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Smc3 acetylation anchors cohesin dependent chromatin loops

Past decade has shown that the cohesin is essential for the regulation of mammalian's genomes 3D organization. Cohesin is a ring-shaped complex that interacts with three related hook-shaped proteins composed of HEAT repeats namely Pds5, Scc3/STAG and Scc2/Nipbl that regulate its functions. Cohesin shapes mammalian genomes by establishing chromatin loops along chromosomes, most likely through an extrusion mechanism. Recent single molecules experiments suggest that loops expansion is mediating by cohesins' ATPase activity stimulated by Scc2/Nipbl.

We have recently showed that yeast mitotic chromosomes are also organized into cohesin-dependent loops. Length of these loops is regulated by two pathways: the Wapl-mediated releasing activity and a mechanism dependent of the acetyltransferase Eco1. Our data suggested that Eco1 inhibits the translocase activity that powers loop formation through a mechanism that is distinguishable from its role in cohesion establishment. However, how Eco1 inhibits this translocase activity is still unknown.
Our latest data show that Eco1 restricts the length of the loops throughout acetylation of the two conserved lysine 112 and 113 located at Smc3's ATPase head. Smc3 acetylation allows anchoring of chromatin loops at specific positions by inhibiting both releasing and translocase activities. Moreover, our data suggest that Smc3 acetylation inhibits translocase activity in a Pds5 dependent manner.

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