Our model reveals that successful cell division requires control of the total number of microtubules: if this number is too small bi-orientation fails, while if it is too large not all the chromosomes are able to congress. The optimal number of microtubules predicted by our model compares well with early observations in mammalian cell spindles. Our results shed new light on the origin of several pathological conditions related to chromosomal instability.

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