Mitotic chromosomes are compacted laterally by KIF4 and Condensin and axially by Topoisomerase IIalpha

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At the end of G2 phase, interphase chromatin undergoes a dramatic change as individual chromatids form from the amorphous chromosome territories of interphase nuclei. This process involves only a 2-3-fold compaction of the chromatin, but requires a profound reorganization of the chromatin fibre. The basis of this reorganisation is still mysterious despite many decades of intense study. Non-histone proteins are now widely believed to have essential roles in mitotic chromosome formation and architecture. To date most is known about the condensin I and II complexes, whose ability to induce (+) supercoils in chromatin templates is proposed to be involved in shaping chromosomes and the structure of the kinetochore. However vertebrate mitotic chromosomes can form and segregate in the absence of condensins. Here we show that the abundant chromosome-associated chromokinesin, KIF4, is also required for chromosomes to form a robust architecture. KIF4 works in parallel with the condensin complexes, and the two are interdependent for their efficient association with mitotic chromosomes. Surprisingly, DNA topoisomerase IIalpha appears to function in opposition to the condensin/KIF4 pathways and knockdown of topo II can rescue a number of the chromosomal phenotypes associated with the loss of condensin or KIF4.

References

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