

# AFM imaging of SMC-proteins mediated DNA loop extrusion

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## Abstract

Condensin belongs to Structural Maintenance Complex (SMC) protein family that is involved in a higher order chromosome formation. The key feature of these SMC protein complexes is the ring-shaped structure consisting of 3 major components – two structural maintenance complex (SMC) subunits and one kleisin subunit that together form a ring with two co-factors. Recently, condensin-mediated DNA loop extrusion was visualized by single-molecule fluorescence microscopy, but the molecular mechanism is largely unknown [1]. Here, we will show that the reconstitution of single condensin-mediated DNA loop extrusion on an AFM microscope and the neck size of the DNA loops has a high correlation with condensin's conformation. Finally, using high-speed atomic force microscopy, we resolved dynamic conformational changes of the condensin in a liquid phase to resolve the mechanism underlying these important functionalities. The real-time imaging reveals how structures of these protein complexes evolve over time, from which the structure-function relationship of condensin. Our results provide insights into the molecular mechanism of SMC proteins-mediated DNA loop extrusion.

**Keywords:** *HS AFM, condensin, SMC proteins, loop extrusion*

## References

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