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Interplays between nucleosomes, the histone chaperone FACT and condensin shape mitotic chromosomes

A conserved, yet incompletely understood, principle in living organisms is the folding of the genome into loops by DNA-translocases of the SMC family1. Upon mitotic entry, the condensin SMC complex binds DNA and shapes metaphase chromosomes by folding chromatin into loops, in preparation for genome segregation in anaphase. How condensin achieves this task remains unclear. The active extrusion of naked DNA into loops of increasing size by condensin observed in vitro convincingly describes the structural properties of mitotic chromosomes. Yet, the consubstantial issue of roadblocks and steric hindrances raises the salient question as to whether and how condensin could conceivably extrude loops in the context of a chromatinized genome. Conflicting results have been obtained thus far regarding the impact of nucleosomes on condensin, leaving the question unanswered. Using Fission yeast as a model system, we obtained evidence that arrays of nucleosomes hinder condensin in vivo, and that the histone chaperone FACT, known for its role in modulating nucleosome structure, associates with condensin and takes part in the formation of mitotic chromosomes. The role(s) played by FACT as an ancillary factor for condensin in the context of chromatin will be discussed.

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